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A Comparative Study of Body Fat Percentage and Biochemical Profile between First Degree Relatives of Diabetic Patients and Non Diabetic Patients

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Abstract

Background: Obesity may lead to diabetes mellitus(DM), cardiovascular disease and other diseases. The prevalence of obesity is increasing rapidly in the world and our country too. Accurate determination of body fat may help to assess risks of diseases in obese individuals. So this study was planned to measure body fat percentage (PBF) of first degree relatives of diabetic patients, to estimate body mass index (BMI) and the risk factors for developing diabetes and to compare above mentioned parameters between first degree relatives of diabetic and non-diabetic patients.

Method: Total 1000 subjects were included in the study and divided into two groups – group A comprised 500 persons with evident family history of diabetes and group B comprised 500 persons without family history of diabetes. Detailed clinical, anthropometric evaluation and fasting plasma glucose (FPG) and other relevant biochemical investigations were done.

Result: 76% of subjects in group A (study group) had high body fat percentage (PBF) while 41.2% in group B (control group) had high PBF ($p < 0.001$).73% subjects in group A were overweight (BMI > 25 kg/m^2) while in group B, 47.6% were overweight ($p < 0.0001$). Likewise in group A 52% were found to be diabetic, while in group B 9.6% were found to be diabetic ($p < 0.0001$).

Conclusion: PBF could be an important screening tool for assessing potential diabetics and it might prove helpful in guiding lifestyle modification approach for health promotion.

Key words: Body fat percentage, obesity, diabetes mellitus.

Introduction

Obesity is characterised by the accumulation of excessive body fat which may lead to diabetes, cardiovascular diseases and joint problems.The prevalence of obesity is increasing rapidly in the world and causing a heavy toll socially and economically.Prevalence of obesity among Indian women has increased from 10.6% (National Family Health Survey- 2 in 98 - 99) to12.6% (National Family Health Survey-3 in 2005 - 06). In India several studies have shown that prevalence of overweight adolescents varies between 10 - 30%[1].

Accurate determination of body fat can guide clinicians to assess risks of disease in an obese person, so that preventive and therapeutic measures can be taken in time[2]. Measurement of body fat can be accomplished by simple measures like waist circumference, waist to hip ratio and body mass index (BMI). Out of these tools, BMI is widely used due to its ease of calculation. Several studies in the past have shown that high BMI is associated with increased risk of metabolic related diseases and may be used as a predictor of these diseases[3]. However, BMI cannot differentiate between body fat and lean mass. It cannot categorise individuals who have normal body weight with too much body fat but too little muscle and who have an excessive body weight with too little body fat but too much muscle[4,5]. Meta-analysis of 32 samples consisting of 31,968 patients revealed that usually used BMI cut-off values to diagnose obesity fail to identify about half of the people with excess body fat percentage (PBF)[6]. Many studies have demonstrated that BMI is less useful for Asian patients because of the different contributions of bone mass, muscle mass and fluid to body weight which in turn could result in misclassification[7,8]. In a recent study it was shown that currently used BMI cut-off values to define obesity overestimated obesity prevalence in African-American persons and underestimated prevalence in Asian-Indian persons, indicating an ethnic basis of universal obesity BMI cut-off values[5]. Therefore we should access the utility of measures like PBF to develop preventive and therapeutic strategies to minimise the health risk resulting from obesity.

PBF is defined as the proportion of body fat mass over body weight[9,10]. Previous studies have demonstrated that PBF reflects body composition more accurately than BMI. Higher BMI and/or PBF often indicate increased cardiovascular risk[11]. The relationship between BMI and PBF is not linear. A higher PBF does not necessarily mean a higher BMI and vice versa.

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Material and methods

Persons above 18 years of age with family history of DM were included in the study.This study was carried out in PG Department of Medicine, SN Medical College Agra for a period of 18 months from December 2014. Informed written consent was taken from the participants and approval of institutional ethics committee was taken to conduct the above study. Subjects with acute coronary syndrome, stroke, renal dysfunction, hepatic dysfunction, malignancy, pregnancy, hypo- or hyperthyroidism were excluded from the study. Moreover body builders and athletes were also excluded from the study. Subjects were divided into two groups:–

Group A: comprised 500 persons having family history of DM

Group B: comprised 500 persons not having family history of DM.

The subjects were enrolled in the study after they signed an informed consent form. All subjects underwent detailed history and thorough clinical examination.

Anthropometric evaluation

During evaluation, all subjects wore light clothes and stood in an upright position on a flat surface without shoes. Height was measured using a measuring tape to an accuracy of 0.1 cm. Waist circumference was measured at the level of midway between the lower border of rib cage and iliac crest upto accuracy of 0.1cm. Hip circumference was measured at the level of maximum circumference over the buttocks upto accuracy of 0.1 cm. Weight was measured using portable weighing machine upto accuracy of 0.5 kg. BMI was calculated as weight in kg divided by height in metre square and accordingly classified. Body fat percentage was measured by the DEXA (dual energy X-ray absorptiometry) scan. It is the gold standard method to measure the body fat percentage.

Obesity was diagnosed if the subjects had BMI ≥ 25kg/m^2 or PBF ≥ 25% (male) or ≥ 30% (female) measured by DEXA according to Asian BMI Criteria[12] and the US National Institutes of Health Criterion standards for PBF[13].

Blood samples were taken for fasting plasma glucose (FPG), total cholesterol (TC), triglycerides (TG), high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C). The cut-off values of above mentioned biochemical parameters were as per modified NCEP ATP III Criteria in Asian Indians.

Results

This study was undertaken in two groups (group A : persons with evident family history of diabetes mellitus, group B: persons without evident family history of diabetes mellitus).

Table I is showing that in group A majority of persons (59%) were in the age group of 26 - 45 years, while in group B 26.1% persons were in age group of 26 - 35 years.

Also, there males were more males than females, as in group A 57.4% were male individuals while in group B 55.4% were male individuals.

Table I: Age and sex wise distribution.

Age (years)	Group A			Group B		
	N	Male	Female	N	Male	Female
18 - 25	90	50	40	40	27	13
26 - 36	155	90	65	130	64	66
36 - 45	140	78	62	65	35	30
46 - 55	35	18	17	120	65	55
56 - 65	55	35	20	105	66	39
> 65	25	16	9	40	20	20
Total	500	287	213	500	277	223

Table II: Results of anthropometric measurement and biochemical parameters.

		Group A (500)	Group B (500)	P value
BMI (kg/m^2)	Normal	135 (27%)	262 (52.4%)	
	Overweight (BMI > 25)	365 (73%)	238 (47.6%)	< 0.0001
FPG (mg/dl)	< 125	240 (48%)	452 (90.4%)	
	≥ 125	260 (52%)	48 (9.6%)	< 0.0001
Hypertension (blood prssure ≥ 140/90 mmHg)	Absent	170 (34%)	295 (59%)	
	Present	330 (66%)	205 (41%)	= 0.0004
S TG (mg/dl)	< 150	140 (28%)	300 (60%)	
	> 150	360 (72%)	200 (40%)	< 0.0001
PBF by DEXA	Normal	120 (24%)	294 (58.8%)	
	High [PBF ≥ 25% (male) or ≥ 30 % (female)]	380 (76%)	206 (41.2%)	< 0.0001

In group A, 330 individuals (66%) were hypertensive while in group B, 205 (41%) individuals were hypertensive. 365 individuals in group A (73%) were overweight (BMI >25 kg/m^2) while in group B 47.6% were overweight. 260 individuals (52%) were newly detected as diabetic in group B while 48 subjects (9.6%) in group B were found to be newly diabetic.

76% of the group A had high body fat percentage, while in group B 41.2% subjects had high body fat percentage (PBF).

In group A triglyceride level was higher in 360 subjects (72%) while in group B 200 (40%) individuals had higher triglyceride levels. Waist circumference measurement was more than 90 cm in 255 (88.8%) males in group A while it was higher in 205 (74%) males in group B. Waist circumference measurement was higher than 80 cm in 150 females (70.4%) in group A while it was higher in 105 females (47.08%) in group B.

Table III: Waist circumference in males (> 90 cm) and females (> 80 cm).

Sex		N	Mean	SD	P value
Female	Group A	150	100.61	65.52	P < 0.0001
	Group B	105	94.66	3.92	
Male	Group A	255	103.26	6.62	P < 0.0001
	Group B	205	100.09	4.59	

Discussion

Out of all the risk factors for developing diabetes, family history of diabetes and obesity are most important. More strong the family history, more the chance is for developing diabetes. In our study, the prevalence of diabetes was higher in the first degree relatives of diabetics as compared to non-diabetics. (52% versus 9.6%). Almost similar result was also found in the study conducted by Mahanta *et al*, they found prevalence rate of 47.1% versus 3%[14]. A study by Ramachandran *et al* showed peak prevalence (41%) in age group of 55 - 64 years[15]. Viswanathan *et al* demonstrated that prevalence of diabetes was 50% among offsprings of conjugal type 2 diabetic patients in India[16]. In our study the prevalence of higher body fat percentage (PBF) was much more in group A than in group B (76% versus 41.2%). Study conducted by Mahanta *et al* showed that prevalence of higher body fat percentage (PBF) in relatives of diabetics than that in non-diabetic control group (60% versus 39%)[14]. Prevalence of hypertension was also higher in our group A as compared to group B (66% versus 41%).

Conclusion

It is evident from the study that family history, obesity and diabetes have strong positive association. Body fat percentage monitoring is a useful screening tool to detect diabetes. In future it may act as tool to monitor lifestyle modification approaches towards better health.

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