Original Article

Clinical Profile of Persons with Family History of Diabetes Mellitus with Special Reference to Body Fat Percentage

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Abstract

Aims and Objectives: To measure total body fat percentage of persons with evident family history of diabetes mellitus; to assess the BMI and other risk factors of persons at risk of developing diabetes mellitus; and to compare the body fat percentage between first degree relatives of diabetics and nondiabetic patients.

Materials and Methods: Total 140 subjects, first degree relatives of diabetic patients and similar number of age and sex matched control were selected from first degree relatives of non-diabetic patients. Detailed clinical, systematic anthropometric evaluation and calculation of BMI and blood sugar and other relevant laboratory investigations were done. Body fat percentages were calculated using bioimpedance method using fat monitor.

Results: Average percentage of body fat was 32 percent. fifty-two percent subjects were overweight (BMI 25-<30). It was proved statistically that hypertension was 4.5 times higher in cases than in the control group (95%CI- 2.57-7.91, p<0.005). In case of obesity the differences between case and control were not significant (OR-2.09,95%CI-0.61-7.24, p>0.05). BMI was four times higher in cases than control groups (95%CI -2.49-7.20, p<0.001). During the study the newly detected diabetes was significantly higher amongst cases than control (OR-25.52, 95%CI-15.42-42.59, p<0.001). Body fat percentage was 3.88 times higher in cases than control group. The difference of body fat percentage was statistically significant (95% CI- 2.35-6.43,p<0.001).

Conclusion: Body fat percentage monitoring could be a useful tool for assessing the potential diabetics, particularly for high risk screening and it might prove as an important tool for evidence based monitoring of lifestyle modification approaches for health promotion.

Introduction

Diabetes is a growing public health problem, especially in India. The global burden may reach a level of almost 300 million patients in 2025 with similar alarming increase in India.[1] Obesity is considered to be a major risk factor for development of type 2 diabetes mellitus in young, and in adult. Clearly, the increase in prevalence of obesity is resulting in an epidemic of diabetes, while the reduction in physical activities and change in diet has led to the increased incidence of obesity in adults and children, it is increasingly apparent that the distribution of fat impacts the risk of type 2 diabetes through its link with insulin resistance.[2] Subjects with family history of diabetes develop diabetes earlier compared to subjects without family history.[4] Family history of diabetes is a strong factor associated with type 2 diabetes mellitus in young. The frequency of family history ranges from 74-100% among the first or second degree relatives.[5] The offsprings of diabetic parents develop diabetes at least a decade earlier than their parents. In a population survey done in South India, it was noted that 47% of the diabetic patient had first degree family history of diabetes. Uncovering hidden diabetes becomes extremely successful if families are screened periodically for diabetes.[6] There is a very good correlation between BMI and the body fat percentage in large population. Deurenberg *et al* established an equation with which the body fat percentage can be accurately estimated: Body fat percent = 1.2(BMI) + 0.23(age) - 10.8(gender) - 5.4. In clinical practice it is theoretically attractive to use measurement of body fat to define obesity in individual patients, but this rarely occurs because of the relative ease of diagnosis based on BMI, waist circumference or clinical judgment. However, body composition analysis is a useful tool to monitor changes in body fat or its distribution as a consequence of anti-obesity interventions, and is assumed to provide a useful outcome measures before long-term consequences are apparent in morbidity or mortality. Therefore it is very much essential to screen the high risk population at a regular interval so that interventions and awareness creation can be done at a timely manner.

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Objectives

1. To measure the total body fat percentage of persons with evident family history of diabetes mellitus.
2. To measure body mass index and other risk factors of persons at risk of developing diabetes mellitus.
3. To compare the body fat percentages between first degree relatives of diabetic and non-diabetic patients.

Materials and Methods

Present study was undertaken in medical out-patient clinic of Assam Medical College and Hospital, Dibrugarh. Total one hundred forty subjects, aged between 20-59 years who were first degree relatives of diabetic patients, attending the clinic were included in the study. 140 subjects were selected as

comparable control after doing age and sex matching from first degree relatives of non-diabetic patients. Subject selection done foreseeing risk factors beard by first degree relatives of diabetes mellitus patients as the relation between family history and DM was well proven. First degree relative with diabetes were excluded from the study. Pregnant women, post-menopausal women, people with fever, people who had oedema, patient with osteoporosis with very low bone density, body builders or professional athletes, patients undergoing dialysis, persons with pacemaker were excluded from the study. Detailed clinical, systematic, anthropometric evaluation and calculation of body mass index and blood sugar and other relevant laboratory investigations were done. Body fat percentages were calculated by using bioelectrical impedance analysis (BIA) method, using body fat monitor. Basic principle is that tissues containing more water e.g., muscles, blood vessels and bones are highly conductive with electricity but fat tissues are not. Therefore by using this principle, it was possible to determine the ratio of fat tissue compared to other tissues in the body by measuring the electric resistance of the body tissues using extremely weak electric current applications, i. e. between 50-500 microAmp to the body. In the bioelectrical impedance method, a small alternating current is passed through the body to assess the total body water, from which the body fat percentage is derived. Omron body fat monitor (HBF 400) was used to measure the percent body fat. Details such as height, age and sex were given as input into the instrument. Subjects refrain from food and drink for at least six hours and voided urine prior to measurement session.[7]

Results

Majority of the study population were males i.e., 65 % (91/140) and 35% (49/140) females (Table 1). Whole study population included was from Dibrugarh Urban area. Study population were businessmen (42%), non-govt. sector (30%), govt. sector (14%), farmer (9%), student (2%), and housewives (3%). Average per capita per month income was about Rs 4500. Majority were literate (81%). Eighty-six percent of study subjects preferred non-vegetarian diet. Past history of chronic illnesses was found in nearly 8% (12/140). Forty-six percent of the subjects showed evidence of hypertension. Waist-hip ratio (WHR) was normal (0.95) in 54%, between 0.95 to 1 in 42% and in 4% of the study subjects the ratio was above one. Average percentage of total fat was thirty-two perxcent. Sixty percent of our study population had high body fat percentage. Majority (52%) of the subjects were overweight, i.e., BMI between >25 - <30 kg/m^2. Forty-seven percent subjects were newly detected as diabetic during our study, which was just similar to the finding observed by Ramchandran *et al.*, from South India[8] (Table 2 and Fig. 1).

In the age and sex matched control group also majority of the subjects were male i.e., 65% (91/140) and 35% (49/140) were female. Seventy-seven percent of them were literate and 90% subjects preferred non-vegetarian diet. Past history of chronic illnesses were found in 12% of the control group. Sixteen percent of the subjects showed evidences of hypertension. WHR was normal in 78%, between 0.95 to 1 in 19% and in 3% the ratio was above one. Average percentage of total fat was 13% amongst the control group.

It has been proved statistically that hypertension is 4.5 times higher in cases than control group (95% C.I- 2.57-7.91, p<0.005). Though, in case of obesity the difference between case and control is not significant (OR- 2.09, 95% C.I- 0.61-7.24, p>0.05), that may be because of lower sample size and lower prevalence of that risk factor. Similarly BMI was four times higher in cases

Table 1 : Demographic profile of the study population

Age Group	Male (%)	Female (%)	Total (%)
20-29	16(11.42)	7(5)	23 (16.4)
30-39	34(24.28)	18(12.85)	52 (37.14)
40-49	29(20.71)	22(15.71)	51 (36.43)
50-59	12(8.57)	2(1.42)	14 (10)
All ages	91 (65)	49 (35)	140 (100)

Table 2 : Results of anthropometric examination

	Study Group (140) Total (%)	Control Group (140) Total (%)
Male	91(65)	91(65)
Female	49(35)	49(35)
WHR		
Normal(<0.95)	75(54)	109(78)
0.95-1	59(42)	27(19)
>1	6(4)	4(3)
Body fat %age		
High	84(60)	39(28)
Normal	56(40)	101(72)
BMI (Overweight)	72(52)	28(20)
Hypertension	64(46)	22(16)
Newly detected DM	66(47)	4(3)

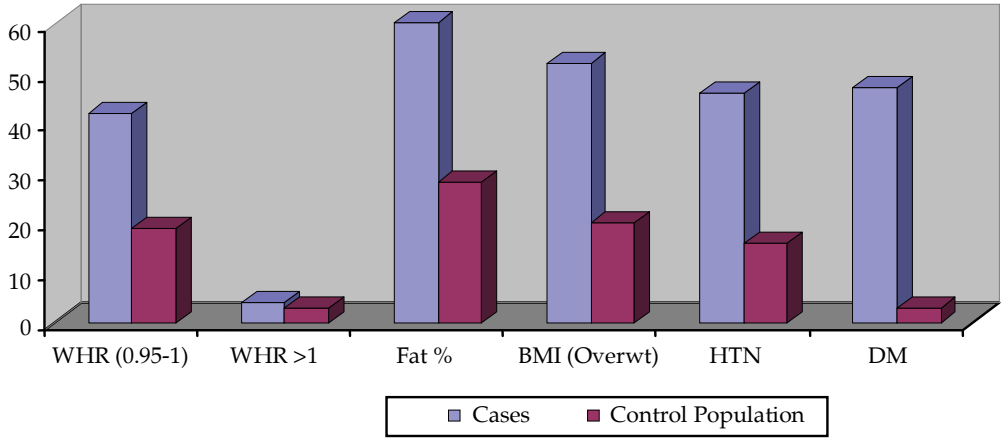
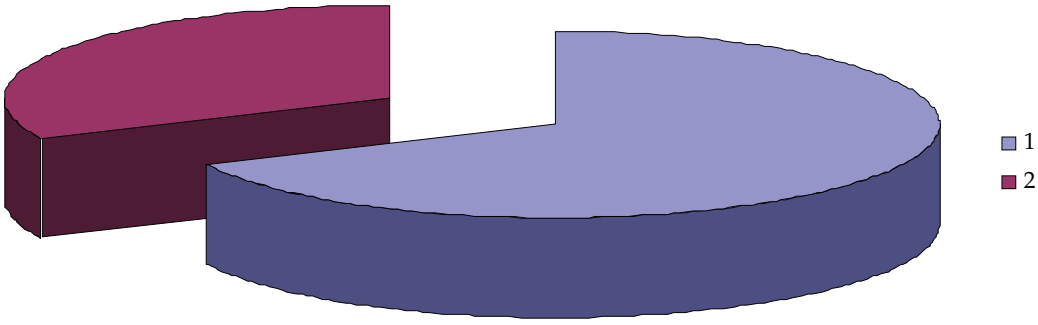


Fig. 1 : Bar diagram showing risk factor distribution between cases and controls



1 = CONTROL, 2 = CASES

Fig. 2 : Pie diagram showing body fat percentage amongst cases and controls

Table 3 : Study of association

Variables	Odds Ratio	95% Confidence Interval (C.I)	p-value
Hypertension	4.52	2.57- 7.91	p <0.005
WHR (Obese)	2.09	0.61- 7.24	p >0.05
WHR (Overweight)	3.18	1.85- 5.46	p <0.001
BMI (Overweight)	4.24	2.49- 7.20	p <0.001
Newly detected DM	25.52	15.42- 42.59	p <0.001
Body fat %	3.88	2.35-6.43	p<0.001

than control groups (95%C.I.-2.49-7.20, p<0.001). During the study the newly detected diabetes DM was significantly higher amongst cases than control (OR-25.52, 95% C.I.-15.42-42.59, p<0.001), which indicates that first degree of diabetic subject were 25 times more prone to have diabetes than in the control group. Body fat percentage was 3.88 times higher in cases than control group (Figure 2). The difference between body fat percentage in cases and control was statistically significant (95% C.I- 2.35-6.43, p<0.001) (Table 3).

Discussion

Diabetes is one of the most common and preventable non-communicable disease. Among all the known risk factors, family history of diabetes and body fat percentage is most important and considered in the present study. Stronger the family history, higher is the chance of getting diabetes. In this study prevalence of diabetes was higher in the first degree relatives of diabetics than that in the nondiabetic control group (47% vs 3%). In a study done by Ramachandran *et al*., also showed similar prevalence of diabetes (47%) in South Indian urban population. Viswanathan et al demonstrated 50% prevalence of diabetes among offsprings of conjugal type 2 diabetic parents in India.[9] Philip G *et al* showed that distribution of fat impacts the risk of type 2 diabetes through its link with insulin resistance. The different research studies done earlier indicate very strong association between heredity, high body fat percentage and diabetes mellitus. Estimation of body fat may serve as an important additional tool for screening of high risk group. Changes related to obesity are linked to high body fat around a person's waist, even when a person has a normal body weight. It's even more important for children of people with diabetes to take care of themselves and adopt healthy habits to prevent getting diabetes.

Conclusion

Diabetes, obesity and family history has striking positive association, evident from the high average percentage of body fat in the first degree relatives of type 2 diabetics (47%vs 3%) in this study. Prevalence of hypertension was also found to be higher (46% vs 16%). Body fat percentage monitoring is a useful tool for assessing the potential diabetics, particularly for high risk screening. Using these tools interventional studies if undertaken may prevent and bring down incidence of diabetes in the community, which is evident from large studies done earlier. Early diagnosis and better management can postpone chronic complications of diabetes and prolong healthy life. It is an important awareness creating approach in the selected population and in future may prove as an important tool for evidence based monitoring of lifestyle modification approaches for health promotion.

References

1. Ramachandran A. Type 2 diabetes- consequences of urbanization, *Type 2 diabetes, urban- rural* p 15, 2004.
2. Philip G. McTernan, Aresh Anwar and Sudesh kumar, 'Relationship between fat distribution and insulin resistance'p 207-225.
3. Arner, P, Obesity and the adipocyte : regional adepocity in man, Arner, P, *J Endocrinology* 1997;155, 191-192
4. Mohan V, Shanthirani C S, Deepa R, Diabetes and IGT in a selected South Indian population with special reference to family history, obesity and lifestyle factors – The Chennai Urban population study (CUPS 14), *J Assoc Phy India 2003*;51: 771-777.
5. Madhu, S V, Kumar Vinod, type 2 diabetes in young, *Type 2 diabetes, urban rural*, p39, 2004.
6. Jacob C Seidell , *Epidemiology- Definition and classification of obesity, Clinical Obesity in Adults and Children* p 3-10
7. Sudha Vasudev et al. Validation of Body fat measurement by skinfolds and two bioimpedance methods with DEXA – The Chennai Urban Rural Epidemiological Study (CURES – 3)
8. Ramchandran A, Jali MV *et al* High prevalence of diabetes in an urban population of south India, *BMJ* 1988; 297, 587-590
9. Viswanathan M, Mohan V, Snehalatha, Ramachandran A. High prevalence of type 2 diabetes among the offspring of conjugal type 2 diabetic patients. *Diabetologia* 1985;28:907-10.