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RELATION BETWEEN PERCENT – BODY FAT, DERIVED FROM SERUM CHOLESTEROL AND BLOOD SUGAR LEVEL IN NON-INSULIN DEPENDENT DIABETES MELLITUS

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ABSTRACT

Purpose: Our main purpose was to study relation between percent – body fat, serum cholesterol and blood sugar level in non- insulin dependent diabetes mellitus, which is found to be increased. As skinfold thickness has very important relation with serum cholesterol and blood sugar level, adiposity is main factor in hyperglycemia in diabetic persons which is due to impaired glucose tolerance. **Material and Method**: This study was carried on 100 non-insulin dependent diabetes mellitus, While carrying this study, parameters included were skinfold thickness, serum cholesterol level, blood sugar level, weight, height, chest circumference. **Percent:** body fat was easily derived from tricep skinfold thickness and sub-scapular thickness rather than thigh region, juxta-nipple, fore-arm region and calf of the leg. While doing this study, their socioeconomic status was also taken into consideration. Result – Percent body-fat derived from skinfold thickness increase in non- insulin dependent diabetes mellitus persons. After doing statistical analysis, a significant correlation was found percent body-fat derived from skin-fold thickness and serum cholesterol ($P<0.01$) and also a highly significant correlation between serum cholesterol and blood sugar level ($P>0.05$) in non- insulin dependent diabetes mellitus. Conclusion – Thus a close relation was found between percent body-fat, derived from skinfold thickness, serum cholesterol level and blood sugar level, which increases with age.

KEYWORDS: Skinfold thickness, percent body-fat, serum cholesterol level, blood sugar level, non - insulin dependent diabetes mellitus.

INTRODUCTION

The present study was carried out to the relation between percent body-fat, serum cholesterol level and blood sugar level in non- insulin dependent diabetes mellitus persons. Percent body-fat is increased in non- insulin dependent diabetes mellitus persons. As skinfold thickness has very important relation between serum cholesterol and blood sugar, adiposity is the main factor in hyperglycemia in non - insulin dependent diabetes mellitus persons. Obesity is seen in non - insulin dependent diabetes mellitus persons due to impaired glucose tolerance. The main risk factors for development of non- insulin dependent diabetes mellitus are old age, centripetal fat distribution, low physical activity and increased serum cholesterol level and increased blood sugar level. Thus adiposity which is increased in non- insulin dependent diabetes mellitus depends on percent body-fat, serum cholesterol and blood sugar level as through lipogenesis, glucose gets converted to fat in adipose tissue.

MATERIAL AND METHODS

Subjects: The present study was undertaken to show the relation between percent body-fat, serum cholesterol, blood sugar level in non - insulin dependent diabetes mellitus .persons. Subjects taken were from age-group 11-60 of age and were divided into different age-groups viz: 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years. Data collected was consisting of 100 non - insulin dependent diabetes mellitus persons. While carrying this work, their economic and nutritional status was taken into consideration Study Protocol: In this study, the parameters included were skinfold thickness, serum cholesterol, percent body-fat, blood sugar level, height and weight. Height and weight evaluate growth and nutritional status and provides information about total body-mass index and linear growth.[9,10]

Skinfold thickness: Skinfold thickness, which gives us an idea of total body fat content, was measured by UNA caliper, which was calibrated before being used.[10] For this various sites were chosen. Skin was lifted with a firm grip between thumb and fore finger, away from muscle, so that only fat was being measured. Sites chosen were

1. Dorsum of right upper arm over triceps muscle, midway between lateral margins of the acromion process and tip of olecranon.
2. Fore-arm flexor at maximum breath.
3. Thigh – middle aspects- midway between knee and inguinal fold.
4. Calf of the leg
5. Mid-way between umbilicus and nipple.

6. Mid-way between umbilicus and anterior superior iliac spine
7. Sub-scapular skinfold below tip of right scapula
8. Juxta-nipple
9. Along mid-axillary line at the level of xyphoid process.

All these readings were taken on the right side of person[9,10]

Serum cholesterol level: Serum cholesterol level was measured by Libermann-Burchard method.

Principle: Cholesterol in serum was extracted into acetic anhydride in the presence of acetic acid, on treatment with modified Libermann-Burchard reagent, producing a green colour, the intensity of which is compared with standard.[3]

Normal serum cholesterol level is 150-200mg%

Percent body-fat: Percent body-fat was calculated from shinfold thickness at sites-triceps and sub-scapula. Percent body-fat was calculated by formula

For women, Percent body-fat = 0.55(A) + 0.31(B)+6.13

For men, Percent body-fat = 0.43(A) + 0.58(B)+1.47

Weight and Height: Weight was measured with a standard weighing machine and with minimum belongings on subject's body. Height was measured with a measuring tape.

Blood sugar level; Blood sugar level was measured by Glucose – oxidase method.

Principle: Glucose oxidase converts glucose to gluconic acid and hydrogen peroxide. Peroxidas acts on H2O2 liberating nascent oxygen which couples with chromogenic substrates, producing red color complex. The intensity of color complex was directly proportional to glucose concentration in specimen when compared with the standard.

Normal limits

1. Fasting blood sugar level: 60-110mg%
2. Post-prandial blood sugar level: less than 140mg%
3. Random blood sugar level: 80-120mg%

Statistical analysis: For estimation of relation between percent body-fat, derived from skinfold thickness, serum cholesterol and blood sugar level, statistical analysis was done by chi square test, from which mean and standard deviation was determined.

RESULT

Table I

Age group in years	Males	Females	Total
11 - 20	8	8	16
21 - 30	10	10	20
31 - 40	10	10	20
41 - 50	11	11	22
51 - 60	11	11	22
Total	50	50	100

From Table I, it was found that study was done on 100 non- insulin dependent diabetes mellitus .persons, on the basis of their age.

Table II gives idea about estimation of Percent body-fat, derived from skinfold thickness

SUM OF 3 SKINFOLDS	AGE TO THE LAST YEAR									
	MALES					FEMALES				
	UNDER 20	21-30	31-40	41-50	51-60	UNDER 20	21-30	31-40	41-50	51-60
11	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	10.12	-	-
14	-	6.52	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	10.43
16	-	-	-	-	-	-	-	-	-	11.22
17	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	11.53
20	-	-	-	-	-	-	8.54	-	-	-
21	-	8.42	8.75	8.54	8.54	-	-	12.80	-	12.70
22	9.54	-	8.75	10.13	10.11	8.97	8.97	-	10.83	-
23	-	8.63	8.97	-	8.97	-	9.50	-	13.25	-
24	9.83	-	-	10.41	10.41	13.01	-	-	13.40	-
25	12.70	10.34	8.97	8.97	8.97	13.56	-	-	13.80	12.97
26	9.98	-	-	9.98	10.07	-	11.39	13.25	-	14.11
27	-	-	-	-	-	-	11.84	-	-	-
28	-	10.84	-	10.12	10.12	-	12.70	14.38	-	13.18
29	-	-	-	-	10.69	14.66	-	-	-	-
30	12.13	-	11.57	11.96	12.28	11.42	-	14.73	14.73	-
31	-	-	-	-	-	16.86	15.28	-	-	-
32	-	-	9.52	13.24	13.24	-	-	15.21	16.31	15.04
33	-	-	-	-	-	-	-	15.28	-	17.35
34	-	-	-	-	-	-	14.11	-	16.90	-
35	-	-	-	-	-	-	-	17.17	-	-
36	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	14.45	17.55	-	-	-
39	-	-	14.60	-	-	-	-	-	17.55	-
40	-	-	-	-	-	-	-	-	-	-

Sum of triceps, thigh and suprailiac skinfolds.

From Table II it was found that Percent body-fat, derived from skinfold thickness increase in non-insulin dependent diabetes mellitus .persons, with increasing age.

Table III shows relationship between serum cholesterol, blood sugar level & percent body-fat

AGE GROUP YEARS		BLOOD SUGAR LEVEL	PERCENT BODY FAT
MALE 11-20 FEMALE	SERUM CHOLESTEROL LEVEL	-	-
		** 0.947	** 0.5988
MALE 21-30 FEMALE	SERUM CHOLESTEROL LEVEL	-0.66	-
		** 0.861	** 0.090
MALE 31-40 FEMALE	SERUM CHOLESTEROL LEVEL	-	-0.98
		** 0.756	- 0.288
MALE 41-50 FEMALE	SERUM CHOLESTEROI LEVEL	-	** 0.922
		** 0.707	** 0.683
MALE 51-60 FEMALE	SERUM CHOLESTEROL LEVEL	** 0.8325	-
		** 0.672	-0.837
MALE ALL FEMALE	SERUM CHOLESTEROL LEVEL	** 0.694	** 0.5942
		** 0.778	* 0.3092

Male : - n = 50 (P < 0.01) Highly significant
Female : - n = 50 (P < 0.05) Significant

Note :- The correlations listed are significant with a P value between 0.05 and 0.01 .

** P < 0.01 : * P < 0.05

After doing statistical analysis, it was found that there is significant correlation in between percent body-fat, derived from skinfold thickness and serum cholesterol ($P < 0.01$) and also a highly significant correlation between serum cholesterol and blood sugar level ($P>0.05$) in non- insulin dependent diabetes mellitus.

DISCUSSION

Skinfold thickness being a measurement of subcutaneous fat is a valuable indicator of calorie reserve. It is very useful to determine the percent body-fat. Skinfold thickness, along with serum cholesterol and percent body-fat are useful indicators of obesity.[1]

Obesity in non-insulin dependent diabetes mellitus – Every diabetic patient was classified into obese & non-obese. Obesity in diabetic mellitus results from conversion of glucose to serum cholesterol in adipose tissue, thus increasing skinfold thickness. Thus in non-insulin dependent diabetes mellitus, obesity is a human problem of great antiquity, which is associated with hypertension. Peripheral increased blood glucose level was found in as a characteristic feature of abdominal obesity.

Percent body-fat and skinfold thickness – The triceps skinfold thickness and sub-scapular skinfold thickness were found as the most valid, simple indicator of percent body-fat at different ages. Percent body-fat gives the percentile level of an individual when compared with height and weight, which are the anthropometric indicators. Height and weight are correlated with percent body-fat.[10] Percent body-fat increases in non-insulin dependent diabetes mellitus.

Serum cholesterol level and percent body-fat derived from skinfold thickness – Central percent body-fat distribution was closely correlated with increased serum cholesterol level. Increased serum cholesterol, in close relation with percent body-fat, was a sign of obesity. A close association was found between serum cholesterol and skinfold thickness. Plasma cholesterol was strongly affected by sub-cutaneous adiposity. i.e. increased percent body-fat. Thus increased percent body-fat is a powerful determinant of rise in serum cholesterol level. This association depends on the degree of obesity.[1]

Serum cholesterol level and its relation with blood sugar level – In the absence of insulin, serum cholesterol level increases with blood sugar level as insulin causes storage of fat in adipose tissue, utilizing glucose as a source of energy and thus decreasing serum cholesterol level. Lipolysis of stored fat by enzyme lipase increases both blood sugar & serum cholesterol level. Thus in human beings, increased sugar metabolism leads to changes in lipid metabolism.[1]

Cholesterol metabolism in non-insulin dependent diabetes mellitus – Liver is a main organ for synthesis of cholesterol. Cholesterol synthesis varies according to the degree of severity of diabetes. Increase in cholesterol synthesis is probably secondary to glucose oxidation with the diabetic cell. Thus glucose breakdown is required for optimal cholesterol synthesis.[4]

Conversion of glucose to fatty acids – The major mechanism by which body is able to store calories of glucose, is by conversion of glucose to long chain fatty acids. This conversion of glucose to fat is rapid and quantitatively important process, which is called as lipogenesis and occurs in adipose tissue.[8]

Defects in glucose metabolism in non-insulin dependent diabetes mellitus were characteristically accompanied by inability to convert glucose to fatty acid in the adipose tissue, which increase skinfold thickness by increasing percent body-fat.[6, 7, 8]

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