

### STUDY OF CORRELATION BETWEEN OBESITY (BMI>25) AND FASTING BLOOD SUGAR IN YOUNG INDIVIDUALS AT A TERTIARY HOSPITAL

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#### Abstract

**Background:** Obesity is a leading cause for increasing mortality and morbidity worldwide. Impaired fasting glucose, type 2 diabetes mellitus (DM) and dyslipidemia (DLP) are one of the common complications of obesity. Present study was aimed to study correlation between fasting blood glucose (FBS) and obesity in young individuals. **Materials and Methods:** Present study was descriptive correlative study, conducted in subjects of age between 18-40 years, body mass index  $\geq 25\text{kg/m}^2$ . **Result:** This study was conducted on a total of 150 young obese individuals, predominant age group of patients in this study was between 36 to 40 years of age and the mean age was 34.43 years. The cases predominantly comprised of male population contributing 62% of the cases. Majority cases were in the BMI group of 25-30  $\text{kg/m}^2$  (74%) as compared to  $> 30 \text{kg/m}^2$  (26%). 96.7% of subjects consumed both veg and non-veg diet. Family history of obesity was seen in 25.3% of cases. 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. Impaired fasting glucose was seen in 53.3% of cases where as only 11.3% were having type 2 diabetes mellitus. Dyslipidemia was seen among 82% of the cases. High TC, LDL and TC/HDL-C ratio was found in 3.3%, 22% and 62.7% of subjects, respectively. Percentage of hypertriglyceridemia was 36.7% among the cases. Low HDL was found in 33.3% of subjects. Impaired fasting glucose & diabetes mellitus were significantly associate with age  $> 30$  years, female gender, BMI  $> 25 \text{kg/m}^2$ , abnormal waist-hip ratio & presence of dyslipidemia. **Conclusion:** Relationship between the presence of altered fasting blood sugar in the form of impaired fasting glucose and type 2 diabetes mellitus was noted in young obese individuals.

## INTRODUCTION

Obesity is a leading cause for 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 atleast 500 million adults being obese.<sup>[1]</sup> Obesity in India and other developing countries is on an increasing trend, as a result of rapid urbanization and changing lifestyles.<sup>[2]</sup>

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.

Impaired fasting glucose, type 2 diabetes mellitus (DM) and dyslipidemia (DLP) are one of the common complications of obesity.<sup>[3]</sup> Progression of patients with impaired fasting glucose (IFG) into type 2 diabetes mellitus in less than three years has been documented.<sup>[4]</sup> 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 correlation between fasting blood glucose (FBS) and obesity in young individuals.

## MATERIALS AND METHODS

Present study was descriptive correlative study, conducted in department of general medicine, at XXX medical college & hospital, XXX, India. Study duration was of 18 months (September 2014 to April 2016). Study was approved by institutional ethical committee.

### Inclusion criteria

- Subjects of age between 18-40 years, body mass index  $\geq 25\text{kg/m}^2$ , came to outpatient and inpatient services, willing to participate in study.

### Exclusion criteria

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

Study was explained to patients & consent was taken for participation. A detailed questionnaire was administered to all study subjects to collect information regarding demographic, socioeconomic, behavioral, and health status. Fasting blood sugar (FBS) & Fasting lipid profile (FLP) of all subjects was done.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

This study was conducted on a total of 150 young obese individuals, predominant age group of patients in this study was between 36 to 40 years of age and the mean age was 34.43 years. The cases predominantly comprised of male population contributing 62% of the cases. Majority cases were in the BMI group of 25-30  $\text{kg/m}^2$  (74%) as compared to  $> 30 \text{kg/m}^2$  (26%).

**Table 1: Age & gender distribution**

Characteristics	Number of subjects	Percentage
<b>Age group (years)</b>		
18 – 25	4	2.7
26 – 30	30	20.0
31 – 35	36	24.0
36 – 40	80	53.3
<b>Gender</b>		
Female	57	38.0
Male	93	62.0
<b>BMI (<math>\text{kg/m}^2</math>)</b>		
25-30	111	74
$>30$	39	26

In present study, 96.7% of subjects consumed both veg and non-veg diet. Family history of obesity was

seen in 25.3% of cases. Majority of the cases (86.3%) were belonging to class I socioeconomic status. Studied subjects hailing from urban place (56.7%) were slightly more compared to those from rural area (42.0%). 98.9% of males and 80.7% of females were having associated abnormal waist hip ratio (WHR).

**Table 2: Lifestyle related parameters**

Parameters	Number of subjects	Percentage
<b>Type of diet</b>		
Veg and non-veg	145	96.7%
Veg	5	3.3%
<b>Alcohol consumption</b>		
Smoking	57	38.0%
<b>Family history of obesity</b>		
Regular exercise	65	43.3%
Watching TV and computer/internet use	38	25.3%
<b>Socio-economic class</b>		
I	7	4.7%
II	118	78.7%
III	26	17.3%
<b>Demographic data</b>		
Urban	2	1.3%
Rural	85	56.7%
Others (NRI, migrants, foreigners)	63	42.0%
<b>Abnormal waist hip ratio (WHR)</b>		
Male (n=93)	2	1.3%
Female (n=57)	91	98.9 %
	50	80.7 %

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.

**Table 3: Comorbidities**

Comorbidities	Number of subjects	Percentage
Dyslipidemia	19	12.70%
Obstructive sleep apnea	13	8.70%
Impaired Fasting Glucose	12	8.00%
Type 2 Diabetes mellitus	10	6.70%
Gallstones	10	6.70%
Genitourinary disease in women	8	5.30%
Hypertension	4	2.70%
Impotence	1	0.70%
Osteoarthritis	1	0.70%
Liver disease	1	0.70%
No history of Comorbidities	104	69.30%

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

**Table 4: Frequency of cutaneous manifestations**

Cutaneous manifestations	Number of subjects	Percentage
Acanthosis nigricans	25	16.66
Skin folds	14	9.33
Hirsutism	19	12.66

In our study, it was found that impaired fasting glucose was seen in 53.3% of cases where as only 11.3% were having type 2 diabetes mellitus.

**Table 5: Abnormal blood sugar profile**

Distribution	No. of patients	Percentage
Impaired fasting glucose	80	53.3
Diabetes mellitus	17	11.3

In this study, it was found that dyslipidemia was seen among 82% of the cases. High TC, LDL and TC/HDL-C ratio was found in 3.3%, 22% and 62.7% of subjects, respectively. Percentage of hypertriglyceridemia was 36.7% among the cases. Low HDL was found in 33.3% of subjects.

**Table 6: Fasting lipid profile**

Fasting lipid profile	Frequency	%
TC	104	69.3%
Borderline	41	27.3%
High	5	3.3%

**Table 7: Correlation between fasting blood glucose & other parameters**

Parameters	Impaired fasting glucose (n=80) (%)	P value	Diabetes mellitus (n=17) (%)	P value
<b>Age</b>				
20-25	0	<0.001	0	<0.001
26-30	11 (13.75 %)		2 (11.76 %)	
31-35	13 (16.25 %)		4 (23.53 %)	
36-40	56 (70 %)		11 (64.71 %)	
<b>Gender</b>				
Male	51 (63.75 %)	<0.001	8 (11.76 %)	<0.001
Female	29 (36.25 %)		9 (52.94 %)	
<b>BMI (kg/m<sup>2</sup>)</b>				
25-30	75 (93.75 %)	<0.001	6 (35.29 %)	<0.001
>30	5 (6.25 %)		11 (64.71 %)	
Abnormal waist hip ratio (WHR)	80 (100 %)	<0.001	17 (100 %)	<0.001
Dyslipidemia	79 (98.75 %)	<0.001	17 (100 %)	<0.001

## DISCUSSION

Being obese/overweight at less than 40 years age is common, and a significant association with increased daily calorie intake, lack of daily physical activity, increased daily consumption of tea/coffee/fruit juices, decreased playing outdoor games, socio-economic status, and family history of obesity was noted. Also, the problem of obesity/overweight is on rise and its association with rapid urbanization, unhealthy eating patterns and reduced physical activity.<sup>[5]</sup>

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.<sup>[6]</sup> The disease burden was mainly found to be distributed among adults who comprise the predominant working class of the population.

Among the total 150 subjects, the disease incidence was mainly distributed among male population (62%). A study done in Iran showed that female population (55.1%) was slightly more than males (44.9%).<sup>[7]</sup>

In the present study the most common associated comorbidity was dyslipidemia (12.7%) followed by obstructive sleep apnea (8.7%) and then Impaired

TG	Normal	95	63.3%
	High	55	36.7%
LDL	Normal	29	19.3%
	Near optimal	42	28.0%
	Borderline	46	30.7%
	High	33	22.0%
HDL	Low	50	33.3%
	Normal	97	64.7%
	High	3	2.0%
TC:HDL	Normal	56	37.3%
	High	94	62.7%
VLDL	Normal	130	86.7%
	High	20	13.3%

In present study, we noted that impaired fasting glucose & diabetes mellitus were significantly associate with age > 30 years, female gender, BMI > 25 kg/m<sup>2</sup>, abnormal waist-hip ratio & presence of dyslipidemia.

fasting glucose (8%). A study conducted by Khurram et al.,<sup>[8]</sup> showed that dyslipidemia (76%) was the most common associated comorbidity followed by hypertension (71%), type 2 diabetes mellitus (65%), gallstones (57%), coronary artery disease (49%), obstructive sleep apnea (35%) and stroke (14%).

The most cutaneous manifestation of obesity in the study group was acanthosis nigricans which was present in 16.6% cases followed by hirsutism and skin folds in 12.6% and 9.33% cases, respectively. Similar results were seen in a study conducted by Divyashree R A et al,<sup>[9]</sup> which showed that incidence of acanthosis nigricans was higher (67.6%) followed by skin folds (45%). Acanthosis nigricans is also an indicator of insulin resistance and is a common occurrence in obese individuals.

There is a well-documented association between obesity and type 2 diabetes mellitus. In a study done by Dunsten DW et al,<sup>[10]</sup> concluded that prevalence of diabetes is rising drastically and they have attributed its close association with obesity. Obesity in diabetes patients is very common phenomenon and often termed as "diabesity".<sup>[2]</sup> In our study, only 11.3% of total cases included were found to have type 2 diabetes mellitus as compared to other studies where prevalence of diabetes was high.

In a study conducted by Gupta et al,<sup>[11]</sup> showed that there was significant correlation between dyslipidemia and obesity in the form of increase in mean total cholesterol, TC/HDL-C ratio, and triglycerides and decline in HDL cholesterol levels. In another study showed that there was high prevalence of dyslipidemia among obese individuals in the form of reduced high-density lipoprotein and high triglyceride.<sup>[6]</sup> Similar findings were noted in present study.

In the study most cases were in the BMI group of 25-30 kg/m<sup>2</sup> with occurrence of 74%. Out of which 48.6% were in the age group of 36-40 years and majority of them were belonging to male population (82.8%). In a study conducted by Patil VC et al,<sup>[12]</sup> showed that high BMI among both sex groups had strong correlation between obesity/overweight and various coronary risk factors.

Occurrence of type 2 diabetes mellitus was slightly more (52.9%) in lower BMI group (25-30 kg/m<sup>2</sup>) as compared with 47.1% of cases in BMI >30 kg/m<sup>2</sup>. This could be possible because majority of cases were in the BMI range of 25-30 kg/m<sup>2</sup>. Incidence of impaired fasting glucose (71.3%) was more than type 2 diabetes mellitus in the most common BMI range of 25-30 kg/m<sup>2</sup>. Indicating high risk of progression into frank type 2 diabetes.

There is an important and well-established clinical association between obesity with dyslipidemia, impaired fasting glucose and type 2 diabetes mellitus. Also, the association of obesity with IFG is well documented. In a study done by Nichols GA et al,<sup>[4]</sup> showed that there is progression of patients with impaired fasting glucose into type 2 diabetes mellitus in less than three years. In our study 53.3% of cases were having IFG and hence at a high risk of progression to type 2 diabetes mellitus.

## CONCLUSION

This 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. This study also showed the presence of dyslipidemia in the form of hypertriglyceridemia and high TG/HDL-C ratio in young obese individuals.

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