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INTERRELATIONSHIP BETWEEN PERCENT BODY-FAT DERIVED FROM SKIN-FOLD THICKNESS & SERUM CHOLESTEROL LEVEL

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ABSTRACT

Purpose: Skinfold thickness is a useful indicator of body-fat. Skinfold thickness along with percent body fat is useful indicators of obesity. Percent body-fat can be easily derived from triceps skinfold thickness and sub-scapular skinfold thickness. Increased serum cholesterol and obesity are independently related to increase skinfold thickness. **Material and Method:** This study was carried out on100 normal subjects from civil hospital, sangli. Interrelationship between percent body-fat, derived from skinfold thickness and serum cholesterol level was found out. While carrying out this work, the socio-economic status and nutritional status was taken into consideration. In this study, the parameters included were skinfold thickness, serum cholesterol level, percent body-fat, weight, height, chest circumference and blood pressure. **Result:** Percent body-fat, derived from skinfold thickness increase in females than in males, with increasing age. Skinfold thickness was found in a descending order at various sites. i.e. triceps region, abdominal region, thigh region, sub-scapular region, juxta-nipple region, fore-arm region, calf of the leg and mid – axillary region. After doing statistical analysis, it was found that there is slight significant correlation in males ($P<0.05$) but shows a highly significant correlation in females ($P < 0.01$). **Conclusion:** There is a close relationship was found in between percent body-fat, derived from skinfold thickness and serum cholesterol.

KEYWORDS: Skinfold thickness, percent body-fat, serum cholesterol level.

INTRODUCTION

Skinfold thickness is a useful indicator of body-fat and hence of calorie reserve. Elevated levels of skinfold thickness, in children & adolescent, is an indicative of risk of cardiovascular disease. Elevated blood pressure, serum lipid abnormalities and alterations in

glucose metabolism are important precursors of cardiovascular disease. Physiologically, the conversion of fat to cholesterol is done by stimulation of hormones, secreted by adrenal cortex. Increased serum cholesterol and obesity are independently related to increase skinfold thickness. Skinfold thickness along with percent body fat is useful indicators of obesity. Skinfold thickness increases with increasing age and is different in different regions of the body. Percent body-fat can be easily derived from triceps skinfold thickness and sub-scapular skinfold thickness. This study was carried out on100 normal subjects from civil hospital, sangli. Interrelationship between percent body-fat, derived from skinfold thickness and serum cholesterol level was found out.

MATERIALS AND METHODS

Subjects: The present study was undertaken to show the relationship between skinfold thickness and serum cholesterol level in a normal person. The subject were taken from the age-group 11 to 60 of age and these subjects were divided into different age-groups viz; 11-20years, 21-30 years, 31-40years, 41-50years, 51-60years. Subjects were selected from blood-bank camps of civil hospital, sangli. The data collected was consisting of 100 normal subjects. While carrying out this work, the socio-economic status and nutritional status was taken into consideration.

Study Protocol: In this study, the parameters included were skinfold thickness, serum cholesterol level, percent body-fat, weight, height, chest circumference and blood pressure. Height and weight evaluate growth and nutritional status and provides information about total body-mass index and linear growth.[7, 8]

Skinfold thickness: Half of the total body-fat deposits in the body were present as subcutaneous adipose tissue. Hence the measurement of skinfold thickness gives an idea of total body-fat content. UNA caliper was used for the measurement of skinfold thickness, which is calibrated before being used.[5]

For this various sites were chosen. The skin was lifted with a firm grip between the thumb and fore-finger, away from muscle, so that only fat was being measured. Sites chosen were.

1. Dorsum of the right upper arm over triceps muscle, midway between lateral margins of the acromion process and the tip of olecranon.
2. Fore- arm flexor at the maximum breath.

3. Thigh-middle aspects – midway between knee and inguinal fold.
4. Calf of the leg.
5. Midway between umbilicus and nipple.
6. Midway between umbilicus and anterior superior iliac spine.
7. Sub-scapular skinfold below the 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 the person.[10]

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

Principle: Cholesterol in serum or plasma was extracted into acetic anhydride in the presence of acetic acid, on treatment with modified Libermann-Burchard reagent, producing a green color, the intensity of which is compared with standard.[9]

Normal Serum cholesterol level is 150 – 200 mg%.

Percent body-fat - Percent body-fat was calculated from skinfold thickness at sites- triceps & sub-scapula. Percent body-fat was calculated by the 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

A = Triceps skinfold thickness, B = Sub-scapular skinfold thickness.[7]

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

Chest circumference: By holding the tape firmly at the level of xiphisternum, reading was taken in end-inspiratory phase.

Blood Pressure: Blood Pressure was measured in a sitting position with a sphygmomanometer.

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

RESULTS

TABLE I

SAMPLE SIZE ACCORDING TO SEX OF VARIOUS AGE GROUP

Age group in year	Males	Females	Total
11 - 20	11	11	22
21 - 30	10	10	20
31 - 40	11	11	22
41 - 50	9	9	18
51 - 60	9	9	18
Total	50	50	100

From Table I, it was found that study was done on 100 normal subjects, which were divided into male and female groups and on the basis of their age.

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

TABLE VII

ESTIMATION OF PERCENT BODY-FAT (CONTROL)

SUM OF 3 SKINFOLDS	AGE TO THE LAST YEAR MALES UNDER 20	21-30	31-40	41-50	51-60	FEMALES UNDER 20	21-30	31-40	41-50	51-60
11	–	–	–	–	–	–	–	–	–	–
12	–	–	–	–	–	–	–	–	–	–
13	7.38	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	–	–	–	–	–
15	7.53	–	–	–	–	–	10.43	–	–	–
16	–	–	–	–	–	–	–	8.84	–	7.2
17	7.53	–	–	–	7.38	–	–	–	–	–
18	–	–	–	9.55	–	–	10.74	–	–	10.5
19	7.68	8.54	7.26	–	7.68	–	–	–	–	–
20	10.41	–	8.03	8.26	–	–	9.38	–	9.68	9.4
21	–	10.03	8.54	8.40	–	–	9.55	10.84	8.39	–
22	–	9.33	8.97	–	8.97	–	–	–	–	–
23	9.55	–	9.55	–	8.97	–	–	10.84	–	12.2
24	13.01	–	13.01	–	10.13	–	11.47	–	–	–
25	–	–	–	–	–	9.93	9.98	–	–	–
26	–	10.41	–	–	–	10.41	–	–	–	–
27	–	–	–	–	–	11.55	–	–	–	–
28	–	10.99	10.70	10.99	11.14	11.86	–	–	10.71	–
29	11.52	–	11.57	–	–	–	–	10.99	–	10.9
30	–	10.40	–	12.21	–	–	13.32	–	–	–
31	–	–	–	–	–	–	–	–	–	13.0
32	15.28	10.71	–	–	–	15.0	–	10.41	12.43	10.4
33	–	–	–	–	–	–	–	–	–	–
34	–	–	–	16.14	14.11	–	–	16.41	15.35	–
35	11.57	–	–	–	–	–	–	–	–	–
36	–	12.13	–	–	–	–	–	–	–	–
37	–	–	–	–	–	–	14.66	–	–	–
38	–	–	–	14.45	–	15.03	–	14.45	17.0	–
39	–	–	–	–	–	–	–	–	–	–
40	–	–	–	–	16.04	15.03	–	15.03	17.28	–

Sum of triceps, thigh and suprailiac skinfolds.

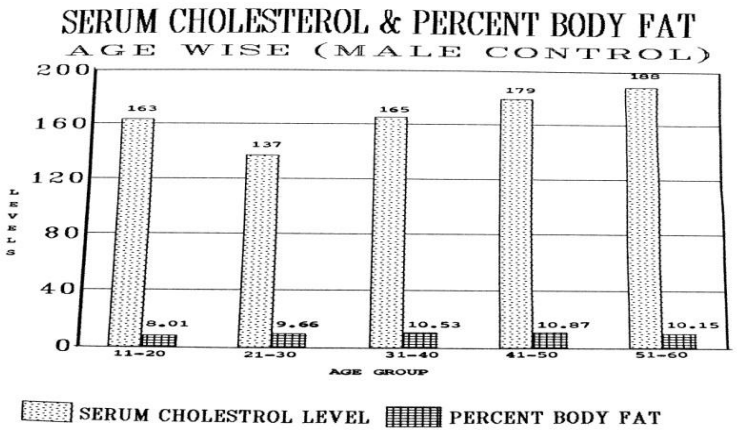
From Table II it was found that Percent body-fat, derived from skinfold thickness increase in females than in males, with increasing age.

Table III is a table of mean values and standard deviation of the data collected

TABLE IV
MEAN VALUES AND S.Ds (CONTROL)

AGE GROUP YEARS	HEIGHT FEET	WEIGHT KG	THICKNESS OF SKIN IN MM D1	D2	D3	D4	D5	D6	D7	D8	D9	SERUM CHOLESTEROL LEVEL MG %	BLOOD SUGAR MG %	PERCENT BODY FAT	CHEST CIRCUM-FERANCE CM
11-20 MALE	4.8 ± 0.18 n = 11	51 ± 0.384	7 ±0.67	6 ±0.57	6 ±0.76	6 ±0.47	6 ±0.43	6 ±0.49	6 ±0.43	5 ±0.40	5 ±0.41	163 ± 13.75	138 ± 9.433	8.01 ±0.571	29 ± 0.351
11-20 FEMALE	4.7 ± 0.26 n = 11	48 ± 1.118	10 ±1.22	9 ±1.11	10 ±1.22	9 ±1.11	9 ±1.11	9 ±1.10	9 ±1.11	9 ±1.129	8 ±1.11	157 ± 12.34	138 ±15.94	14.31 ±2.482	29 ± 0.866
21-30 MALE	5.2 ± 0.25 n = 10	62 ± 2.306	10 ±0.51	9 ±0.54	9 ±0.41	8 ±0.44	9 ±0.48	9 ±0.47	9 ±0.41	8 ±0.40	6 ±0.32	137 ± 15.02	107 ± 7.035	9.66 ±0.394	28 ± 0.666
21-30 FEMALE	5 ± 0.70 n = 10	58 ± 2.477	9 ±0.58	7 ±0.61	10 ±0.65	8 ±0.63	8 ±0.65	8 ±0.65	8 ±0.50	8 ±0.48	7 ±0.50	155 ± 13.36	108 ± 8.402	11.75 ±0.531	29 ± 0.966
31-40 MALE	5 ± 0.37 n = 11	60 ± 2.166	9 ±0.65	7 ±0.58	9 ±0.61	7 ±0.60	9 ±0.62	8 ±0.63	8 ±0.68	9 ±0.60	6 ±0.52	165 ± 14.97	116 ±16.641	10.53 ±2.193	29 ± 0.729
31-40 FEMALE	5.1 ± 0.69 n = 11	59 ± 3.85	11 ±1.13	10 ±1.12	12 ±0.98	10 ±0.91	11 ±0.66	11 ±0.83	11 ±0.84	11 ±0.66	9 ±0.94	175 15.27	119 ±10.39	14.62 ±0.599	30 ± 0.810
41-50 MALE	5.2 ± 0.135 n = 9	59 ± 1.763	10 ±1.07	7 ±0.93	10 ±1.00	8 ±0.90	9 ±0.91	9 ±0.91	9 ±0.93	9 ±0.94	7 ±0.96	179 ± 15.22	105 ± 8.099	10.87 ±0.736	25 ± 2.093
41-50 FEMALE	5 ± 0.103 n = 9	59 ± 3.48	11 ±0.88	9 ±1.12	11 ±1.08	8 ±0.99	10 ±1.03	10 ±1.06	10 ±1.01	10 ±0.91	8 ±0.89	193 ± 10.37	140 ± 6.38	13.99 ±1.305	32 ± 1.205
51-60 MALE	5.1 ± 0.122 n = 9	54 ± 1.564	8 ±1.14	8 ±0.80	8 ±1.06	8 ±0.97	8 ±1.10	6 ±0.86	7 ±0.96	7 ±0.92	5 ±0.88	188 ± 13.58	105 ± 8.36	10.15 ±0.890	27 ± 0.755
51-60 FEMALE	5 ± 0.116 n = 9	62 ± 4.26	9 ±0.86	7 ±1.19	8 ±0.70	6 ±0.75	8 ±1.29	9 ±1.93	7 ±0.91	7 ±0.93	5 ±0.82	226 ± 14.04	122 ±15.62	8.54 ±1.547	34 ± 2.315

Table III shows a relation in between percent body –fat, height, weight, skinfold thickness and serum cholesterol level and chest circumference with different age groups. Skinfold thickness was found in a descending order at various sites. i.e. triceps region, abdominal region, thigh region, sub-scapular region, juxta-nipple region, fore-arm region, calf of the leg and mid – axillary region.[10]



Graph of statistical analysis showing a correlation-coefficient in between serum cholesterol level and body-fat. After doing statistical analysis, it was found that there is slight significant

correlation in males ($P<0.05$) but shows a highly significant correlation in females ($P < 0.01$). Thus a close relationship was found in between percent body-fat, derived from skinfold thickness and serum cholesterol.

DISCUSSION

Skinfold measurement provides a good estimate of the quantity of fat in the body. It enables us to compare the proportion of body-fat in different individuals or in the same individual of different age-groups. 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. An inch of Skinfold thickness is probably the maximum amount of fat in most regions of the body. Skinfold thickness, along with serum cholesterol and percent body-fat are useful indicators of obesity.[1] Skinfold thickness, at a given percentile, corresponds to different levels of bogy –fat at different age groups.

Obesity and serum cholesterol level - Obesity results from serum cholesterol in the adipose tissue, thus increasing skinfold thickness. There was a significant correlation between body-weight and serum cholesterol level (Table II). Massive obesity is a serious disease and is always found in association with a variety of complications. Obesity was adversely affected by blood pressure. Increased body –fat leads to obesity.[8]

Centripetal fat distribution estimates percent body-fat from sub-cutaneous skinfold measurements. From sub-cutaneous skinfold measurements, severe obesity was invalidated with increasing age. Thus there is a strong association between obesity and abnormal serum cholesterol level. 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]

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] Mitochondrial lipogenesis – The series of reactions by which fatty acids could be synthesized in the mitochondria of the cell is called as mitochondrial lipogenesis. The site for lipogenesis is in the adipose tissue of the body. But this mitochondrial lipogenesis differs from the oxidative breakdown of fatty acids. In this the microsomes of the cell play a role. Thus lipogenesis is found to exist in the adipose tissue. This fatty-acid synthesized in the adipose tissue, increase skinfold thickness by increasing percent body-fat.[3]

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