e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(6); 325-328

Original Research Article

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

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Received: 25-03-2024 / Revised: 23-04-2024 / Accepted: 26-05-2024

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Conflict of interest: Nil

Abstract:

Background: Diabetes mellitus (DM), cardiovascular disease, and other illnesses can be brought on by obesity. Overweight people are becoming more and more common both globally and in our nation. Determining body fat accurately may aid in evaluating an obese person's risk of developing certain ailments. In order to compare the aforementioned parameters between first degree relatives of diabetic and non-diabetic patients, this study was designed to measure body fat percentage (PBF) of first degree relatives of diabetic patients, estimate body mass index (BMI), and determine the risk factors for developing diabetes.

Method: A total of 1000 participants were included in the study and were split into two groups: 500 individuals in group A had a clear family history of diabetes, while 500 individuals in group B did not. Comprehensive clinical, anthropometric assessment, fasting plasma glucose (FPG), and other pertinent biochemical analyses were performed.

Result: Body fat percentage (PBF) was high in 76% of participants in group A (study group) compared to 41.2% in group B (control group) ($p < 0.001$).47.6% of respondents in group B were overweight ($p < 0.0001$), compared to 73% of subjects in group A who were overweight (BMI > 25 kg/m2). Similarly, 52% of group A and 9.6% of group B were found to have diabetes, respectively ($p < 0.0001$).

Conclusion: PBF may be a crucial screening tool for identifying individuals who may have diabetes and may also be useful in directing lifestyle change strategies for the promotion of health.

Keywords: Body Fat Percentage, Obesity, Diabetes Mellitus.

Introduction

The build-up of excess body fat, which can cause diabetes, cardiovascular disease, and joint issues, is what defines obesity. Globally, the prevalence of obesity is rising quickly, which is having a negative social and economic impact. The National Family Health Survey-2 in 1998–1999 found that 10.6% of Indian women were obese; the National Family Health Survey-3 in 2005–06 found that 12.6% of Indian women were obese.

Numerous studies conducted in India have revealed that the percentage of overweight teenagers ranges from 10% to 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].Simple measurements such as waist circumference, waist to hip ratio, and body mass index (BMI) can be used to determine body fat. BMI is the most commonly utilized of these tools because it is simple to calculate. High BMI has been linked to an elevated risk of metabolic-related disorders and may be a predictor of these conditions, according to a number of previous studies [3]. But BMI is unable to distinguish between lean mass and body fat. It is unable to distinguish between people who are overweight with excessive body fat and those who are underweight with excessive body fat and muscle. [4,5].

A meta-analysis of 32 samples, totalling 31,968 patients, showed that around half of the individuals with excess body fat percentage (PBF) are not identified by the BMI cut-off values that are typically used to diagnose obesity. [6] Numerous studies have shown that Asian patients benefit less from BMI due to the varying contributions of fluid, muscle, and bone mass to body weight, which can lead to misclassification [7,8]. A recent study revealed that the BMI cut-off values currently used to describe obesity overstated the prevalence of obesity in African Americans and underestimated the prevalence in Asian and Indian people, suggesting an ethnic basis for the BMI cut-off values for obesity that are universal [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.

The percentage of body fat mass over body weight is known as PBF [9,10]. Prior research has indicated that PBF provides a more accurate representation of body composition than BMI. Increased cardiovascular risk is frequently indicated by higher BMI and/or PBF [11].

There is a nonlinear link between PBF and BMI. Higher PBFs are not always correlated with higher BMIs, and vice versa.

Material and Methods

The study included individuals above the age of eighteen who had a family history of diabetes mellitus. For a duration of 12 months, from April 2023 to March 2024, this study was conducted in the department of medicine at Darbhanga Medical College and Hospital in Laheriasarai, Bihar. The aforementioned study was conducted with the subjects' informed written consent. The study excluded participants with pregnancy, cancer, acute coronary syndrome, stroke, renal dysfunction, hepatic dysfunction, hypo- or hyperthyroidism, and pregnancy. Athletes and physique builders were also not included in 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.

After completing an informed consent form, the subjects were added to the research. Every subject had a comprehensive clinical examination along with a complete history. All of the subjects were dressed modestly for the evaluation and stood straight up on a level surface without shoes. A measuring tape was used to measure height with 0.1 cm accuracy. With an accuracy of 0.1 cm, the waist circumference was measured halfway between the iliac crest and the lower boundary of the rib cage. To within 0.1 cm of accuracy, the hip circumference was measured at the maximal circumference across the buttocks. Portable weighing equipment was used to measure weight with an accuracy of 0.5 kg.

Weight in kilograms divided by height in meters squared was used to compute BMI, which was then classed. With a dual energy X-ray absorptiometry (DEXA) scan, the percentage of body fat was determined. It is the gold standard technique for calculating the proportion of body fat.

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 PBF13.

For the measurements of triglycerides (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), total cholesterol (TC), and fasting plasma glucose (FPG), blood samples were obtained. The aforementioned biochemical parameters' cut-off values were determined using the modified NCEP ATP III Criteria for 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 1 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 1: Age and sex wise distribution

Age (years)	Group A			Group B		
	No.	Male	Female	No.	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

330 people (66%) in group A and 205 people (41%) in group B, respectively, had hypertension. 365 people in group A (BMI > 25 kg/m^2) been overweight (73%) whereas 47.6% of those in group B were overweight. In group B, 260 individuals (52%), out of 48 subjects (9.6%), were discovered to have diabetes for the first time.76% of the group A had high body fat percentage, while in group B 41.2% subjects had high body fat percentage (PBF).

Table 2: 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%)	<0.0001
	Overweight	365(73%)	238(47.6%)	
	(BMI>25)			
FPG (mg/dl)	<125	240(48%)	452(90.4%)	<0.0001
	≥125	260(52%)	48(9.6%)	
Hypertension (blood pressure ≥140/90mmHg)	Absent	170(34%)	295(59%)	=0.0004
	Present	330(66%)	205(41%)	
STG (mg/dl)	<150	140(28%)	300(60%)	<0.0001
	>150	360(72%)	200(40%)	
PBF by DEXA	Normal	120(24%)	294(58.8%)	<0.0001
	High [PBF≥25% (male) or ≥30% (female)]	380(76%)	206(41.2%)	

Triglyceride levels were higher in 200 (40%) of group B subjects compared to 360 (72%) of group A subjects. In group A, 255 males (88.8%) had a waist circumference measurement of more than 90 cm, but in group B, 205 males (74%), had a greater measurement. In group A, 150 females (70.4%) had a waist circumference measurement greater than 80 cm, but in group B, 105 females (47.08%) had a larger value.

Table 3: Waist circumference in males (> 90 cm) and females (> 80 cm)

Sex	No.	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

The most significant risk factors for diabetes include obesity and a family history of the disease. A strong family history increases the likelihood of developing diabetes.

According to our research, first-degree relatives of diabetics had a higher prevalence of the disease than non-diabetics. (52% as opposed to 9.6%). Mahanta et al. investigation yielded nearly identical results, finding a 47.1% prevalence rate as opposed to 3% [14]. According to a study by Ramachandran et al, the 55–64 age group had the highest frequency (41%) [15].

Viswanathan et al. [16] showed that among the children of type 2 diabetic couples in India, the prevalence of diabetes was 50%. 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

The study clearly shows a high positive relationship between diabetes, obesity, and family history. Monitoring body fat percentage is a helpful screening method for diabetes detection. It might be used in the future as a tool to track methods of changing one's lifestyle for improved health.

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