

Pattern Of Subcutaneous Fat Distribution, Its Variation with Age Among Young Rajput Females of Pauri Garhwal, India

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KEY WORDS Skinfold Thickness. Adiposity. Subcutaneous Fat Distribution. Grand Mean Thickness (GMT).

ABSTRACT The pattern of fat distribution and the variations exhibited in the same with increase in age were studied amongst 216 young and healthy Rajput females of Pauri Garhwal, Uttar Pradesh. The subjects were between 12-25 years of age. Skinfold thickness values as a measure of adiposity do not signify any specific growth trend but put sufficient light on the distribution pattern of subcutaneous fat. Predictably, with puberty there is evidenced an increased tendency to gain fat.

INTRODUCTION

The present study was designed to analyse and assess the pattern of fat distribution at five skinfold thickness sites among young Rajput girls of Pauri Garhwal. It also attempts to trace the variations occurring with age through the years 12-25.

MATERIALS AND METHODS

One third of Pauri's population is that of Rajputs who are morphologically thin, lean and lanky, fair complexioned with black or brown coloured hair and eyes. A total of 216 young and healthy Rajputs girls between the ages 12-25 years, were measured. The data were mainly obtained from the local government schools, some nearby villages and a few urban settlements.

The data were grouped on a yearly basis from 12 years onwards, excepting the last group of 20-25 years, which was clubbed together as adults.

For the purpose of determining adiposity, five skinfold thicknesses at different body sites were taken with the help of a Holtain's

skinfold caliper using standard techniques. The sites selected were biceps, triceps, subscapular, suprailiac and calf posterior. Strict adherence was maintained with respect to the usage of standardised instruments and methodology of taking the measurements. Standard techniques recommended by Weiner and Lourie (1969) and Cameron (1984) alongwith necessary precautions were used.

RESULTS AND DISCUSSION

For the age group under study, i.e., 12-25 years, the biceps skinfold thickness values show a mixed trend, finally resulting in an overall increase by the age of 25 years. The average mean values ranged from a minimum of 3.28mm at 13 years of age to a maximum of 4.65mm at 17 years of age. The 't' test did not reveal any discernable difference in biceps skinfold thickness values among different age groups (Table 1).

An evaluation of the triceps skinfold thickness with respect to age shows the non-existence of any perfect linear trend in the mean values which ranged from 6.75mm at 12 years to a maximum of 9.73mm at 19 years of age.

As age caught on, the mean values for the subscapular skinfold thickness increased with a single exception among the 19 to 20-25 years age group, where the annual increment took on a negative value of -0.69 mm. The mean values ranged from 11.12mm at 19 years, the highest among all skinfolds in the present study, to 5.74mm at 12 years of age. The difference of values at this site among various age groups were found to be statistically non-significant.

Table 1 : Age changes in subcutaneous skinfold thickness among young Rajput girls (Log values appear in bold beside the actual values)

Age	No.	Skinfold thickness sites (in mm)														
Group		Biceps					Triceps					Subscapular				
		$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	
	12	3.35 $\pm$ 0.91	-	1.21 $\pm$ -0.09	-	6.75 $\pm$ 1.75	-	1.91 $\pm$ 0.56	-	5.74 $\pm$ 1.13	-					
	13	3.28 $\pm$ 0.65	0.10	1.19 $\pm$ -0.43	0.0478	6.77 $\pm$ 1.43	0.01	1.91 $\pm$ 0.36	-0.0044	6.54 $\pm$ 1.57	0.50					
	14	4.09 $\pm$ 0.85	1.22	1.41 $\pm$ -0.16	-0.4793	9.00 $\pm$ 1.76	1.52	2.20 $\pm$.056	-0.4256	8.86 $\pm$ 2.73	1.30					
	15	4.11 $\pm$ 1.30	0.10	1.41 $\pm$ 0.26	-0.0158	8.59 $\pm$ 2.57	0.71	2.15 $\pm$ 0.94	0.0423	9.46 $\pm$ 2.91	1.05					
	16	4.13 $\pm$ 1.02	0.04	1.42 $\pm$ 0.02	-0.0184	8.57 $\pm$ 2.07	0.02	2.15 $\pm$ 0.73	0.0019	9.58 $\pm$ 2.49	0.17					
	17	4.65 $\pm$ 2.08	1.09	1.54 $\pm$ 0.73	-0.1618	9.46 $\pm$ 2.88	1.22	2.25 $\pm$ 1.06	-0.0769	9.89 $\pm$ 2.71	0.42					
	18	4.04 $\pm$ 1.25	0.88	1.40 $\pm$ 0.22	0.1836	8.82 $\pm$ 2.18	0.69	2.18 $\pm$ 0.78	0.0533	9.96 $\pm$ 2.63	0.07					
	19	4.33 $\pm$ 1.82	0.57	1.47 $\pm$ 0.60	-0.1084	9.73 $\pm$ 3.09	1.07	2.27 $\pm$ 1.13	-0.0716	11.12 $\pm$ 3.32	1.21					
	20+	4.14 $\pm$ 2.04	0.30	1.42 $\pm$ 0.71	0.0481	9.12 $\pm$ 2.66	1.67	2.21 $\pm$ 0.98	0.0433	10.43 $\pm$ 2.67	0.71					
		Calf Posterior														
		$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	
	12	5.75 $\pm$ 1.74	-	1.75 $\pm$ 0.54	-	7.61 $\pm$ 2.02	-	2.03 $\pm$ 0.70	-	1.75 $\pm$ 0.12	-					
	13	5.95 $\pm$ 1.90	0.10	1.78 $\pm$ 0.64	-0.0408	8.81 $\pm$ 1.80	0.65	2.17 $\pm$ 0.59	-0.1597	1.88 $\pm$ 0.45	-0.2791					
	14	8.55 $\pm$ 2.62	1.33	2.15 $\pm$ 0.96	-0.3132	10.65 $\pm$ 1.80	0.10	2.36 $\pm$ 0.59	-0.2281	2.18 $\pm$ 1.00	-0.2757					
	15	9.50 $\pm$ 4.55	0.97	2.25 $\pm$ 1.51	-0.0586	10.09 $\pm$ 3.23	0.80	2.31 $\pm$ 1.17	0.0411	2.25 $\pm$ 1.07	-0.0446					
	16	9.24 $\pm$ 3.78	0.23	2.22 $\pm$ 1.33	0.0137	10.24 $\pm$ 2.35	0.20	2.33 $\pm$ 0.85	-0.0101	2.16 $\pm$ 0.91	-0.0089					
	17	10.07 $\pm$ 2.74	0.89	2.31 $\pm$ 1.01	-0.0515	10.18 $\pm$ 2.52	0.09	2.32 $\pm$ 0.92	0.0046	2.29 $\pm$ 1.00	-0.0235					
	18	8.22 $\pm$ 2.19	2.01	2.11 $\pm$ 0.78	0.1589	9.45 $\pm$ 2.71	0.76	2.25 $\pm$ 1.00	0.0547	2.30 $\pm$ 0.97	-0.0050					
	19	10.28 $\pm$ 4.23	1.92	2.33 $\pm$ 1.44	-0.1362	10.00 $\pm$ 2.83	0.62	2.30 $\pm$ 1.04	-0.0392	2.41 $\pm$ 1.20	-0.0714					
	20+	9.36 $\pm$ 3.31	0.76	2.24 $\pm$ 1.19	0.0500	10.74 $\pm$ 3.54	0.72	2.37 $\pm$ 1.26	-0.0436	2.34 $\pm$ 0.98	0.0413					
		Suprailiac														
		$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	$\bar{X} \pm S.D$	r'	
	12	5.75 $\pm$ 1.74	-	1.75 $\pm$ 0.54	-	7.61 $\pm$ 2.02	-	2.03 $\pm$ 0.70	-	1.75 $\pm$ 0.12	-					
	13	5.95 $\pm$ 1.90	0.10	1.78 $\pm$ 0.64	-0.0408	8.81 $\pm$ 1.80	0.65	2.17 $\pm$ 0.59	-0.1597	1.88 $\pm$ 0.45	-0.2791					
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The mean values for the suprailiac skinfold thickness also showed a general trend to increase with age, however it did not follow a strict exponential curve. The values ranged from a minimum of 5.75mm at 12 years of age to 10.28 mm at 19 years of age. The 't' test applied did not reveal any statistically significant difference among the various age groups.

Age changes in the calf posterior skinfold thickness values showed a mixed trend, ranging from a maximum value of 10.74 mm at 20-25 years of age to a minimum of 7.61mm at 12 years of age.

It is interesting to note that standard deviation values for all the five skinfold sites, rests at their minimum amongst the 12 and the 13 year olds. This would signify a greater level of similarity among these age groups, implying in turn that during this period of increased growth almost all children acquire a certain level of accomplishment of growth, only to be later subjected to variations arising due to genetic potential, environmental stress, nutrition etc. This assumption is further corroborated by the finding that all the maximum standard deviation values for the various skinfold sites fall under the older age group category, viz., 17, 19, 20-25 years.

As a measure of adiposity, different sites may show a mixed trend due to the multitudinous factors contributing to the degree of fat deposition. Although in general, a gradual increase is expected, calorific imbalances cause discrepancies. As the growth rate and energy demand increase, diet may remain unsupplemented, causing mobilization of reserve fat and consequently a decrease in the skinfold thickness values. Therefore a wide variation or non consistency of any particular trend could be attributed to the nutritional status, physical activity level, energy expenditure, modification of fat resources, variations in the rate of growth, genetic constitution, cross sectional nature of data, etc.

Variations in such a study could also be due to a positive growth pattern with different body segments exhibiting different rates of growth but nonetheless directed progressively. Although these skinfold thickness values as a measure of adiposity do not signify any specific growth trend, it does put sufficient light on the distribution pattern of subcutaneous fat.

GMT, calculated to assess the overall subcutaneous fat content of an individual, specifies a general pattern of increased fatness. With increase in age and the attainment of puberty in these girls, there is an increased tendency to gain fat, evidenced by the maximum annual increment value of 1.92 mm between 13 and 14 years of age. GMT as well as the triceps and subscapular skinfold thickness were found to be significantly and positively correlated with age.

Analysis Of Distribution Pattern Of Subcutaneous Fat

On comparison, it was observed that in contrast to the 13 and 14 years olds, the trunk fat among the older girls takes precedence over the upper extremity fat. This trend increases to an extent where the trunk skinfold thickness supercedes the lower extremity fat at 18 and 19 years of age. Thus the trend can be generalised as: The trunk skinfold thickness lies midway between that of the upper arm (minimum) and lower limb (maximum) in the younger age groups, but with increasing age and approaching adulthood, the trunk region deposits maximum fat, followed by lower limb and upper arm in descending order. This confirms the results obtained by Borkan and Norris (1977). Berry (1974), however, observed triceps as the site of maximum fat deposition in females.

The fact that skinfold thickness or fatness increased with advancing age could be due to a gamut of factors, a few of which are discussed below:

- (a) With the approach of adulthood, the growth rate decelerates and the body tissues now require lesser energy to sustain various metabolic processes. This appended to the same or increased amount of nutritive intake gives way to increased adiposity.
- (b) Gender specific roles in a country like India, and that too in a largely semi urban settlement like Pauri, play a crucial part in the growth, development and personality of a child. As girls grow older, they are called upon to do more household chores which though tiring and strenuous, may not necessarily burn up fat tissues as much as in outdoor activities, thus resulting in increased adiposity.
- (c) As with any other parameter associated with growth, fatness being no exception, increases with age and so it did with the girls in this study.

Age at Menarche

The average age at menarche among the girls in the present study worked out to be 14.04 years. The adolescent spurt evidenced by the maximal increment values of the skinfold thicknesses worked out to be 13-14 years, giving weightage to the fact that a certain level of adiposity is required to trigger the onset of menstruation.

Comparison with Other Studies

Although a one-to-one comparison cannot be made with other studies conducted so far, a general consensus in trends can be agreed upon. Increase in adiposity with age has been illustrated by Edwards (1950-51), Skerj et al. (1953), Garn (1954-55), Allen et al. (1956), Young et al. (1963), Malina (1966), Sen (1969), Forbes et al. (1970), Satwanti (1979), Muller et al. (1979, 81), Ramirez and Muller (1980), Satwanti et al. (1980-84), Bhalla et al. (1983) and Kapoor et al. (1985) (cited in Jain, Kavita, 1988).

Comparing the present study with that the

Harshawardhana (1987), Jain (1988) and Rajita (1990), it was found that a distinct sexual dimorphism existed in the pattern of growth and distribution of fat. Females in general were found to have a higher level of adiposity than the males who in turn were taller, heavier and leaner than the females of the same age group.

Although fat deposition is known to be affected by a multitude of factors, it has been consistently emphasised that genetics is the basic predetermining factor deciding distributional pattern of subcutaneous fat in various individuals (Satwanti et al., 1980, 1985). Next to the genetic factor age and sex form a major decisive element (Wilmore, 1970; Badora, 1975; Tanner, 1962 and Reynold et al., 1950) (cited in Harshawardhana, 1988).

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