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# Clinical Profile of Young Obese Individuals and Its Correlation with Fasting Blood Sugar and Fasting Lipid Profile

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## Abstract

**Introduction:** Obesity can alter lipid and carbohydrate metabolism. Dyslipidemia (DLP), type 2 diabetes mellitus (DM) and impaired fasting glucose (IFG) have been recognised as a common complication of obesity. Obesity can also lead to other non-metabolic complications. There is an epidemic rise in obesity in the country. A disease practically unheard of a few years back is now considered to affect even the younger age group. Obesity and its complications can lead to various cardiovascular diseases making early detection and prevention important.

**Objectives**

- To study the clinical profile of young obese (Age group of 18-40 years of male and females) individuals in Sri Ramakrishna Hospital, Coimbatore.
- To study the fasting blood sugar and fasting lipid profile in these subjects.
- To correlate clinical profile with fasting blood sugar and fasting lipid profile.

**Materials and Methods:** The study will be a descriptive correlative study on young obese inpatients and outpatients in Sri Ramakrishna Hospital. The study will include a minimum of 150 subjects from the general population. A detailed questionnaire will be administered to all study subjects to collect information regarding demographic, socioeconomic, behavioural, and health status. The fasting blood sugar (FBS) of all subjects will be estimated to diagnose diabetes mellitus and impaired fasting glucose. Fasting lipid profile (FLP) of all the subjects will be done to note lipid profile abnormalities. Results will then be analyzed and correlated.

**Results:** A total of 150 cases of young obese subjects were included in the study, evaluated for fasting blood sugar and fasting lipid profile, and clinically correlated. Obesity among young individuals was found to be more common among males (62%) and during the fourth decade (53.3%). There is a significant association between gender and BMI in the present study.

In the study, most cases (38.67%) were in the BMI group of 25-30 kg/m² with the occurrence of IFG (54%) being more than DM in this group. T2DM and IFG are statistically significant to BMI. In this study, 82% of cases with DLP were present in obese patients. The BMI is highly significant to the DLP where the p-value is <0.01. The incidence of dyslipidemia was also highest (57.33%) in the BMI group (25-30 kg/m²).

**Conclusion:** The present study showed that there exists a relationship between the presence of altered fasting blood sugar in the form of impaired fasting glucose and type 2 diabetes mellitus in

young obese individuals. Thus from this study, we conclude that there is a statistically significant relationship between young obesity and diabetes. There was a direct proportional relationship between dyslipidemia and degree of obesity. Cutaneous manifestations of obesity and lifestyle have a significant correlation with the occurrence of complications of obesity. In the current period, young obesity should be considered an important risk factor for non-communicable diseases and should be treated at the earliest to prevent such complications.
**Keywords:** Obesity, Morbidity, Diabetes Mellitus, Fasting Blood Glucose, Psychological Factors, Alcohol Consumption.

## Introduction

Obesity is a leading cause of increasing mortality and morbidity worldwide. As per data released by WHO, in 2008 there were about 1.4 billion overweight persons aged 20 years and above with at least 500 million adults being obese. (1) Obesity in India and other developing countries is on an increasing trend, as a result of rapid urbanisation and changing lifestyles. (2) There are various determinants of obesity such as age, sex, genetic factors, physical inactivity, socio-economic status, eating habits, psychological factors, family history, endocrine factors, alcohol consumption, level of education, smoking, ethnicity and drugs. Hence the etiology of obesity is multiple and complex. Obesity itself can lead to multiple complications.

Obesity is rapidly becoming one of the most important medical and public health problems of our time. Obesity is associated with a high rate of morbidity and early mortality if left untreated. Studies indicate that the presence of obesity increases diabetes. Its role health hazard in adults has been well recognized for some time but little attention has been paid to adolescent obesity.

Obesity has increased worldwide with an increase in the incidence of associated diseases especially type 2 diabetes mellitus (DM). The longitudinal study on young adults who were overweight, hypertensive and had dyslipidemia had the same risk factor (i.e., being overweight, with elevated blood sugar levels and abnormal serum lipid profile values) in childhood.

The prevalence and trend of obesity is increasing worldwide. Since 1991, the prevalence of obesity has increased by 95% in men and 23% in women. Current trends indicate that by 2050, 60% of males and 50% of females worldwide will be obese. Impaired fasting glucose, type 2 diabetes mellitus (DM) and dyslipidemia (DLP) are some of the common complications of obesity. (3) Progression of patients with impaired fasting glucose (IFG) into type 2 diabetes mellitus in less than three years has been documented. (4) Complications due to type 2 diabetes mellitus and dyslipidemia are well established. Very few studies have targeted the younger age group. Hence an attempt has been made to study the clinical profile, fasting blood glucose (FBS) and fasting lipid profile (FLP) in young obese individuals.

The currently recommended cut-offs of BMI for Asian Indians include 18.0-22.9 kg/m2 for normal, 23.0-24.9 kg/m2 for Overweight and ≥25kg/m2 for Obesity. WHR cut-offs for Asian Indians include 0.9 for men and 0.8 for women.

### Objective of the Study

- To study the clinical profile of young obese (Age group of 18-40 years of male and females) individuals in Sri Ramakrishna Hospital, Coimbatore.
- To study the fasting blood sugar and fasting lipid profile in these subjects.
- To correlate clinical profile with fasting blood sugar and fasting lipid profile.

## Material & Methodology

### Source of Study

The study is conducted on patients attending Sri Ramakrishna Hospital, Coimbatore during the study period (November 2020 to September 2021). A total of 150 patients with BMI ≥25kg/m2 attending outpatient and inpatient services in Sri Ramakrishna Hospital were included in the study, based on the inclusion and exclusion criteria. The study is done after getting informed and signed consent from the patients.

**Duration of study**: 1 Year (November 2020 to September 2021)

**Design of Study**: Cross-sectional study

**Sample Size Calculation Formula:**

$$n = \frac{Z^2 p(1-p)}{d^2}$$

n = required sample size

z = confidence level of 95% (standard value of 1.96)

p = Standard of deviation

d = Confidence interval 8%

$$n = \frac{1.96^2 * 0.5(1-0.5)}{0.08^2}$$

$n = 150\ samples$

**Method of Collection of Data:**

### Study Design

The study will be a descriptive correlative study on young obese inpatients and outpatients in Sri Ramakrishna Hospital. The study will include a minimum of 150 subjects from the general population. A detailed questionnaire will be administered to all study subjects to collect information regarding demographic, socioeconomic, behavioural, and health status. The fasting blood sugar (FBS) of all subjects will be estimated to diagnose diabetes mellitus and impaired fasting glucose. Fasting lipid profile (FLP) of all the subjects will be done to note lipid profile abnormalities. Results will then be analyzed and correlated.

### Inclusion Criteria

1. Patients between the ages of 18 and 40 years.
2. Body mass index ≥25kg/m2.

### Exclusion Criteria

1. Subjects suffering from diseases like cirrhosis, congestive cardiac failure, tuberculosis, and renal diseases.
2. History of drug intake like steroids, anti-epileptics, antipsychotics, and oral contraceptive pills.
3. Subjects who are on treatment for obesity, diabetes mellitus and dyslipidemia.
4. Pregnant or lactating women.
5. Proven cases of Cushing's disease, hypothyroidism, acromegaly, polycystic ovarian disease and hypogonadism.

### Statistical Method

The collected Data was analysed using the following statistical methods,

1. Diagrammatic representation and Frequency analysis

2. Descriptive Statistics such as Mean ± standard deviation

3. Chi-Square tests

4. Independent sample 't' test

### Results

This study was conducted on a total of 150 young obese individuals in Sri Ramakrishna Hospital. Data was collected and the following results were obtained from the study. The data collected were subjected to Statistical Analysis using SPSS. Frequency analysis, independent

sample 't' test, and Chi-Square tests were performed for appropriate variables. The probability value, p below 0.05 was 'Significant'. The results of the Statistical analysis are presented in subsequent tables.

**Age Distribution**

**Table 1: Age-Wise Distribution of the Patients**

| Age Group | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| 20-25 | 4 | 2.7 | 2.7 |
| 26-30 | 30 | 20.0 | 22.7 |
| 31-35 | 36 | 24.0 | 46.7 |
| 36-40 | 80 | 53.3 | 100.0 |
| Total | 150 | 100.0 | |

Graph 1:

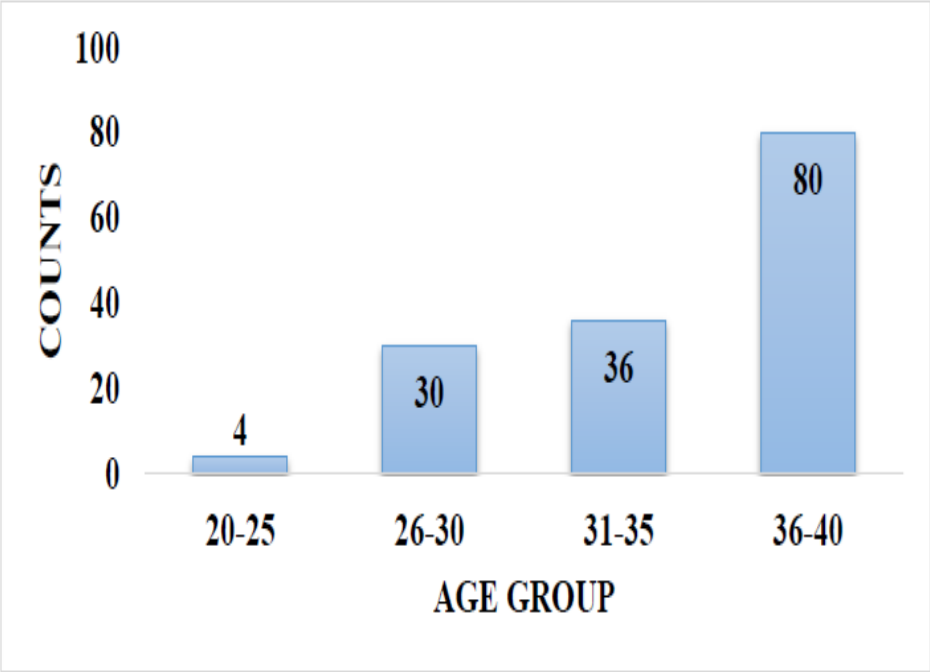
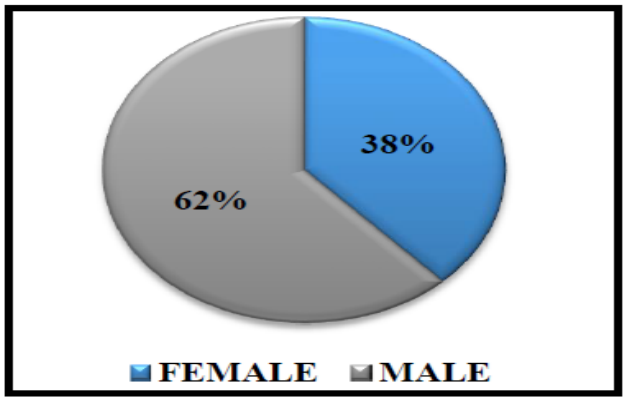



Table 1 displays the distribution of patients based on age. It is evident from the Table that the majority of the patients (53.3%) fall under the age group of 36 to 40 years followed by 24% of them belonging to 31 to 35 years, 20% of the patients belonging to 26 to 30 years of age and 2.7% fall under the age group of 20 to 25 years.

**Sex Distribution**

**Table 2: Gender Wise Distribution of the Patients**

| Gender | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Female | 57 | 38.0 | 38.0 |
| Male | 93 | 62.0 | 100.0 |
| Total | 150 | 100.0 | |



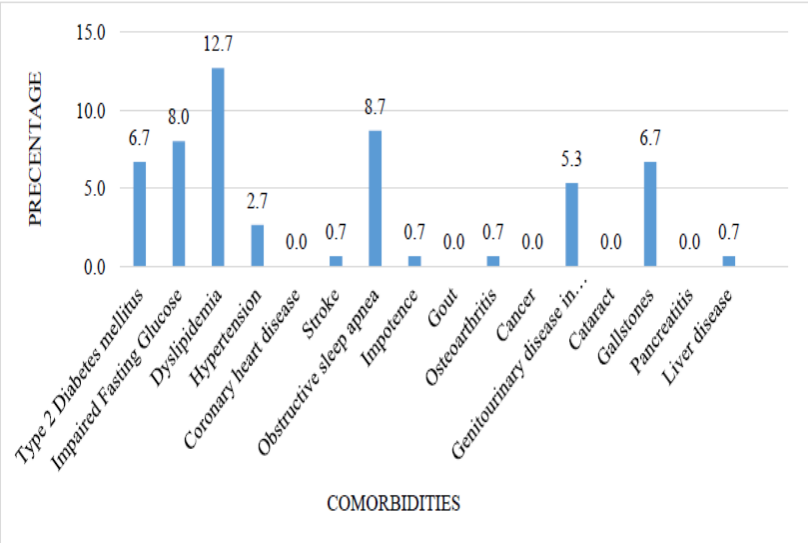

**Graph 2: Sex Distribution of Cases**

Table 2 displays the distribution of patients based on gender. It is evident from the Table that the majority of the patients (62%) are male and only 38% are female.

**Distribution of Associated Comorbidities**

**Table 3: Distribution of Associated Comorbidities**

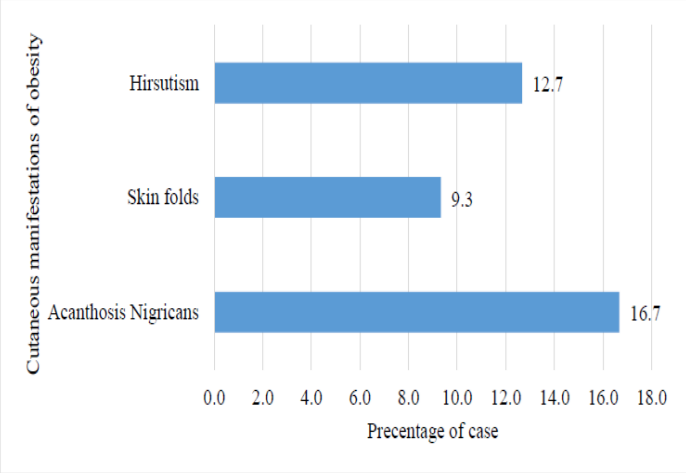
| COMORBIDITIES | Pearson Chi-Square Statistic (p -Value) |
|---|---|
| Type 2 Diabetes mellitus | P<0.05 (Significant) |
| Impaired Fasting Glucose | P<0.05 (Significant) |
| Dyslipidemia | P<0.05 (Significant) |
| Hypertension | p>0.05 (Not Significant) |
| Coronary heart disease | p>0.05 (Not Significant) |
| Stroke | p>0.05 (Not Significant) |
| Obstructive sleep apnea | P<0.05 (Significant) |
| Impotence | p>0.05 (Not Significant) |
| Gout | p>0.05 (Not Significant) |
| Osteoarthritis | p<0.05 (Significant) |
| Cancer | p>0.05 (Not Significant) |
| Genitourinary disease in women | p<0.05 (Significant) |
| Cataract | p>0.05 (Not Significant) |
| Gallstones | p<0.05 (Significant) |
| Pancreatitis | p>0.05 (Not Significant) |
| Liver disease | p>0.05 (Not Significant) |




**Graph 3: Distribution of Associated Comorbidities**

The most common associated comorbidity was dyslipidemia found in 12.7% of cases followed by obstructive sleep apnea (OSA) in 8.7% and then impaired fasting glucose in 8% of cases. 69.3% of cases had no history of comorbidities.

**Distribution of Cutaneous Manifestations of Obesity**



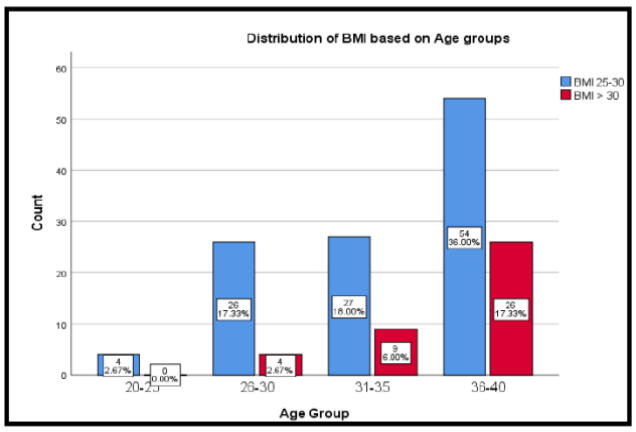

**Graph 4: Frequency of Cutaneous Manifestations of Obesity**

The most common cutaneous manifestation of obesity in the study group was acanthosis nigricans which was present in 30.77% (24 cases) cases followed by hirsutism and skin folds in 12.7% (18 cases) and 9.33% (14 cases) cases, respectively. As per Pearson Chi-square CMO is more significant to Type-2 Diabetes Mellitus ($p<0.05$).

**Correlation between Different Age and BMI Groups**

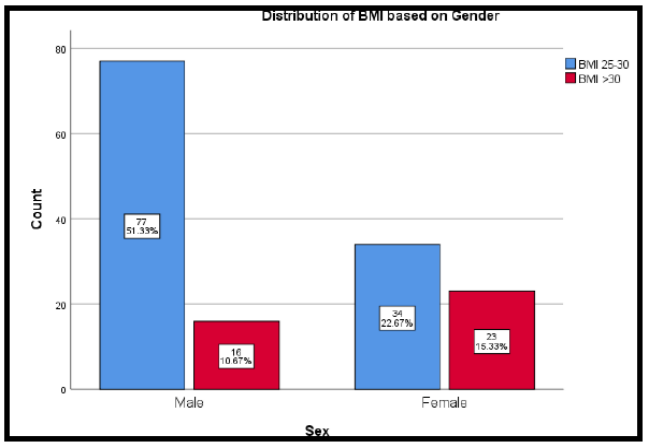
**Table 4: Distribution of the Patients Based on BMI**

| Age Group | BMI 25-30 | BMI>30 | Total | Cumulative Percent |
|---|---|---|---|---|
| 20-25 | 3 | 1 | 4 | 2.67 |
| 26-30 | 22 | 8 | 30 | 22.67 |
| 31-35 | 23 | 13 | 36 | 46.67 |
| 36-40 | 46 | 34 | 80 | 100 |
| Total | 94 | 56 | 150 | |




Graph 5: Age and BMI

### Correlation between Sex and BMI



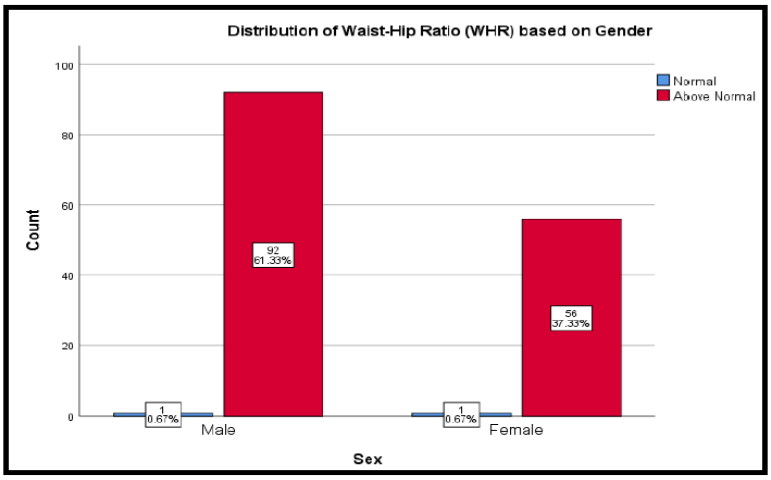

**Graph 6: Sex and BMI**

In this study, it was found that 51.3% of males and 22.67% of females were in the BMI range of 25-30 kg/m². As per the Chi-squared test, it is statistically significant ($p<0.05$).

### Correlation between Sex and WHR

**Table 5: Mean WHR Based on Gender**

| | Sex | N | Mean | Independent Samples Test (p-Value) |
|---|---|---|---|---|
| Waist to Hip Ratio | Male | 93 | 1.0029±0.09806 | P>0.05 |
| | Female | 57 | 0.9475±0.10218 | |



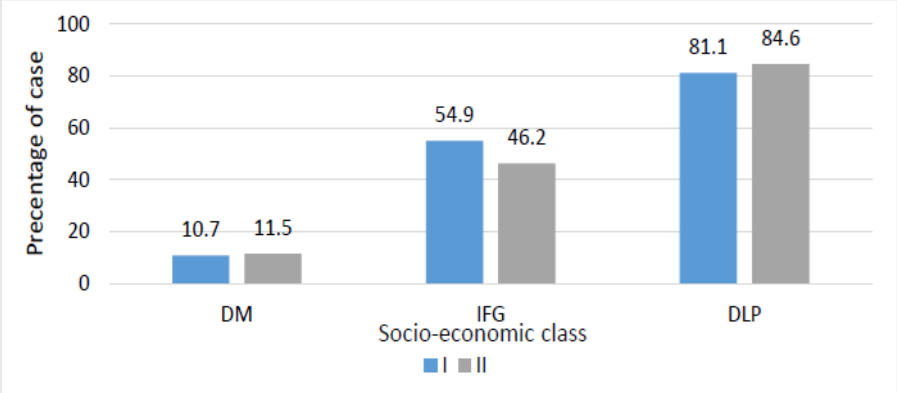

**Graph 7: Sex and WHR**

In our study, it was found that 61.33% of males and 37.33% of females had associated abnormal waist-hip ratio (WHR). Independent T-test shows that WHR is not statistically significant ($p>0.05$) with sex distribution.

### Correlation between Socioeconomic Class and IFG, DM, DLP

**Table 6: Correlation between Sec and IFG, DM, DLP**

| | | |
|---|---|---|
| Socio-Economic Class | Diagnosis | Pearson Chi-Square (P-Value) |
| | Type-2 Diabetes Mellitus | P>0.05 (Not Significant) |
| | Impaired Fasting Glucose | P>0.05 (Not Significant) |
| | Dyslipdemia | P>0.05 (Not Significant) |



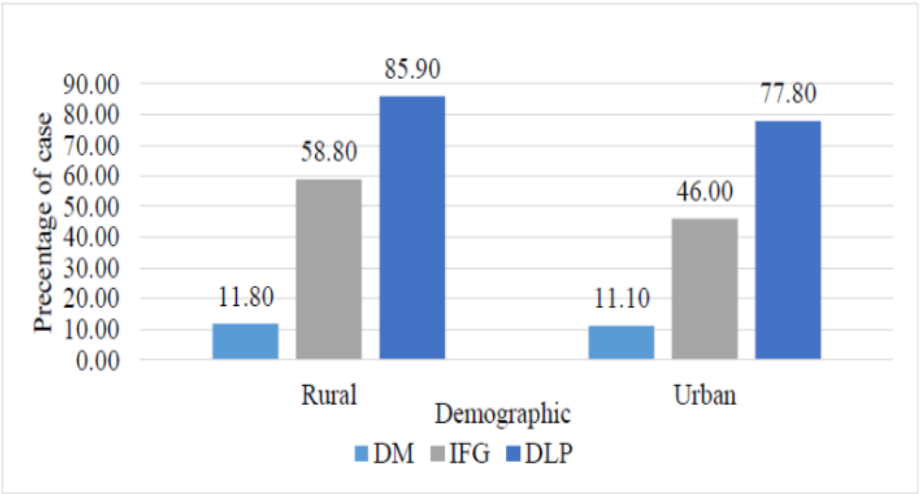

**Graph 8: Correlation between Sec and IFG, DM, DLP**

Graph 8 displays the distribution of patients based on Socioeconomic class with DM, IFG and DLP. As per the Chi-squared statistical test, there is no significant between DM, IFG and DLP with Socio-Economic Class.

**Correlation between Demographic Data and IFG, DM, DLP**

**Table 7: Correlation between Demographic Data and IFG, DM, DLP**

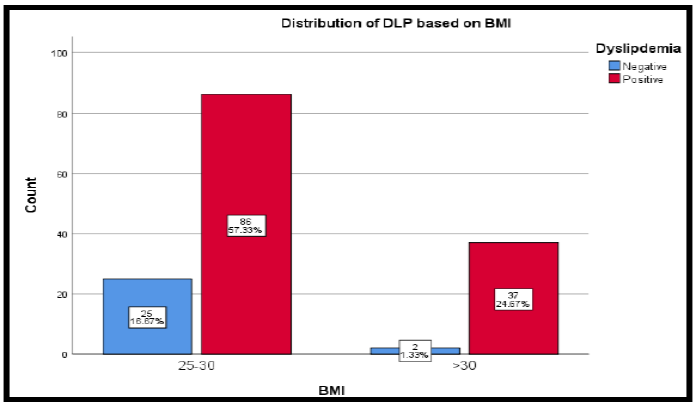
| | | |
|---|---|---|
| Demographic | Diagnosis | Pearson Chi-Square (P-Value) |
| | Type-2 Diabetes Mellitus | P>0.05 (Not Significant) |
| | Impaired Fasting Glucose | P>0.05 (Not Significant) |
| | Dyslipdemia | P>0.05 (Not Significant) |




**Graph 9: Correlation between Demographic Data and IFG, DM, DLP**

Graph 9 depicts the distribution of patients based on their place of residence. As per the Chi-squared statistical test, there is no significant between DM, IFG and DLP with demographics.

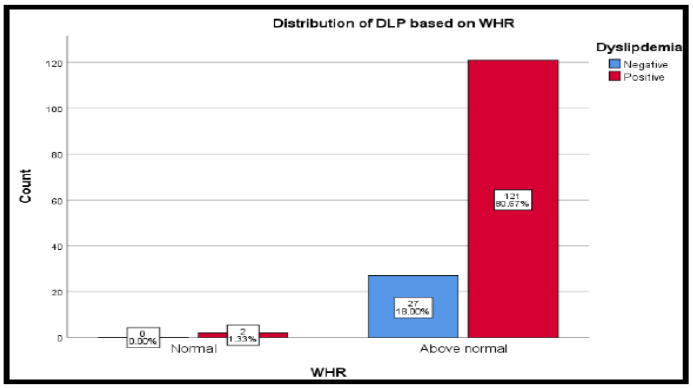
**Correlation between DLP and BMI**




**Graph 10: Distribution of DLP Based on BMI**

In this study, 82% of cases with DLP were present in obese patients. The BMI is highly significant to the DLP where the p-value is <0.01.

**Correlation between DLP and WHR**




**Graph 11: Distribution of DLP Based on WHR**

The above graph shows that 80.7% of cases with abnormal WHR have positive DLP. The WHR is highly significant to the DLP where the p-value is <0.01.

## Discussion

### Age Distribution

In this study, the disease occurrence was found to be predominantly in the fourth decade with a mean age of 34.43 years. In a similar study done in Malaysia, the mean age was found to be 39.5 years[13].

### Sex Distribution

Among the total 150 subjects, the disease incidence was mainly distributed among the male population (62%). A study done in Iran showed that female population (55.1%) was slightly more than males (44.9%) [11].

### Associated Comorbidities

In the present study, the most common associated comorbidity was DLP (12.7%) followed by OSA (8.7%) and then IFG (8%). A study conducted by Khurram et al, in Rawalpindi, showed that dyslipidemia (76%)

was the most commonly associated comorbidity followed by hypertension (71%), type 2 diabetes mellitus (65%), gallstones (57%), and coronary artery disease (49%), obstructive sleep apnea (35%) and stroke (14%).[10]

### Cutaneous Manifestations of Obesity

The most cutaneous manifestation of obesity in the study group was acanthosis nigricans which was present in 16.6% of cases followed by hirsutism and skin folds in 12.6% and 9.33% of cases, respectively.

### Association with Impaired Fasting Glucose

The association of obesity with IFG is well documented. A study done by Nichols GA et al showed that there is a progression of patients with impaired fasting glucose into type 2 diabetes mellitus in less than three years

### Association with Type 2 Diabetes Mellitus

There is a well-documented association between obesity and type 2 diabetes mellitus. A study done by Dunstan DW et al concluded that the prevalence of diabetes is rising drastically and they have attributed its close association with obesity.9 Obesity in diabetes patients is a very common phenomenon and often termed as “diabesity”.

### Association with Dyslipidemia

In our study subjects, the lipid profile was typical of atherogenic dyslipidemia with its significant association with obesity (82%). High total cholesterol, LDL cholesterol and TC/HDLC ratio were found in 3.3%, 22% and 62.7% of subjects, respectively. The percentage of hypertriglyceridemia was 36.7% among the cases.

## Conclusion

The present study showed that there exists a relationship between the presence of altered fasting blood sugar in the form of impaired fasting glucose and type 2 diabetes mellitus in young obese individuals. Thus from this study, we conclude that there is a statistically significant relationship between young obesity and diabetes. There was a direct proportional relationship between dyslipidemia and degree of obesity. Cutaneous manifestations of obesity and lifestyle have a significant correlation with the occurrence of complications of obesity. In the current period, young obesity should be considered an important risk factor for non-communicable diseases and should be treated at the earliest to prevent such complications.

## Limitation

- Age-matched non-obese controls were not included in the study.
- The sample size was small with only 150 patients and the results cannot be correlated with higher confidence.

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