

Body Composition and Non-Communicable Diseases: A study on Diabetic Subjects.

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Non-communicable disease (NCD), is a medical condition or disease which by definition is non-infectious and non-transmissible between persons. It may be chronic diseases of long duration and slow progression, or they may result in more rapid death such as some types of sudden stroke. They include autoimmune diseases, heart disease, stroke, many cancers, asthma, diabetes, chronic kidney disease, osteoporosis, Alzheimer's disease, cataracts and more. Out of these, India is facing an "epidemic" of diet-related non-communicable disease namely diabetes along with widely prevalent under-nutrition resulting in substantial socio-economic burden over the country.

According to data released by International Diabetes Federations, in India the number of persons suffering from diabetes have increased from 19 million in 1995 to 51 million in 2010 and it is projected to be increased to 87 million by 2030 (Ramachandran, 2010). Diabetes mellitus is a chronic metabolic disorders characterized by high blood glucose levels resulting from defects in insulin secretion, insulin action or both, which prevents the body to utilize glucose completely or partially (zimmel, 1983).

The prevalence of diabetes in developing countries is due to adoption of western life-style, sedentary life, smoking, high fat diet and lack of physical exercise. Indians are at special risk because of fat accumulating phenotype/ genotype, high percentage of body fat at lower level of BMI as well as central and truncal distribution of fat. All these factors have led to substantial increase in the prevalence of obesity. People who eat too much food and lead a sedentary life become overweight and obese. Obesity reduces the sensitivity of tissues to the action of insulin in the utilization of glucose. Lack of physical activity and obesity increases the risk for development of diabetes in the later stage of a person's life (Raghuram et al, 1998).

Extensive research published over the past two decades has demonstrated a positive association between increased levels of body fatness, obesity and type-2 diabetes (Pi-Sunyer, 1991). In particular abdominal obesity has been identified as a significant risk factor for the development of insulin resistance, glucose intolerance and type-2 diabetes (Despres, 1993). Although not all Individuals with increased body fatness and abdominal obesity manifest the metabolic complications of diabetes, approximately 85% of patients with type-2 diabetes display increased levels of body fatness (Tsui Eyl et al, 1998).

In order to make the most valid assessment of body composition, it is necessary to understand the underlying theoretical models and reference methods used to develop body composition prediction equations. The two-component model of body composition divides the body into a fat component and fat free body (FFB) component (Brozek et al, 1963; Siri, 1961). The FFB consists of all residual chemicals and tissues including water, muscles (protein) and bone (minerals). This model assumes that (a) the density of the FFB is 1.1 g/cc and (b) the densities of the fat and the FFB components are same for all individuals (c) the individual being measured differs from the reference body only in the amount of fat, and (4) the FFB of the reference body is 73.8% water, 19.4% protein and 6.8% mineral. So, the present study was planned to know the relationship between body composition and diabetes.

I. Materials and Methods

For the study selection of sample was done from various hospitals, private clinics and health care centers running in different location of Patna (Bihar). A total of 200 non-insulin dependent diabetes mellitus (NIDDM) subjects visiting the centers regularly and volunteered for the study were selected. Half of the number of diabetic subjects, age and sex matched normal healthy subjects were also selected for comparative study.

General informations and other lifestyle patterns of the subjects were obtained through a questionnaire cum interview schedule method. Clinical assessment of the subjects was done by measuring blood pressure and analyzing body composition. Under body composition percentage of fat, fat free mass and water was determined by bioelectrical impedance using a body composition analyzer (TBF-410 Tanita Co Ltd., Tokyo, Japan). Regarding biochemical estimation blood glucose levels of the subjects (30 diabetics and 15 normals) were analyzed in pathological laboratory by the pathologist and results obtained were used by the researcher for the

study. The data collected were tabulated and analyzed by using appropriate statistical tools like percentage, mean, standard deviation, test of significance (paired t-test) and correlation between variables.

II. Results and Discussion:-

Based on general information majority of the diabetics belonged to the age group of 50 to 59 years. On the basis of education maximum percentage of diabetics had higher level of education i.e. college and above. Regarding demographic and family profile maximum percentage of the diabetics were from urban areas and nuclear family respectively. While going through the details of the disease mean age at the onset of diabetes was 41 ± 11.2 years in male subjects and 48 ± 13.4 years in female subjects.

Table '1' and '2' depicts body composition of male and female subjects respectively. It indicates that BMR, total body weight and body fat percent of both male and female subjects were higher than ideal level before the onset of diabetes. There was a significant reduction in all the above parameters was observed after medical treatment and dietary restriction followed by the subjects. Regarding fat free mass and total body water initial level was lower than ideal, however it was increased significantly after the treatment and dietary precautions taken by the subjects. Changes was also observed among normal subjects but it was non-significant. While considering about initial blood pressure, it was higher in both male and female subjects before the onset of diabetes but reduced significantly and it might be due to changes in dietary pattern and lifestyle of the subjects.

Table:1 Body composition of male subjects before and after the onset of diabetes.

Body Composition	Ideal for adult man	Diabetic(N=30)			Normal(N=15)		
		Past (mean±SD)	Present (mean±SD)	't' value	Past (mean±SD)	Present (mean±SD)	't' value
BMR(kcal)	1400-1500	1875±120.3	1665±80.6	3.86**	1625±92.3	1595±83.2	1.96NS
Total Body wt(kg)	60	83.6±13.2	75.8±13.2	4.26**	72.3±13.6	69.3±8.5	4.26**
Fat(%)	15-22	35.6±12.6	28±11.2	4.98**	21.8 ±13.6	21.4±6.4	0.36NS
Lean body mass(%)	78-85	64.3±19.4	79.2±12.3	4.70**	77.6±16.6	78.2±18.3	1.06NS
Water(%)	60	47.8±9.6	58.8.2±9.6	2.36*	61.3±8.5	63.2±18.3	3.82**

** - significant at 1% level

* - significant at 5% level

NS- not significant

Table:2 Body composition of female subjects before and after the onset of diabetes.

Body Composition	Ideal for adult woman	Diabetic(N=30)			Normal(N=15)		
		Past (mean±SD)	Present (mean±SD)	't' value	Past (mean±SD)	Present (mean±SD)	't' value
BMR(kcal)	1200-1300	1483±112.3	1341±90.6	6.46**	1441±102.3	1365±96.2	3.96**
Total Body wt(kg)	50	72.5±16.3	65.6±13.2	4.38**	68±9.6	63±6.5	3.92**
Fat(%)	20-25	38.6±13.2	28.2±11.2	3.92**	31.7±9.4	27.6±8.5	4.23**
Lean body mass(%)	75-80	61.3±23.4	69.8±7.3	1.07NS	69.4±16.3	72±14.3	1.03NS
Water(%)	57	49.3±22.6	53.2±8.6	5.43**	52.3±11.4	55.6±6.9	6.36**

** - significant at 1% level

NS- not significant

Table '3' depicts blood glucose levels of the subjects. It shows that initial glucose level (fasting and postprandial) of the diabetic subjects was higher than normal level. After medical and dietary treatment it was reduced significantly and it might be due to changes in body composition of the subjects. In normal cases no significant changes was observed.

Table (3) Blood glucose levels of the subjects before (past) and after (present) the onset of diabetes.

Blood glucose level(mg/dl)	Diabetic (N=30)			Normal (N=15)		
	Past (mean±SD)	Present (mean±SD)	't' value	Past (mean±SD)	Present (mean±SD)	't' value
Fasting	174.3±70.1	123.6±31.1	3.46**	108±23.2	109±26.3	1.06 ^{NS}
Postprandial	270.7±91.4	178.5±52.2	4.32**	128.2±33.2	140.2±54.2	1.03 ^{NS}

**-. Significant at one percent level

NS-Not significant

Table '4' presents correlation coefficient between body composition and blood sugar levels of the subjects. Regarding body compositions, total body weight as well as the body fat percent were found to be positively and significantly correlated with both fasting and postprandial blood sugar levels. The findings supported the evidence that obesity is known to be a cause of insulin resistance (Bonadonna et al,1990). Heimburger (1997) also stated that excess body fat with mean percentage body fat of 45 percent pose a higher risk towards diabetes. However lean body mass percent and total body water percent was found to be negatively and significantly correlated with fasting as well as postprandial blood sugar levels. Several studies also indicate that increased water level poses beneficial effect on body fat percent.

Table (4) Correlation Coefficient between Body Composition and Diabetes.

Particulars	Blood sugar levels(mg/dl)	
	Fasting	Postprandial
Total body weight	0.459**	0.319*
Body fat percent	0.653**	0.744**
Lean mass percent	-	-0.312*
Body water percent	-0.594**	-0.323*

**-. Significant at one percent level

*- Significant at five percent level

III. Summary and Conclusion

Non-communicable disease, or NCD, is a medical condition or disease which by definition is non-infectious and non-transmissible between persons. Out of the number of NCDs, India is facing an "epidemic" of diet-related NCD namely diabetes. Extensive research published over the past two decades has demonstrated a positive association between increased levels of body fatness, obesity and type-2 diabetes. In particular abdominal obesity has been identified as a significant risk factor for the development of insulin resistance, glucose intolerance and type-2 diabetes.

In the present study there was a significant and positive correlation was observed between total body weight, body fat percent and blood glucose levels whereas lean mass and total body water percent was found to be significantly and negatively correlated with blood glucose levels. The study indicates that by maintaining body composition to the ideal level, risk of developing NCD particularly diabetes can be minimized.

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