



CORRELATION BETWEEN OBESITY, LIPID PROFILE AND URIC ACID IN DIABETICS AND NON-DIABETICS: A COMPARITIVE STUDY

Biochemistry

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ABSTRACT

Obesity is the leading public health challenge in India and across world. Indians are highly susceptible to diabetes with modest over weight, central obesity, and decrease in physical activity. Obesity is closely linked with the etiology of T2DM. Previous research has shown that the relative risk for overweight adults to develop T2DM is 4.6-fold for women and 3.5-fold for men compared with their normal weight same sex peers. The incidence and prevalence of diabetes mellitus (DM) and cardiovascular disease (CVD) in India increasing and is a result of dietary habits and life style. The aim of the study is to recognize obesity by BMI and find correlations if any between biochemical parameters (uric acid, lipid profile with BMI). Total 120 individuals were registered at OPD, Rohilkhand Medical College & Hospital, Bareilly (UP). This study included 120 subjects, 60 known cases of DM and matched healthy adults as control subjects. parameters were investigated. The data was analysed by using SPSS software. A total 120 patients of diabetics and non diabetics were recorded. There were 29 (48.3%) males and 31 (51.7%) females in Diabetic group. We found BMI was found to be positively correlated with triglyceride, cholesterol and HDL in diabetic group. Both body fat and lipid parameters have been revealed to be the significant predictor for metabolic disturbances including diabetes, dyslipidaemia, hypertension, hyperinsulinaemia, and cardiovascular diseases. Lipid profiles association is reported with lifestyle, age, intra abdominal adiposity.

KEYWORDS

INTRODUCTION

Obesity is the leading public health challenge in India and across world. Indians are highly susceptible to diabetes with modest over weight, central obesity, and decrease in physical activity. As per report by Kelly et al. in 2005, the overweight and obese adults were 937 million and 396 million respectively worldwide and the figure has almost doubled in number in comparison to past 20 years. The incidence and prevalence of diabetes mellitus (DM) and cardiovascular disease (CVD) in India increasing and is a result of dietary habits and life style. Glucose synthesizes fatty acid that constitute body fat content. An increase in blood glucose level will result in increase in BMI causing increased lipid biosynthesis and hence body weight. Insulin which is secreted from beta cells of islets of Langerhans from pancreas act through specific cell receptor of insulin sensitive cells which results in enhanced glucose uptake into the cell. Insulin being an anabolic hormone results in energy conservation and thereby signaling the body to produce fat. As BMI increases, insulin resistance also increases which results in increased blood glucose level in body. Since body weight is associated with BMI, it may be expected that BMI should correlate with blood glucose levels. [1] The impact of BMI classification, including overweight and various grades of obesity, on the risk of T2DM in the real-world practice is a well-investigated topic [2,3]. However, the evidence for the US is dated, with most of the studies relying on data before the year 2005 and does not reflect recent changes in the obesity 'epidemic'. [4] The World Health Organization estimated that in 2014 more than 1.9 billion adults worldwide were overweight (39%), defined as a body mass index (BMI) of 25.0 to 29.9 kg/m², and 600 million adults were obese (13%) (BMI ≥30 kg/m²) [5]. Overweight and obesity are established risk factors for the development of metabolic diseases such as diabetes, hypertension, dyslipidemia, CVD, and certain cancers [6]. Nevertheless, the association between overweight/obesity and mortality remains an area of interest, importance, and debate. Some previous research has shown a U- or J-shaped association between BMI and mortality, with higher mortality in underweight or obese subjects [7,8]. On the contrary, reviews of other research have demonstrated that adults with a higher BMI have lower mortality compared with leaner individuals in population-based samples with various clinical conditions [9,10]. Obesity is closely linked with the etiology of T2DM. Previous research has shown that the relative risk for overweight adults to develop T2DM is 4.6-fold for women and 3.5-fold for men compared with their normal weight same sex peers.

A Japanese study demonstrated that an increase in BMI of 1 kg/m² (corresponding to a body weight gain of 2.4 to 2.9 kg) may increase the risk of diabetes by 25%. Furthermore, a lifestyle intervention has been shown to prevent the development of type 2 DM in overweight persons at high risk for this outcome, with weight loss being the

dominant predictor of reduced diabetes risk. However, as for the association between BMI and longevity, the predominant evidence from longitudinal observational studies implies that overweight or obese individuals with DM have lower mortality compared with normal weight individuals. We reviewed the literature for research on the obesity paradox in type 2 DM to determine how consistently this has been observed and to discuss potential causal and non-causal explanations for this phenomenon. [4] In adults the prevalence of diabetes is 2-3 folds greater in urban than in rural population. National surveys showed that there has been a marked decrease in under nutrition and significant increase in the prevalence of overweight and obesity, more specifically among the urban populations of India. [1] Therefore we have designed this study with aim is to recognize obesity by BMI and find correlations if any between biochemical parameters (uric acid, lipid profile with BMI)

MATERIAL AND METHODS

Over a period of one year. From April 2012 to March 2013, a total 120 individuals were registered at OPD, Rohilkhand Medical College & Hospital, Bareilly (UP). This study included 120 subjects, 60 known cases of DM and matched healthy adults as control subjects. Cases with biochemical evidence of hypothyroidism, smoking congestive heart failure and with any nephropathy were excluded in this study.

Body mass index

Calculated from height and weight (kg/m²) measured using standardised examination protocols. [11]

Diabetes Mellitus

Defined to include both previously diagnosed and undiagnosed DM. Diagnosed DM was based on self-reported responses (i.e. respondent answered yes to 'Has a doctor ever told you that you have DM?'). Undiagnosed DM was defined using the American Diabetes Association criterion of FPG > 125 mg/dl (7.0 mmol/l). [12]

Dyslipidaemia

Defined to include any one of the following: total cholesterol (TC) ≥ 240 mg/dl (6.22 mmol/l), triglycerides (TG) > 200 mg/dl (2.26 mmol/l), low-density lipoprotein cholesterol (LDL-C) ≥ 160 mg/dl (4.14 mmol/l) or high-density lipoprotein cholesterol (HDL-C) < 40 mg/dl (1.04 mmol/l), as well as those ever told by a doctor or other healthcare professional that their blood cholesterol level was high. [13]

RESULT AND DISCUSSION

All Anthropometric measurements Height, Weight and Lipid Profile, other Biochemical parameters were investigated. The data was analysed by using SPSS software.

- A total 120 patients of diabetics and non diabetics were recorded. There were 29 (48.3%) males and 31 (51.7%) females in Diabetic group.
- 26 (43.3%) male and 34 (56.7%) female were included in Non Diabetics group.
- In diabetics group, age range was 28-74 years and in Non Diabetics group it was 20-60 years.

Table 1: Distrubution of Cases according to BMI

BMI	Number of Cases	
	Diabetics	Non diabetics
Normal	28	34
Overweight	13	10
Obese	19	16

In the above table we found more obese and overweight people in diabetic group than non diabetics. Similar results were found by S Lin et. al; in a study , over 1978–2013, Type 2 DM prevalence increased from 1.2% to 19.6% in men (2.3% per 5 years), and from 2.2% to 19.5% in women (2.2% per 5 years). Obesity prevalence increased from 27.7% to 53.1% in men (3.6% per 5 years) and from 44.4% to 76.7% (4.5% per 5 years) in women. Type 2 DM and obesity prevalences increased in all age groups. From period trends, Type 2 DM prevalence in 2020 is projected to be 26% in men and women. Projected obesity prevalence is projected to be 59% in men and 81% in women. Type 2 DM period trends attributable to BMI increase are estimated as 31% (men) and 16% (women), after adjusting for age.[14]

In a study by Arshad Hussain, Patients were divided into three groups based on their BMI; group one consisted of patients with normal BMI ($\leq 22.9 \text{ kg/m}^2$), the group two consisted of patients with BMI value (23.0–24.9 kg/m^2) and group three ($\geq 25 \text{ kg/m}^2$). Group one was noted to have higher values of TC (201.79 $\pm$ 47.94), TG, (234.94 $\pm$ 167.03) LDL-C (120.98 $\pm$ 50.56), TC/HDL-C (4.61 $\pm$ 1.87) and LDL-C/HDL-C (2.90 $\pm$ 1.46), [18] This similar type of grouping was done by us as in table1.

Table 2: Correlation of all parameters in diabetis and non-diabetics group

Parameters	Diabetics (N=60)	Non -diabetics (N=60)	p VALUE
BMI (Kg/m ²)	26.26 $\pm$ 3.2	25.71 $\pm$ 3.8	p < 0.05 significant
URIC ACID (mg/dl)	4.8 $\pm$ 1.4	3.76 $\pm$ 1.1	p < 0.05 significant
CHOLESTEROL (mg/dl)	168.2 $\pm$ 42.3	167.2 $\pm$ 25.5	p > 0.05 not significant
TG (mg/dl)	151.8 $\pm$ 32.2	134.7 $\pm$ 41.3	p < 0.05 significant
HDL-C (mg/dl)	41.05 $\pm$ 5.9	45.6 $\pm$ 4.1	p < 0.05 significant
LDL-C (mg/dl)	105.3 $\pm$ 36.7	89.3 $\pm$ 25.5	p > 0.05 not significant
VLDL-C (mg/dl)	30.3 $\pm$ 6.4	28.6 $\pm$ 8.5	p > 0.05 not significant

Table 2 depicts that there is rise of obesity in diabetic group or we can say that diabetics have more BMI compared to non-diabetics group. Similarly as found by S. Lin et al. The increase in Type 2 DM is partially influenced by the rise in obesity. Similar results are seen in other Pacific Island countries where increases in mean BMI in Fiji Melanesians explained 27% (men) and 25% (women) of increases in Type 2 DM prevalence (1980–2011), after age adjustment [15]. In Tonga, BMI increases explained 76% (men) and 73% (women) of Type 2 DM prevalence increases over 1973–2012 [16]. BMI increases in Samoa, Fiji [15] and Tonga [16] have been attributed to changes in way of life, including a shift away from farming and fishing towards more sedentary occupations; and increased consumption of energy-dense imported foods. [17]

Table 3: Corelation of BMI with other parameters

	BMI	
	Diabetic	Non diabetic
TG	p < 0.05 significant	p > 0.05 not significant
CHOLESTEROL	p < 0.05 significant	p < 0.05 significant
HDL	p < 0.05 significant	p > 0.05 not significant
LDL	p > 0.05 not significant	p > 0.05 not significant
VLDL	p > 0.05 not significant	p > 0.05 not significant
URIC ACID	p > 0.05 not significant	p < 0.05 significant

In this study we found BMI was found to be positively correlated with triglyceride, cholesterol and HDL in diabetic group. In different studies of Arora M, and Ali Zaua research literature support a relationship between BMI and TG, and the relationship of blood lipids and body fat distribution.[20,21] Table 3 depicted that no significant relation was found with LDL, uric acid and VLDL in diabetic group. In non-diabetic group significant relation was found with cholesterol and uric acid.

Body fat and blood lipids have been observed to be key determinants of metabolic disorders, like CVD, diabetes, dyslipidemia, hypertension, hyperinsulinemia and elevated serum uric acid.

Dyslipidemia, a well known risk factor for cardiovascular manifestations, is mostly observed in the population of the Asian continent. People with T2DM have an increased cardiovascular morbidity and mortality, and are affected more by CVD compared with non diabetics. Prompt recognition and management of DM associated dyslipidemia might be one step in controlling the risk of CVD.

The study of Arshad Hussain, Iftikhar Ali, in Pakistan intends to evaluate the correlation between BMI and lipids in patients with T2DM in a Khyber Pakhtunkhwa population. With regards to relationship between BMI and lipid profile they showed that BMI had a negative correlation $r = -0.125$, $p = 0.029$ with HDL-C value while the others parameters like TC ($r = -0.052$, $p = 0.367$), TG ($r = -0.006$, $p = 0.919$), LDL-C ($r = -0.021$, $p = 0.721$) did not reveal any correlation with BMI.

Results of a study conducted in Korea described that there was a positive correlation between BMI with TC and LDL-C respectively; whereas a study from India illustrated the existence of only BMI vs. LDL-C correlation. A weak negative correlation of HDL-C with BMI was also reported by a similar study conducted in Nigeria.[19] Likewise in a study by Shamai et al there was an association between BMI, HDL-C and TG.[18]

This study had its limitation as socio-economic factors in influencing lipid profile and obesity were not considered. A randomly drawn larger sample would have been more advantageous. Lack of resources and time was the chief causes for these limitations.

CONCLUSION

These results are imperative as they back up that there is modest impact of BMI on lipid profile. Both body fat and lipid parameters have been revealed to be the significant predictors for metabolic disturbances including diabetes, dyslipidaemia, hypertension, hyperinsulinaemia, and cardiovascular diseases. Lipid profiles association is reported with lifestyle, age, intra abdominal adiposity. Normal BMI significantly improves dyslipidemia in T2DM patients. Further studies with large sample size are needed to identify the causes of obesity that would help in better understanding of its influence on lipid profile.

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