

Research Article

A study on body mass index and its correlation with type 2 diabetes

Subhash Chand Jain^{1,*}, Rameshwar Prasad Gupta², Deepak Gupta³, Madhu Kanta Jain⁴

¹Associate Professor, ²Assistant Professor, ³Senior Professor & HOD, Department of Medicine, ⁴SMO & Deputy Controller, Jhalawar Hospital and Medical College Society, Jhalawar, Rajasthan, India

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*Correspondence:

Dr. Subhash Chand Jain,

E-mail: subhash.nopra@gmail.com

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ABSTRACT

Obesity and increases in body weight are among the most important risk factors for type 2 diabetes mellitus. Obesity contributes to the development of type 2 diabetes mellitus. Body mass index is also known as obesity index. Body mass index is a strong and independent risk factor for being diagnosed in cases of type 2 diabetes mellitus. There is a high risk of type 2 diabetes in those who have a higher body mass index. The present study has been done with the objective of finding correlation between BMI and type 2 diabetes.

Keywords: Body mass index, Obesity, Hyperglycemia, Type 2 diabetes, Hypertension

INTRODUCTION

Obesity is an important cause of several ailments in human being (Georg V. Mann, 1974)¹ and its association with type 2 diabetes mellitus is well known (Benzamin N. Chaing, 1969).² Obesity is defined as an excess of adipose tissue. Clinically obesity can be viewed as any degree of excess adiposity that imparts a health risk (Jerrod Molefsky, 1984).³ Body mass index is calculated using formula weight (Kg)/Height (m²). (Key et al, 1972).⁴ On the basis of the classification of the obese persons (WPT James, 1984)⁵ subjects are graded as follows:

Table 1: Grading of Obesity.

Grade	Index (Wt/Ht ²)
Grade 0	20.0 – 24.9
Grade I	25.0 – 29.9
Grade II	30.0 – 40.0
Grade III	> 40.0

Grade I – Obesity was associated with two fold increase in incidence of coronary heart disease.

Grade II - Obesity was associated with 7-12 fold increase in incidence of type 2, diabetes (WPT James – Clinics in Endocrinology, 1984).⁵ Dunn, J.P. et al (1970)⁶ reported that obese men (Body weight 125% or more than ideal according to metropolitan life insurance standard) had a risk of developing diabetes 1.5 times higher than those with body weight less than 110% of ideal weight. Knowler et al (1981)⁷ reported incidence of diabetes in Pima Indians in whom there is a high prevalence of obesity and type 2 diabetes. The Pima Indians are the population in the world with high prevalence of obesity and they have the highest incidence of type 2 diabetes. (Pittitt, D.J. et al, 1981).⁸ Bonham (1985)⁹ reported relationship of body mass index to type 2 diabetes mellitus. Among obese American aged 45-75 years the relative risk for diabetes is above twice than for non overweight person in same age group.

Obesity is causally related to type 2 diabetes is evident as has been shown from the results of metabolic and epidemiological studies.¹⁰⁻²⁰

An association between body mass index (BMI: in kg/m²) and type 2 diabetes have been reported by many

studies in men^{11,16-18,20-28} and women).^{11,18,19,23-25,27,29} Any weight gain and early obesity are the risk factors for development of type 2 diabetes.^{16,19} Diabetes mellitus is a state of chronic hyperglycemia i.e. the state of having excessive concentration of glucose in the blood which may result from many environmental and genetic factors often acting jointly. Hyperglycemia may be due to a lack of insulin or to an excess of factors that oppose its action. The Major effects of diabetes include characteristic symptoms, ketoacidosis, progressive disease of capillaries of the kidney and retina, damage to the peripheral nerves and excessive incidence of arteriosclerosis.

In view of the above facts we plan to study the role of body weight especially obesity using body mass index as a criterion for defining its role in type 2 diabetes.

METHODS

Following approval from institutional ethical committee, the present study was conducted on OPD and admitted patients of SRG Hospital Jhalawar. Six hundred cases of type 2 diabetes formed the material for the present study. Detailed history was taken, each patient underwent thorough clinical examination. In addition to routine blood and urine examination, blood sugar fasting, post glucose blood sugar, urea, total serum cholesterol, ECG (12 lead), X-ray chest, serum k+ and Na+ were done. Those who were excluded were patients with hypothyroidism, Cushing syndrome, nephritic syndrome, liver disease, chronic renal failure, congestive heart failure and anemia. Diabetes were divided in to two groups (i) diabetes without coronary artery disease/hypertension (ii) diabetes with coronary artery disease/hypertension. In each case BMI was calculated as follows: BMI= w/(h²) kg/mt² “w” stands for weight in kilograms and “h” stands for Height in meters. Cases were divided in to three groups according to BMI – those who had BMI below 19 were labelled as lean, ones with BMI 19 to 23 were normal weight individuals while in those cases where BMI was above 23 were called obese (according to ICMR criteria personal communication).

Diagnostic criteria for diabetes mellitus (WHO, 1980) Table 2.

Table 2: Glucose Concentration

Diabetes mellitus	Venous whole blood	capillary whole blood	Venous plasma
Fasting	≥ 7.0 m mol/L (≥1.2 gm/L)	≥ 7.0 m mol/L (≥1.2 gm/L)	≥8.0 m mol/L (≥1.4 gm/L)
and or 2 hrs after glucose load	≥ 10.0 m mol/L (≥1.8 gm/L)	≥ 11.0 m mol/L (≥2.0 gm/L)	≥11.0 m mol/L (≥2.0 gm/L)

RESULTS

In the present study we evaluated 600 patients of type 2 diabetes mellitus of which 369 (61.5%) were males and 231 (38.5%) were females. Of this, 418 (280 males and 138 females) were without hypertension and coronary artery disease while of the remaining 182 patients hypertension was present in 121 cases (66.48%), coronary artery disease in 38 cases (20.87%) and 23 patients were having both coronary artery disease and hypertension (12.63%).

Table 3: Sex distribution in type 2 diabetes mellitus.

Sex	Type 2 diabetes (600 cases)	
	Uncomplicated	Complicated
Male	280 (66.98%)	89 (48.90%)
Female	138 (33.01%)	93 (51.09%)
Total	418	182

Table 4: Age and sex distribution in type 2 diabetes mellitus.

Age in Years	Type 2 Diabetes 600 cases			
	Uncomplicated		Complicated	
	Male	Female	Male	Female
35	15 (5.35%)	13 (9.42%)	8 (8.98%)	7 (7.52%)
36-45	80 (28.07%)	32 (23.18%)	17 (19.10%)	19 (20.43%)
46-55	100 (35.71%)	54 (39.14%)	40 (44.94%)	35 (37.63%)
55	85 (30.35%)	39 (28.26%)	24 (26.96%)	32 (34.40%)

Table 4 depicts distribution of these cases according to age. It is apparent from the table that the majority of cases in our study were above 45 years age (68.5% of diabetes, 84% with coronary artery disease and 81% of hypertensive).

In table 5 it is interesting to note that 68.0% of patients with uncomplicated diabetes mellitus were obese while only 6.9 were in the lean group. This phenomenon was also observed in patients with CAD and hypertension where also majority of patients were obese (58% and 55% respectively). Obesity was even more common in patients who had diabetes associated with hypertension and/or CAD where 80.76% cases had BMI above 23 kg/mt².

Table 6 shows that mean fasting blood sugar levels was lowest in obese individuals (162.14±62.49 mg%) while it was highest (200.72±90.52%) in underweight individuals (BMI 19). It was in between in normal weight individuals (177.00±77.92%). These findings were statistically significant (P=0.05).

Table 5: Showing body mass index in type 2 diabetes mellitus.

BMI Kg/mt2	Type 2 Diabetes mellitus 600 cases							
	Uncomplicated				Complicated			
	Male	Female	Total	%	Male	Female	Total	%
19	23	06	29	6.93	3	3	6	3.29
19-23	78	26	104	24.88	20	09	29	15.93
23	179	106	285	68.18	66	81	147	80.76
Total	280	138	418		89	93	182	

Table 6: Fasting blood sugar and its correlation with BMI.

Body mass index kg/mt2	Type 2 Diabetes 600 cases			
	Uncomplicated		Complicated	
	Mean	S.D.	Mean	S.D.
19	200.72	90.52	141.33	95.14
19-23	177.20	77.92	146.5	68.65
23	162.14	62.49	164.22	69.68

P=0.05

DISCUSSION

We studied body mass index in 600 cases of type 2 diabetes, out of these 418 were without hypertension and coronary artery disease, the uncomplicated group; while remaining 182 were associated with CAD and/or hypertension. In the uncomplicated group two third (280) were males while in complicated groups 89 were males. In all the groups majority of the patients were above 45 years of age. It was significant to note that majority of patients 68% of type 2 diabetes were obese, BMI more than 23 kg/mt2. This finding is contrary to popular belief that Indian diabetics are not obese. Our study brings out clearly that obesity is very common in type 2 diabetes cases and it is even more so in those who have associated hypertension and/or coronary artery disease. In those who have complicated type 2 diabetes incidence of obesity rose to 80.70%. There was an inverse association between fasting blood sugar level and BMI in cases with type 2 diabetes without complication. Mean (200.72 mg%) fasting blood sugar was highest in the lean group while lowest (162.14 mg%) in those who had BMI above 23 kg/mt2 It was intermediate (177.20 mg%) in normal weight persons. Surprisingly this association was not seen in those who had associated CAD and/or hypertension with type 2 diabetes.

CONCLUSION

The results conclude that there is a relation between body mass index and type 2 diabetes both complicated and uncomplicated. Obesity is extremely common in patients with type 2 diabetes. BMI is the best index of obesity.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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