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Original Research Article

Study of subcutaneous fat, BMI in diabetic and non-diabetic adolescents

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Abstract

Introduction: Diabetes is a Metabolic Disorder which has got prime focus in the present days. An increase in body fat is generally associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus, hypertension and dyslipidaemia. Prevalence of childhood and adolescent obesity is further adding the severity. Therefore, any measures that could prevent or delay the development of diabetes are urgently needed. The present study is focused on early detection of the occurrence of Diabetes so that its control can be more effective because of early intervention.

Materials & Methods: 50 people with increased blood sugar levels of age group of 16-20 years of both the sexes are selected randomly as subjects and 50 people with normal blood sugar levels are randomly selected as control group**.** Primary data of all the subjects like name, age, sex, occupation, address etc., are obtained as per the proforma. Calculation of Body Fat Percentage (%BF) involves measuring of skin fold thickness at four sites. Body Mass Index (BMI) calculated from Height and Weight of an individual.

Results: The mean value of BMI in Diabetic group is found be 25.64Kg/m^2 (SD ±2.22), while in Non-Diabetic group it is found to be 23.35Kg/m^2 (SD ±3.95). The mean value of %BF in Diabetic group is 18.20 (SD ± 1.62), while in Non-Diabetic group it is found to be 17.36 (SD ± 1.41). The mean values of RBS in Diabetic group are found be 157.98mg/dl (SD ± 30.37) and 120.66mg/dl (SD ± 21.44) in Non-Diabetic group.

Discussion: In the present study, we observed the correlation of increased subcutaneous fat with increased plasma glucose levels. Increased subcutaneous fat is considered to be an aggravating factor for early development of diabetes. Increased subcutaneous fat is also responsible for increasing the severity of diabetes there by, worsening the condition of the person. By knowing the body subcutaneous fat, the chances of occurrence of diabetes can be known.

Keywords: Diabetes, Subcutaneous Fat, Body Fat, BMI, Blood Sugar.

1. Introduction

Diabetes is a Metabolic Disorder which has got prime focus in the present days. Focus on Diabetes is not only because of its high prevalence, but also because of the after effects of increased Blood sugar levels in an individual. Even most important aspect is lack of proper management and treatment for Diabetes. An increase in body fat is generally associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus, hypertension and dyslipidaemia[1].

There is a great deal of evidence that both genetic and environmental factors are of importance in the pathogenesis ofT2DM. Whereas the genetic factors are still poorly understood, numerous studies have shown that obesity (in particular, central obesity), physical inactivity, a

high-fat diet, and a diet rich in saturated fatty acids increase the risk of diabetes [2]. The health risks associated with excessive intraabdominal or visceral adipose tissue deposition have become increasingly well-established [3,4].

Obesity is associated with increased morbidity and mortality and decreased life expectancy. Obesity is associated with increased risk for cardiovascular diseases. These include coronary heart disease, heart failure, and sudden death [5,6]. In addition to cardiovascular diseases, obesityis associated with numerous other medical conditions including type 2 diabetes, dyslipidemia, hypertension, nonalcoholic fatty liver disease, cancers, and sleep apnea [5].

Diabetes is also very common among young people and even children now days. Its contribution is increasing day by day in both developed and developing countries. Prevalence of childhood and adolescent obesity is further adding the severity. Therefore, any measures that could prevent or delay the development of diabetes are urgently needed. The present study is focused on early detection of the occurrence of Diabetes so that its control can be more effective because of early intervention.

The present study is focused mainly on early detection of the chances of occurrence of Diabetes so that development of Diabetes is prevented or delayed.

2. Materials & Methods

The present study is done in a population of the villages surrounding Pacific Medical College& Hospital, Udaipur, Rajasthan during the regular Medical Camps. The study is approved by the Institutional Ethical Committee.50 people with increased blood sugar levels of age group of 16-20 years of both the sexes are selected randomly as subjects and 50 people with normal blood sugar levels are randomly selected as control group after obtaining informed consent in their mother tongue. Subjects taking any hormonal medications, drugs which interfere with blood sugar levels are excluded from the study.

Primary data of all the subjects like name, age, sex, occupation, address etc., are obtained as per the proforma. Calculation of Body Fat Percentage (%BF) involves measuring of skin fold thickness at four sites. The subjects were made to stand and skin fold thickness at four sites i.e., Biceps, Triceps, Subscapularis and suprailiac were measured using skin calipers carefully. Biceps fat was measured at the level of nipple line. Triceps skin fat was measured midway between acromion process of scapula and olecranon process. Fat pads at the inferior angle of scapula and superiorly on iliac crest directly in the midaxillary line were measured for subscapular and supra iliac skin fold [**7]**.

The density value was calculated using the equation of Durnin and Womersley[8,9]. The density value can then be converted to Percentage Body Fat using Siri Equation. Body weight of the subjects is measured using KUPPS weighing scale to nearest 0.1Kg with minimal clothing. Height without foot ware was measured using vertical scale (Avery, India) with an accuracy of 0.5cms.

BMI is calculated as:

$$BMI = \frac{weight\ in\ Kilograms}{(height\ in\ meters)^2}$$

Waist circumference is measured after all precautions, by placing a measuring tape horizontally around the abdomen at the levels of both iliac crests.

Diabetes mellitus was confirmed based on self-reported responses (i.e. respondent answered yes to 'Has a doctor ever told you that you have diabetes?'). Undiagnosed diabetes mellitus cases were confirmed as per the American Diabetes Association criterion of Fasting Plasma Glucose(FPG)> 125 mg/dl (7.0 mmol/l) [10].

The data was arranged in suitable tables for discussion under different headings. The results were averaged (mean±standard deviation) for each anthropometrical parameter subgroups separately for Diabetics & Non-Diabetics. One-way analysis of variance was used to test the difference between the groups. Analysis of Variance is a technique by which the total variation is split into two parts, one between groups and other within the groups. Statistical analysis was done using IBM SPSS Statistics 20 package. p-value of <0.05 is considered as statistically significant and p-value of <0.005 is considered as statistically highly significant. Conclusions were drawn based on outcome of this statistical treatment.

3. Observations and Results

Table 1: Mean ± SD of parameters in Diabetic Subjects & Non-Diabetic Control groups.

Parameter	Diabetics Mean ± SD	Non-Diabetics Mean ± SD	P Value	Significance
BMI	25.64 ± 2.22	23.35 ± 3.95	<0.01	HS
%Body Fat	18.20 ± 1.62	17.36 ± 1.41	<0.01	HS
RBS	157.98 ± 30.37	120.66 ± 21.44	<0.01	HS

Table 2: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Blood Sugar	RBS_D	157.98	50	30.365	4.294
	RBS_ND	120.66	50	21.442	3.032
%Body Fat	%BF_D	18.18	50	1.637	0.232
	%BF_ND	17.32	50	1.449	0.205
BMI	BMI_D	25.68	50	2.180	0.308
	BMI_ND	23.34	50	3.972	0.562

Table 3: Paired Samples Correlations

		N	Correlation	Significance
Blood Sugar	RBS_D & RBS_ND	50	-0.134	0.352
%Body Fat	%BF_D&%BF_ND	50	0.199	0.166
BMI	BMI_D& BMI_ND	50	0.081	0.575

Table 4: Paired Samples Test

		Paired Differences					t	df	Significance (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Blood Sugar	RBS_D - RBS_ND	37.320	39.455	5.580	26.107	48.533	6.688	49	0
% Body Fat	%BF_D - %BF_ND	0.860	1.959	0.277	0.303	1.417	3.104	49	0.003
BMI	BMI_D - BMI_ND	2.340	4.373	0.618	1.097	3.583	3.783	49	0

The mean value of BMI in Diabetic group is found be 25.64Kg/m^2 (SD ±2.22), while in Non-Diabetic group it is found to be 23.35Kg/m^2 (SD ±3.95). The mean value of % BF in Diabetic group is 18.20 (SD ± 1.62), while in Non-Diabetic group it is found to be 17.36 (SD ± 1.41). The mean values of RBS in Diabetic group is found be 157.98mg/dl (SD ± 30.37) and 120.66mg/dl (SD ± 21.44) in Non-Diabetic group.

4. Discussion

In the present study, we observed the correlation of increased subcutaneous fat with increased plasma glucose levels. Normally we expect increased skin thickness and increased body fat, subcutaneous fat in the diabetics. There are relatively limited data on skin thickness in childhood and adolescents. But three other studies have noted an age-related increase in dermis among children [11–13]. Considerably more data exist in adulthood, and several studies have shown a thinning of the dermis with increasing age [13–20]. In particular, our findings are similar to the findings of Tan *et al* showing a linear increase in dermis until the age of 20, with a subsequent decline thereafter [13]. Although Shuster *et al* also found this pattern of decreasing dermal thickness among men, they observed that it was relatively unchanged in women until their 50s after which it began to decline [21] (probably due to decreasing oestrogen levels after menopause). Increased subcutaneous fat is considered to be an aggravating factor for early development of diabetes. Increased subcutaneous fat is also responsible for increasing the severity of diabetes there by, worsening the condition of the person. By knowing the body subcutaneous fat, the chances of occurrence of diabetes can be known.

With the above observation, it can be clearly confirmed that BMI is more in Diabetics when compared to non-diabetics. It may be the other way; increased BMI resulted in development of diabetes. It can also be noted that increased BMI is one of the favoring factor in development of diabetes. With simple tests like measuring the height and weight of the subject, the increased chances of development of diabetes can be detected early. Once the chances of development of diabetes are detected early, early intervention such as change in life style, food habits and inclusion of healthy habits can be advised. With our current study findings, one can have an idea of chances of developing diabetes based on the increased BMI and Subcutaneous fat. In our further studies, we plan to include more number of subjects from more population and include wide range of age and other parameters.

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