ORIGINAL ARTICLE

GENDER DISPARITIES IN RISK OF METABOLIC SYNDROME AMONG OBESE YOUTH

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Background: Metabolic syndrome in obese youth is linked to an increased risk of early disease onset, particularly in males. This study examined the relationship between obesity and the components of metabolic syndrome in youth. **Methods:** The study included subjects aged 19–21 from various colleges screened for obesity (BMI, WC, and WHtR). Blood samples were analysed for fasting blood sugar, triglycerides, HDL-C and insulin levels. **Results:** Obese males showed an insignificant 8% higher blood glucose level (5.468±0.12 mmol/L) than their corresponding controls (5.060±0.17 mmol/L), and a striking 14.5% difference between obese males and females (4.773±0.081 mmol/L) (p<0.001). Overweight and obese groups collectively demonstrated higher HDL-C levels compared to their controls, reflecting a general upward trend in young adults, though it was not significant. Insulin levels were higher in obese males (1.07±0.36 µIU/mL) compared to their controls (0.411±0.089 µIU/mL, but the differences were not significant. In overweight males, triglyceride levels (102.7±7.2 mg/dL) were 26% higher than normal-weight males (81.5±6.1 mg/dL) (p<0.05), while obese males showed a 36.2% elevation (111.3±6.8 mg/dL) (p<0.005) and significantly higher levels compared to obese females (89.9±5.9 mg/dL) (p<0.01). **Conclusion:** This study highlights the early development of metabolic disturbances in obese youth, with males being at higher risk for metabolic syndrome and related diseases.

Keywords: Metabolic Syndrome, Obesity, Body Mass Index, BMI

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INTRODUCTION

Organisms rely on physiological mechanisms to maintain homeostasis, but disruptions in this balance can contribute to degenerative diseases, particularly affecting metabolic and hormonal systems, as seen in obesity. More people are dying from coronary artery disease and cerebrovascular disease with passing time. These deadly conditions have several risk factors in common. One key feature is the presence of central obesity and insulin resistance. People with metabolic syndrome, as it is known, also tend to have high blood pressure, elevated triglyceride levels, and abnormal fasting blood sugar levels.[1]

Diabesity, a term for age-related diabetes associated with obesity, shows a well-established connection between body mass index (BMI) and diabetes mellitus.[2] Over a 22-year retrospective study, the Triglyceride (TyG) index was significantly associated with the incidence of Type 2 diabetes mellitus (T2DM).[3]

Obesity has become a global pandemic. In the US alone, over one-third of adults are obese[4], its prevalence varies significantly worldwide, emphasizing the need for region-specific investigations. Alarming trends show obesity rising among young adults due to sedentary lifestyles and fast food consumption.[5,6]

People with metabolic syndrome face a heightened risk of cerebrovascular and cardiovascular issues, which is increasing due to lifestyle and dietary changes promoting obesity. Life style modification alone can resolve a lot of health compromise associated with development of overweight and obesity by enhancing antioxidant defences in the body.[7] A number of recent studies have focused on the shift of life style modification from secondary to primary treatment modality in diseases associated with metabolic syndrome.[8] The TyG index serves as a surrogate marker for assessing insulin resistance (IR) and diabetes risk, with a linear relationship to T2DM in the Japanese population.[9,10]

Yet, research on obese young adults is limited. This study explores gender disparity in obese young adults and development of metabolic syndrome.

MATERIAL AND METHODS

This study was carried out in Mirpur city of Azad Kashmir. A total of 662 volunteers aged 19–21 years were selected from 17 colleges. Subjects having diabetes or any other endocrine disorder were excluded.

Body Mass Index (BMI), Waist Circumference (WC), and Waist Height Ratio (WHtR) were used to categorise the subjects into normal, overweight, and obese groups.

The blood glucose of the subjects was measured using an AccuCheck® Instant-S Glucometer and strips (PIP code 402-6324, GMS code 85543). HDL-C, and triglycerides were estimated using Chema

Diagnostic kits from Italy. Insulin levels were assessed using Quantitative Immunoenzymometric Assay with Insulin AccuBind ELISA Microwells (Product Code 2425-300, Monobind Inc., USA).

Data were analysed using SPSS-22. Two-sample Student's *t*-test was applied to compare the control group with overweight and obese groups, in both males and females, and $p \leq 0.05$ was considered statistically significant.

RESULTS

Out of the 662 volunteers, 561 had normal weight, 43 were overweight, and 58 were obese. Ages of females averaged 19.11 years, and ages of males averaged 18.82 years. The average BMI in the control group was 21.30, overweight 29.38, and obese 34.75. Among females, control BMI was 21.64, overweight 29.50, and obese 34.12. Among males, control BMI was 20.97, overweight was 28.42, and obese was 35.38. Obese males had 8% higher glycaemia than their controls ($p<0.087$) with a striking 14.5% difference from obese females ($p<0.001$). (Table-1). Obese males had significantly higher triglyceride levels than obese females ($p<0.01$). (Table-2). Overweight and obese groups collectively demonstrated higher HDL-C levels compared to their respective controls, reflecting a general upward trend in young adults though the increases were not statistically significant. (Table-3). Insulin levels were found to be 182% higher in obese males compared to females ($p<0.068$), indicating early hyperinsulinemia in obese males, while females seemed less infected. (Table-4).

Table-1: Average blood glucose level (mmol/L) in different groups to their respective control (Mean±SEM)

Gender	Control	Overweight	Obese
Females	4.670±0.12	4.872±0.10	4.773±0.081
Males	5.060±0.17	5.274±0.098	5.468±0.12

Table-2: Serum triglycerides (mg/dL) in different groups on the basis of BMI (Mean±SEM)

Gender	Control	Overweight	Obese
Both Genders	78.6±6.7	96.4±6.3	100.6±6.35
Females	75.7±7.3	90.5±5.8	89.9±5.9
Males	81.5±6.1	102.7±7.2	111.3±6.8

Table-3: Total serum HDL-cholesterol (mg/dL) in groups on the basis of BMI (Mean±SEM)

Gender	Control	Overweight	Obese
Both Genders	58.75±3.9	64.4±2.5	64.7±3.3
Females	59.4±4	68.0±2.3	68.6±3.9
Males	58.1±3.8	58.58±2.2	60.8±2.7

Table-4: Serum insulin concentration (uIU/mL) in groups on the basis of BMI (Mean±SEM)

Gender	Control	Obese
Both Genders	0.4045±0.0755	0.728±0.1995
Females	0.398±0.062	0.386±0.029
Males	0.411±0.089	1.07±0.6

DISCUSSION

This study explores metabolic syndrome adaptability in young adults with obesity, highlighting gender-based variations. It investigates the correlation between development of metabolic syndrome components and persistent obesity. Obesity is influenced by genetics, diet, metabolism, and environment.[11] Reports suggest a higher prevalence of metabolic syndrome in individuals with elevated levels of various metabolic markers, including triglycerides and blood pressure. However, the link between metabolic dysfunction and specific components of metabolic syndrome remains debated, highlighting the need for a comprehensive metabolic assessment in individuals at increased cardiovascular disease risk.[12]

Glycolipids are modifiable risk factors for diabetes and metabolic illnesses, as well as for promoting healthy metabolism. Waist circumference, often included in health surveys, is closely associated with body fat and its distribution.[13] A cross-sectional study of a Chinese population discovered that women in subclinical and overt hypothyroidism groups had significantly higher BMI, waist circumference, TGs, SBP, and DBP levels than euthyroid individuals.[14] Research further demonstrates that WC and BMI can serve as indicators to predict the severity of diabetes, supporting their use as outcome variables to observe factors contributing to diabetes combined with obesity (Diabesity).[15,16]

Persistence of obesity into adulthood has been established as a significant risk factor, eventually leading to the development of metabolic syndrome.[17] Metabolic syndrome is a contributing factor to the development of T2DM and insulin resistance, which subsequently lead to cardiovascular complications. Daily data continues to emerge regarding obesity in older age, exploring its causes and associated health risks.

This study observed insulin concentrations in young adults, finding that in the combined gender group, normal individuals had an average concentration of 0.374±0.053 µIU/mL, while obese subjects exhibited significantly higher levels at 0.71±0.18 µIU/mL, indicating a 92% increase. However, when broken down by gender, normal and obese females did not significantly differ in insulin levels, whereas obese males showed a noticeable 160% increase compared to control males. Insulin concentration was 182% higher in obese males than obese females. These findings suggest early signs of hyperinsulinemia in obese young adult males compared to their male controls and obese females.

This study examines predictive factors for metabolic syndrome onset in young adults, considering gender-specific metabolic differences. It emphasizes the importance of analysing parameters separately for males and females, particularly in cultures where gender roles differ. Central obesity, indicated by an increased waist-hip ratio, was more pronounced in obese males and is a

known predictor for type 2 diabetes in the context of metabolic syndrome.[18]

Obesity led to significantly higher systolic and diastolic blood pressure in both females and males compared to their non-obese counterparts. This blood pressure increase aligns with well-documented associations between obesity and elevated risk factors for related diseases.[19]

In studying hypertension and lipid profiles, indicators like Triglycerides (TyG), TyG-BMI, TyG-WC, and TyG-WHtR were shown to have stronger positive associations with systolic and diastolic blood pressure than traditional obesity indicators.[20]

In our study triglyceride levels remained stable in obese females, and obese males showed significant increase in their triglyceride levels emphasizing the need for gender-specific analysis when studying obesity-related lipid profiles. There were distinct obesity risk profiles among genders. Males exhibit central obesity, elevated glycaemia, increased total cholesterol, and heightened triglycerides, indicating potential insulin resistance, emphasizing the significant concern associated with obesity in young adult males. In contrast, females show minimal parameter variations except for increased total cholesterol.

CONCLUSION

Gender-specific metabolic variations are evident in obese young adults, with males showing early signs of metabolic syndrome and hence increased predisposition to development of associated diseases. Both genders share common risk factors like central obesity, elevated blood pressure, and dyslipidemia, underscoring the importance of tailored interventions in addressing obesity-related health risks.

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