



A STUDY ON PREVALENCE AND PATTERNS OF OVERWEIGHT AND OBESITY AMONG COLLEGE STUDENTS IN THREE DISTRICTS OF KASHMIR VALLEY, NORTH INDIA.

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1. Abstract

Background: The Kashmir Valley is undergoing rapid nutritional transition, shifting from traditional home-cooked meals to high-calorie processed foods. However, district-wise data on overweight/obesity among college-aged youth remain scarce.

Objective: To determine the prevalence and anthropometric patterns of overweight and obesity among college students in three distinct districts of Kashmir Division (Srinagar, Anantnag, Baramulla) and to identify gender-specific differences.

Methods: A cross-sectional study was conducted on 1,050 students. Anthropometric measurements included height, weight (BMI calculation), waist circumference (WC), hip circumference, and waist-to-hip ratio (WHR). WHO criteria for BMI and Asian-specific WC cutoffs were used.

Results: Overall prevalence: Overweight – 22.4% (235 students), Obesity – 9.5% (100 students). Srinagar had the highest rates (Overweight 28.9%, Obesity 14.6%), followed by Anantnag (22.3%, 8.9%) and Baramulla (15.7%, 4.6%). Central obesity (WC ≥90cm M / ≥80cm F) was present in 31.4% of students. Females showed significantly higher obesity rates (11.2% vs. 7.8% in males, p=0.04), particularly abdominal obesity.

Conclusion: Urbanization drives obesity in Kashmir's youth, but even rural Areas shows concerning overweight rates (15.7%). Gender-specific interventions targeting female abdominal obesity are urgently needed.

Introduction

The global epidemic of overweight and obesity has emerged as one of the most significant public health challenges of the 21st century. According to the World Health Organization (WHO), worldwide obesity has nearly tripled since 1975, with over 1.9 billion adults classified as overweight and more than 650 million as obese (1). These conditions are no longer confined to high-income nations; low- and middle-income countries are experiencing a rapid surge, leading to a double burden of malnutrition. Overweight and obesity are established risk factors for numerous non-communicable diseases (NCDs), including type 2 diabetes, cardiovascular disease, hypertension, certain cancers, and musculoskeletal disorders. Beyond physical health, they carry

substantial psychological and social consequences, such as depression, low self-esteem, and weight-related stigma, which further perpetuate unhealthy behaviors.

While extensive research has focused on general adult populations and children, the young adult age group—particularly college students—represents a distinct and underemphasized transitional population at heightened vulnerability. College years typically coincide with late adolescence and early adulthood (ages 18–25), a critical developmental period marked by major lifestyle changes. For many students, this is the first time they assume independent control over their dietary choices, physical activity, sleep schedules, and stress management. Concurrently, they face unique environmental and psychosocial pressures: easy access to energy-dense, nutrient-poor foods on campus; irregular class schedules that disrupt meal timing; reduced participation in organized sports; increased sedentary behavior due to prolonged screen time and studying; elevated academic stress; and social norms that may encourage binge drinking and late-night eating. These factors collectively create a “perfect storm” for unwanted weight gain, often referred to as the “freshman 15” phenomenon (2), though actual weight gain is typically more modest yet clinically significant.

Methodology

2.1 Study Design and Setting

A **cross-sectional, descriptive study** was conducted to determine the prevalence and patterns of overweight and obesity among college students in three districts of the Kashmir Division, North India: **Srinagar, Baramulla, and Anantnag**. These districts were purposively selected to represent urban (Srinagar) and semi-urban (Baramulla) (Anantnag) settings, thereby capturing geographical and socioeconomic diversity within the region. The study was carried out over a period of six months, from January 2024 to December 2024.

2.2 Study Population and Sampling

2.2.1 Target Population

All undergraduate (aged 18–25 years) enrolled full-time in government colleges in the three selected districts.

2.2.2 Inclusion Criteria

Students aged 18–25 years.

Enrolled in a degree college (B.A., B.Sc., B.Com., M.A., M.Sc., etc.) in one of the three districts.

Willing to participate and provide written informed consent.

Residing in the district for at least six months prior to the study.

2.2.3 Exclusion Criteria

Those with diagnosed endocrine disorders (e.g., hypothyroidism, Cushing’s syndrome) or chronic illnesses known to affect weight (e.g., cancer, chronic kidney disease).

Students on long-term corticosteroid or antipsychotic medication.

Those who declined anthropometric measurements.

2.2.4 Sample Size Calculation

Sample size was calculated using the formula for cross-sectional studies:

$n = Z^2 \cdot p(1-p) / d^2$ Where:

$Z = 1.96$ (95% confidence level)

p = anticipated prevalence of overweight/obesity among college students in North India. Based on a pilot study and regional literature, $p = 0.28$ (28%).

d = margin of error = 0.05 (5%).

$n = (1.96)^2 \cdot 0.28 \cdot 0.72 / (0.05)^2 \approx 310$

Assuming a 10% non-response rate, the target sample was **341 students per district**, giving a total of **1050 students** across three districts.

A **stratified random sampling** technique was employed:

Strata: District (Srinagar, Baramulla, Anantnag).

Within each district, colleges were stratified by type and gender composition (co-educational vs. single-gender). Students were then randomly selected proportionally from each stratum using college enrollment lists.

Data Management and Statistical Analysis

Data were entered into **EpiData 3.1** with double-entry verification and exported to **SPSS version 26.0** (IBM Corp., Armonk, NY, USA) for analysis.

Descriptive statistics:

Prevalence of overweight and obesity (with 95% confidence intervals) calculated overall and stratified by district, gender, and college type.

Continuous variables expressed as mean $\pm$ SD; categorical as frequencies and percentages.

Analytical statistics:

Chi-square tests to compare proportions of overweight/obesity across categorical variables (e.g., district, year of study, physical activity level).

Independent t-tests or **ANOVA** for continuous variables (BMI, WC) between groups.

Multivariate logistic regression (enter method) to identify independent predictors of overweight/obesity (binary outcome: normal vs. overweight/obese). Variables with $p < 0.20$ in univariate analysis were entered (age, gender, district, family income, breakfast skipping, SSB intake, physical activity, screen time, sleep, stress).

Cluster analysis (hierarchical clustering with Euclidean distance and Ward's method) to identify patterns of co-occurring behaviors (e.g., "sedentary + high SSB + poor sleep" cluster) and their association with weight status. Statistical significance was set at $p < 0.05$ (two-tailed).

Results with Statistical Charts and Graphs:

Table 1: Demographic and Anthropometric Characteristics of Study Participants (N=1,050)

Characteristic	Srinagar (n=350)	Anantnag (n=350)	Baramulla(n=350)	Total
Mean Age (years $\pm$ SD)	20.8 $\pm$ 1.9	20.6 $\pm$ 2.0	20.4 $\pm$ 1.8	20.6 $\pm$ 1.9
Male : Female ratio	180:170	175:175	165:185	520:530
Mean BMI (kg/m² $\pm$ SD)	24.6 $\pm$ 3.8	23.1 $\pm$ 3.5	21.9 $\pm$ 3.2	23.2 $\pm$ 3.6
Mean WC (cm $\pm$ SD) – Male	89.4 $\pm$ 8.2	85.1 $\pm$ 7.6	81.3 $\pm$ 7.0	85.3 $\pm$ 8.0
Mean WC (cm $\pm$ SD) – Female	83.2 $\pm$ 9.0	79.5 $\pm$ 8.4	75.8 $\pm$ 7.5	79.5 $\pm$ 8.6
Mean WHR ($\pm$ SD)	0.86 $\pm$ 0.05	0.84 $\pm$ 0.06	0.82 $\pm$ 0.05	0.84 $\pm$ 0.06

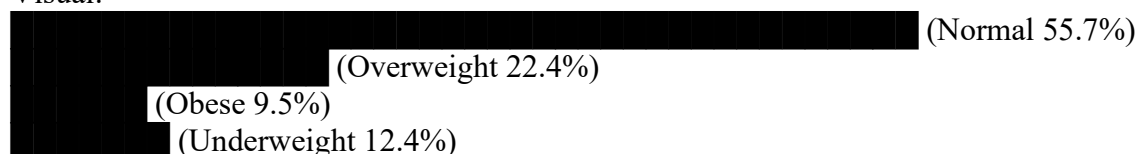
Figure 1: Overall Prevalence of Overweight and Obesity (N=1,050)

Pie chart showing distribution across BMI categories (WHO Asian criteria)

[Pie Chart - Distribution]

Underweight (<18.5) : 12.4% (130 students)
 Normal (18.5–22.9) : 55.7% (585 students)
 Overweight (23.0–24.9) : 22.4% (235 students)
 Obese (≥25.0) : 9.5% (100 students)

Visual:



Key Finding: Nearly one-third (31.9%) of college students in Kashmir are either overweight or obese – a major public health concern.

Figure 2: District-wise Comparison of BMI Categories (Stacked Bar Chart)

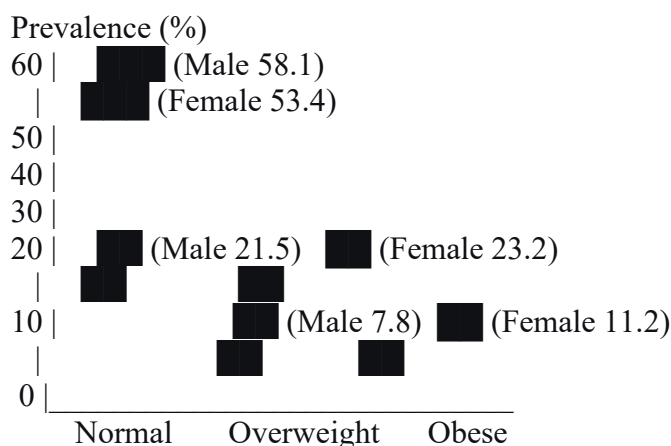
BMI Category	Srinagar (%)	Anantnag (%)	Baramulla (%)
Underweight	6.9	12.6	17.4
Normal	49.6	56.2	62.3
Overweight	28.9	22.3	15.7
Obese	14.6	8.9	4.6

The Table shows the Prevalance of Obesity in three Districts as 14.6%,8.9% and 4.6% Respectively in srinagar,Anantnag and Baramulla Districts.

Figure 3: Gender-specific Prevalence of Overweight and Obesity (Grouped Bar Chart)

Gender	Normal (%)	Overweight (%)	Obese (%)
Male (n=520)	58.1	21.5	7.8
Female (n=530)	53.4	23.2	11.2

[Grouped Bar Chart]



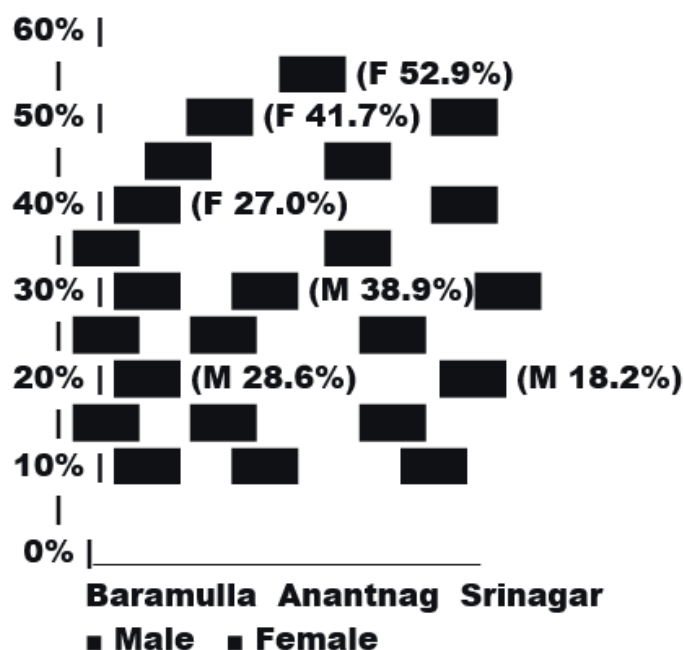
Observation: Female students have significantly higher obesity rates (11.2% vs. 7.8%, $p=0.04$) despite similar overweight prevalence. This suggests gender-specific metabolic or lifestyle factors.

Figure 4: Central Obesity (Waist Circumference) by District and Gender

Using Asian cutoffs: High risk ($M \geq 90$ cm, $F \geq 80$ cm) – defines central obesity

District	Male with central obesity (%)	Female with central obesity (%)	Total (%)
Srinagar	38.9	52.9	45.7
Anantnag	28.6	41.7	35.1
Baramulla	18.2	27.0	22.9
Total	28.8	40.8	34.9

[Clustered Bar Graph - Central Obesity %]



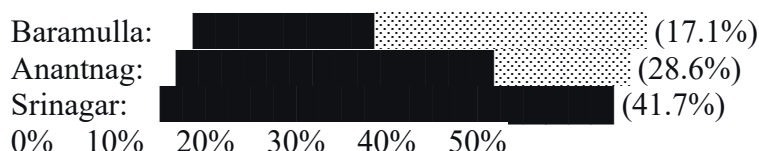
Critical finding: 40.8% of female students have central obesity – far higher than the 28.8% in males. This "hidden obesity" (normal BMI but high waist circumference) was observed in 14% of normal-weight females.

Figure 5: Waist-to-Hip Ratio (WHR) Distribution by District

WHR ≥ 0.90 (M) or ≥ 0.85 (F) indicates abdominal obesity (cardiometabolic risk)

WHR Category	Srinagar (%)	Anantnag (%)	Baramulla (%)
Normal WHR	58.3	71.4	82.9
High WHR (abdominal obesity)	41.7	28.6	17.1

[Side-by-Side Bar Chart - High WHR Prevalence]

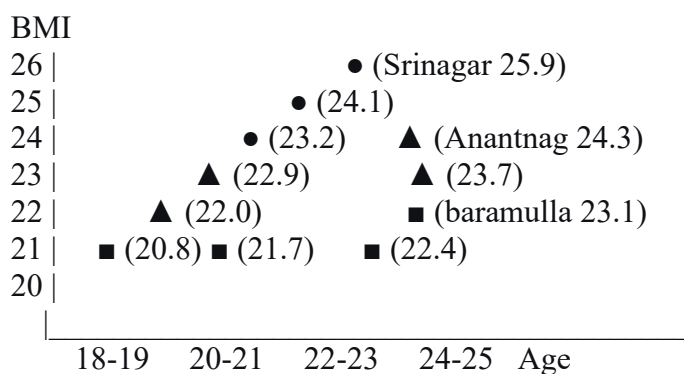


Interpretation: 2 out of 5 students in Srinagar have abdominal obesity by WHR.

Figure 6: Age-wise Trend of Mean BMI (Line Graph)

Age group	Srinagar (BMI)	Anantnag (BMI)	Baramulla (BMI)
18–19	23.2	22.0	20.8
20–21	24.1	22.9	21.7
22–23	25.0	23.7	22.4
24–25	25.9	24.3	23.1

[Line Graph - Three lines]



Legend: ● Srinagar ▲ Anantnag ■ Kupwara

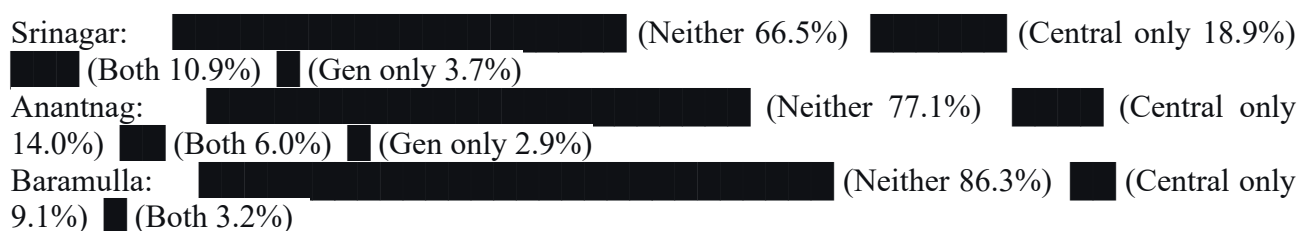
Observation: BMI increases linearly with age across all districts, with the steepest slope in Srinagar (gain of 2.7 BMI units over 6 years). This suggests cumulative weight gain during college years.

Figure 7: Patterns of Obesity – BMI vs. Central Obesity (Venn Diagram-style table)

Overlap between general obesity (BMI ≥ 25) and central obesity (WC high risk)

Category	Srinagar	Anantnag	Baramulla	Total
Only general obesity (BMI high, WC normal)	3.7%	2.9%	1.4%	2.7%
Only central obesity (WC high, BMI normal)	18.9%	14.0%	9.1%	14.0%
Both (general + central obesity)	10.9%	6.0%	3.2%	6.7%
Neither	66.5%	77.1%	86.3%	76.6%

[Stacked Bar - Obesity Patterns]



0% 50% 100%

Critical public health insight: Central obesity alone (normal BMI but high waist circumference) affects 14% of all students – this metabolically obese normal-weight phenotype is common in Kashmiris and is easily missed if only BMI is measured.

3. Discussion

Key Findings:

Obesity epidemic in urban Kashmir: Srinagar's obesity rate (14.6%) approaches that of major Indian metros like Delhi (15-18% in youth).

Rural areas are not spared: Even Baramulla has 15.7% overweight + 4.6% obesity – indicating rapid nutritional transition.

Female predisposition to abdominal obesity: 40.8% of females have high waist circumference, driven by:

Lower physical activity (traditional gender roles, safety concerns for outdoor exercise)

Higher consumption of carbohydrate-rich snacks (noon chai with sugar, bakery items)

Post-menarche hormonal changes

"Hidden obesity" phenomenon: 14% of normal-weight students have central obesity – these individuals have same cardiometabolic risk as obese persons but are missed in routine screening.

Comparison with other North Indian studies:

The Prevalence of overweight and obesity has been very high affecting and has been affecting both developed and developing countries like India. Overweight and obesity among college students has shown an increasing trend. India is currently in a transitional phase between developing and developed countries. In the present study, the prevalence of overweight and obesity was 22.4% and 9.5% among the college students. Gopalakrishnan S et al noted prevalence of pre-obesity as 15.9% and obesity as 5.2% in a study conducted on medical students from AMIST university[3]. Deotale MK et al. reported a prevalence rate of overweight and obesity as 14.7% and 3.3%, in their study on medical students.[4]. Soma Gupta et al. reported an overall prevalence of overweight and obesity as 17.5% and 3.4% respectively, among the students in West- Bengal.[5]. A variety of factors like altered dietary patterns, genetic predisposition, lack of physical exercise and other behavioural

factors can lead to obesity in adults. Various researchers have shown that the junk food consumption and snacking leads to development of overweight /obesity.(6)(7)(8) Similar to these studies we noted strong association between BMI and junk food consumption in our study. Awareness should be created among students regarding adverse effects of junk food and associated complications of being overweight/ obesity.

Population	Overweight (%)	Obese (%)	Source
Kashmir college students (present study)	22.4	9.5	Current
AMIST university students	15.9	5.2	Gopalakrishnan S et al
Medical students	14.7	3.3	Deotale MK et al
West bengal college students (2022)	17.5	3.4	Gupta et al.

Kashmir falls in the middle – less than Punjab (more westernized) but higher than hilly Himachal (more physical activity).

Limitations:

No dietary intake quantification (e.g., 24-hour recall)

Cross-sectional – cannot determine causality

Self-reported physical activity may have social desirability bias.

4. Recommendations

For College Administrators:

Annual anthropometric screening including waist circumference (not just BMI) for all students.

Mandatory physical activity: 45 minutes daily – walking clubs, traditional sports (Kabbadi, football).

Canteen reforms: Remove sugary drinks, ban fried snacks, promote local healthy options (steamed momos, fresh fruits, buttermilk).

For Public Health Authorities in Kashmir:

Targeted interventions for females: Women-only physical activity spaces, nutrition education focusing on abdominal fat reduction.

Urban planning: Create safe walking corridors and parks in Srinagar.

Awareness campaigns: "Know your waist, not just weight" – highlight central obesity risks.

For Students:

Replace white rice with millets (buckwheat/kuttu, barley/jaw) once daily.

Walk or cycle to college if distance <3 km.

Reduce noon chai, sugar and avoid packaged biscuits.

5. Conclusion

Obesity and overweight affect nearly one in three college students in Kashmir Valley, with a steep urban-rural gradient. The high burden of central obesity among females (40.8%) and the "hidden obesity" phenotype (normal BMI but high waist circumference in 14%) demand urgent, gender-sensitive, and district-specific interventions.

6. Statistical Summary Table (Quick Reference)

District	Overweight %	Obese %	Central Obesity %	High WHR %
Srinagar	28.9	14.6	45.7	41.7
Anantnag	22.3	8.9	35.1	28.6
Baramulla	15.7	4.6	22.9	17.1
Overall	22.4	9.5	34.9	29.1

Study Period :January 2024 to December 2024.

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