J. Hum. Ecol., 12(2): 115-119 (2001)
PRINT: ISSN 0970-9274 ONLINE: 2456-6608
DOI: 10.31901/24566608.2001/12.02.04

Skinfold Thickness of The Meitei Boys of Manipur

L. Dibamani Singh, T. Shyamacharan Singh and L. Rajendra Singh

INTRODUCTION

Skinfold consists of a double layer of skin and a variable amount of subcutaneous structures lifted by the fingers to separate it from, underlying tissues. Skinfold thickness measured in different body sites, singly or summed, provides various information such as the outer architecture or shape of the body (Garn, 1954, 1955), body fatness (Berry, 1974; Durnin and Rehaman, 1967; Durnin and Womerslay, 1974; Lohman, 1981), plasma cholesterol (Albrink and Meigs, 1971; Amusa et al., 1989, 1990) and diseases (Bailey, 1985; McGarvey, 1984; Paul et al., 1963; Stallones et al., 1982; Weinsier et al., 1976). Differences in the amount of fat deposited subcutaneously, as measured by skinfolds have been studied by many workers in relation with ethnicity (Dharma Rao et al., 1997; Greaves et al., 1989; Piscopo, 1962), social classes (Bogin and MacVean. 1981; Bogin and Sullivan, 1986; Malina et al., 1981), altitudes (Balgir, 1996; Bhasin in and Singh, 1992) and sportsperson of different traits (Carter and Yuhasz, 1984; DeGaray et al., 1974; Mass, 1974; Mokha and Sidhu, 1986; Sodhi, 1986). These findings, however, cannot distinguish genetic from cultural or environmental influences. Nevertheless, genetic influence on thickness of separate skinfolds in young subjects (Bouchard et al., 1985) and middle aged twins (Selby et al., 1989) is well documented. The sums of different types of skinfolds are regarded as better indicators of body fat than separate skinfolds, and reasonable relationship between external (as measured by skinfolds) and internal fat can also be assumed (Carter and Yuhasz, 1984). In the present paper, an attempt has been made to examine variability in skinfold thickness of two socio-economic groups, such as affluent families and non-affluent families, of the Meitei boys of Manipur, India during adolescence period.

The Meiteis represent the most populous community of the state of Manipur and are mostly concentrated in the four valley districts, *viz.*, Imphal West, Imphal East, Thoubal and Bishnupur, They are predominantly mongoloid but in no way homogenous. Caucasoid and australoid racial elements are also found among them. Majority of the Meiteis are Hindu by religion. Mass proselytation into this religion took place during the early part of the eighteenth century. There are, of course, sizeable numbers of revivalists who follow pre-Hindu beliefs and practises. A very recent trend of conversion to Christianity and Buddhism by a few Meiteis is also seen. By and large the Hinduised Meitei society is divisible into two main sections, such as the Brahmins and the Kshetriyas. Racially the Brahmins are predominantly caucasoid whereas the Kshetriyas are mongoloid. Social proscription of inter-marriage between the two sections is now on the wane. In the present study, the Brahmins were excluded from the sample so as to minimise racial influence in the data.

MATERIAL AND METHOD

The sample comprises 969 apparently healthy boys belonging to the Meitei ethnic group ranging their age from 12 to 18 years. 488 of the boys belong to affluent families and 481 to non-affluent families. They were selected from various educational institutions of the four valley districts of Manipur, *viz.*, Imphal West, Imphal East, Thoubal and Bishnupur. The data were collected during the period of 1993-1995. To ensure correct age was not a problem among the Meiteis as they customarily maintain horoscope scroll, written soon after the birth of their babies. The age of each of the subjects was converted to Tanner's (1966) classification and arranged them into seven age-groups, from 12 years to 18 years.

Thickness of six skinfolds, three at limb sites such as triceps, anterior thigh, and medial calf, and three at trunk sites such as subscapular, suprailiac and umbilical were measured using a Harpenden skinfold caliper and following the techniques prescribed by DeGaray et al. (1974)

and Carter (1982).

RESULTS AND DISCUSSION

Mean values of six skinfold thickness measurements among the Meitei boys of affluent and non-affluent families are shown in tables 1 and 2 respectively. Among the boys of affluent families the mean values of all the skinfolds, except triceps, show continuous increasing trend with the advancement of age during the adolescent period. Among the boys of non-affluent families the mean values of umbilical, anterior thigh and medial calf skinfolds show gradual increase during the growth phase, whereas other three skinfolds - triceps, subscapular and suprailiac show fluctuations during this period, No marked adolescent growth spurts in all the separate six skinfolds have been observed in both the socio-economic groups. The affluent boys show greater skinfold thickness than the non-affluent boys in all the measurements and in all the age groups.

Concerning the mean values of triceps skinfold thickness, the youngest 12 years group represents the thinnest measurement in both the affluent boys (7.8 mm) and the non-affluent boys (6.1mm). The thickest measurement, 8.4 mm among the affluent boys is found in two age groups- 14 and 17 years. The non-affluent boys achieve the thickest triceps skinfold, 7.7 mm at the age of 17 years. Considering the seven age groups together (i.e. from 12 to 18 years), the average triceps skinfold thickness of the affluent boys is 8.2 mm and that of the non-affluent boys is 7.2 mm.

Unlike triceps, anterior thigh skinfold gains thickness gradually for every seccessive year. Thus the smallest mean value of thickness is shown by 12 years group (9.8 mm among the affluent boys and 7.4mm among the non-affluent boys), whereas the greatest mean value is given by the eldest 18 years group (11.2 mm for the affluent boys and 10.3 mm for the non-affluent boys). Average thickness, considering all the ages together is 10.6mm for the affluent boys and 9.7 mm for the non-affluent boys.

Medial calf skinfold thickness also increases on average for every yearly addition, except at 14 and 15 years of the non-affluent boys during which similar mean value (7.1mm) is observed. Among the affluent boys, mean value of the youngest -12 years group is 7.3 mm and that of the eldest 18 years group is 9.0 mm. The thinnest of medial calf skinfold shown by 12 years boys of the non-affluent group is 5.3mm and the thickest among them, represented by 18 years, is 7.6 mm. The affluent boys display an overall average measurement of 8.1mm, while that of the non-affluent boys is 6.9 mm.

Mean values for subscapular skinfold thickness show a trend of gradual gain of thickness along with aging. Among the affluent boys, mean values range from a minimum of 6.2 mm at 12 years to 9.0 mm at two age groups- 17 and 18 years yielding an average value of 7.8 mm

Table 1: Age-wise descriptive statistics of skinfold measurements among the Meitei boys of affluent families

Skinfold thickness (mm)		*12 years (N=68)*	*13 years (N=72)*	*14 years (N=69)*	*15 years (N=69)*	*16 years (N=72)*	*17years (N=66)*	*18 years (N=72)*	*Total (N=488)*
Triceps	$\bar{X}$±SE	7.8±0.20	8.2±0.17	8.4±0.14	7.9±0.19	8.1±0.17	8.4±0.17	8.3±0.14	8.2±0.06
	SD	1.64	1.48	1.14	1.56	1.47	1.42	1.22	1.35
Anterior thigh	$\bar{X}$±SE	9.8±0.29	10.3±0.32	10.5±0.20	10.6±0.20	10.7±0.18	11.1±0.18	11.2±0.19	10.6±0.09
	SD	2.40	2.73	1.68	1.66	1.53	1.49	1.64	1.99
Medial calf	$\bar{X}$±SE	7.3±0.24	7.5±0.22	7.6±0.19	7.9±0.20	8.6±0.23	8.9±0.19	9.0±0.17	8.1±0.08
	SD	2.02	1.85	1.57	1.66	1.95	1.57	1.48	1.86
Sub-scapular	$\bar{X}$±SE	6.2±0.18	7.3±0.20	7.3±0.18	7.7±0.20	8.5±0.22	9.0±0.19	9.0±0.16	7.8±0.08
	SD	1.52	1.72	1.52	1.66	1.85	1.57	1.36	1.85
Suprailiac	$\bar{X}$±SE	6.7±0.23	7.4±0.25	7.9±0.17	8.1±0.21	8.7±0.25	9.1±0.18	9.1±0.19	8.1±0.09
	SD	1.87	2.10	1.42	1.78	2.16	1.48	1.60	1.97
Umbilical	$\bar{X}$±SE	9.8±0.27	10.2±0.28	10.6±0.20	10.8±0.23	10.9±0.16	11.3±0.18	11.5±0.17	10.7±0.09
	SD	2.24	2.40	1.70	1.92	1.37	1.50	1.46	1.92
Sum of six skinfolds	$\bar{X}$±SE	47.4±1.25	50.8±1.19	52.3±0.85	53.2±1.06	55.5±1.03	57.9±0.92	58.0±0.92	53.6±0.43
	SD	10.28	10.11	7.09	8.79	8.76	7.46	7.78	9.39

Table2: Age-wise descriptive statistics of skinfold measurements among the Meitei boys of non-affluent families

Skinfold thickness (mm)		*12 years (N=69)*	*13 years (N=68)*	*14 years (N=66)*	*15 years (N=70)*	*16 years (N=68)*	*17 years (N=70)*	*18 years (N=70)*	*Total (N=481)*
Triceps	$\bar{X}$±SE	6.1±0.14	7.0±0.16	7.5±0.15	7.3±0.18	7.5±0.21	7.7±0.22	7.5±0.18	7.2±0.07
	SD	1.19	1.29	1.22	1.47	1.74	1.88	1.67	1.60
Anterior thigh	$\bar{X}$±SE	7.4±0.13	9.5±0.15	10.1±0.27	10.2±0.24	10.2±0.23	10.3±0.27	10.3±0.25	9.7±0.10
	SD	1.06	1.22	2.18	2.05	1.87	2.29	2.06	2.10
Medial calf	$\bar{X}$±SE	5.3±0.09	6.7±0.17	7.1±0.20	7.1±0.18	7.3±0.21	7.5±0.21	7.6±0.20	6.9±0.08
	SD	0.73	1.37	1.61	1.53	1.71	1.78	1.66	1.68
Subsca-pular	$\bar{X}$±SE	4.3±0.08	5.5±0.12	6.2±0.17	6.6±0.17	6.8±0.17	7.1±0.19	6.9±0.14	6.2±0.07
	SD	0.65	0.97	1.38	1.44	1.38	1.60	1.20	1.57
Suprailiac	$\bar{X}$±SE	4.6±0.09	5.8±0.12	6.8±0.19	6.7±0.18	6.6±0.20	6.9±0.17	6.8±0.20	6.3±0.07
	SD	0.72	0.97	1.52	1.52	1.67	1.41	1.67	1.60
Umbilical	$\bar{X}$±SE	7.5±0.14	9.7±0.11	10.2±0.21	10.3±0.24	10.4±0.22	10.6±0.27	10.8±0.23	9.9±0.09
	SD	1.15	0.89	1.73	2.02	1.78	2.30	1.93	2.02
Sum of six skinfolds	$\bar{X}$±SE	35.3±0.51	44.1±0.65	47.8±1.01	48.0±0.93	48.8±0.92	50.6±1.04	50.9±0.89	46.5±0.40
	SD	4.27	5.33	8.19	7.75	7.56	8.67	7.42	8.78

for the whole age groups. Among the non-affluent boys, mean thickness values range from a minimum of 4.3 mm at 12 years to a maximum of 7.1mm at 17 years. At the age of 18 years the thickness reduces a little, that is 6.9 mm. The average thickness of subscapular skinfold among the boys of non-affluent families considering all the ages together is 6.2mm.

Suprailiac skinfold thickness increases gradually from 12 to 18 years among the affluent boys. The non-affluent boys, however, display a curvilinear trend of gaining thickness in this skinfold. The thinnest mean value of the affluent boys, shown by the 12 years boys is 6.7mm and the thickest value, 9.1mm is found at 17 and 18 years groups. The thinnest value for the non-affluent boys is 4.6 mm, represented by 12 years group, and the thickest value of 6.9 mm is shown by 17 years group. Overall mean thickness of this skinfold among the affluent boys is found to be 8.1mm, whereas that of the non-affluent boys is 6.3 mm.

Umbilical skinfold also shows a gradual increase of mean values from 12 to 18 years in both the affluent and non-affluent boys. The smallest mean value, shown by 12 years old affluent boys is 9.8 mm and that of the non-affluent boys is 7.5 mm. The greatest for the affluent boys is 11.5 mm, and 10.8 mm for the non-affluent boys represented by 18 years group in both. Average thickness of the affluent boys as a whole is 10.7 mm while that of the non-affluent boys is 9.9 mm.

Mean values for sum of six skinfolds increase gradually during the growth phase in both the affluent and non-affluent boys. The rate of increment, however, is not uniform. The average range of summed skinfolds for the affluent boys is 47.4 mm at 12 years to 58.0 mm at 18 years. The overall average thickness among the affluent boys is 53.6 mm and the absolute gain during 12 to 18 years is 10.6 mm. In case of the non-affluent boys, mean value, of 35.5 mm at 12 years increases to 50.9 mm at 18 years yielding an overall average value of 46.5mm. The summed thickness gained during this period is 15.6 mm which is 5.0 mm greater than the total gain among the affluent boys. Of course, the affluent boys possess thicker skinfold, in general, than the non-affluent boys. Peak growth spurt, considering the total value of six skinfolds discussed above, is found during 12 to 13 years in both the affluent and non-affluent groups. A second spurt of comparatively low intensity is again seen after 15 years of age which is continued upto 17 years.

The values of 't' test for age-wise comparison between the affluent and non-affluent Meitei boys in respect of mean values of different skinfold measurements and sum of six skinfolds are shown in table 3. It is observed that the two categories of Meitei boys disagree in all comparisons at the age of 12 years. In the next 13 years group, statistical similarity between the affluent and non-affluent boys is seen only in umbilical skinfold and differences in other

Table 3: The values of 't' test for age-wise comparison in respect of skinfold measurements between the Meitei boys of affluent and non-affluent families

Variable	*12 years (df=135)*	*13 years (df=138)*	*14 years (df=133)*	*15 years (df=137)*	*16 years (df=138)*	*17 years (df=134)*	*18 years (df=140)*	*Total (df=967)*
Triceps skf.	6.84*	4.94*	4.47*	2.33*	2.20*	2.73*	3.43*	9.43*
Anterior thigh skf.	7.82*	2.11*	1.25	1.53	1.85	2.37*	2.95*	6.93*
Medial calf skf.	7.63*	3.04*	1.98*	3.13*	4.12*	5.12*	5.35*	10.55*
Subscapular skf.	9.24*	7.34*	4.34*	4.92*	6.18*	7.04*	9.73*	14.68*
Suprailiac skf.	8.75*	5.99*	4.14*	4.79*	6.27*	8.72*	8.28*	16.26*
Umbilical skf.	7.25*	1.37	1.29	1.40	1.94	2.19*	0.29	6.09*
Sum 6 skf.	9.02*	4.95*	2.61*	3.71*	4.88*	5.28*	5.57*	12.17*

df= degree of freedom
* statistically significant at 0.05 level

separate skinfold thicknesses and sum of skinfolds are statistically significant. The age groups of 14, 15 and 16 years display non-significant difference only in two skinfold measurements, *viz.*, anterior thigh, and umbilical. Seventeen years' group shows statistical difference between the two categories of boys in all the measurements. In the 18 years group, the two categories agree only in umbilical skinfold. Considering mean values of all the ages together for each skinfold and sum of skinfolds, the affluent and non-affluent boys exhibit significant difference in all the skinfold measurements. It can, therefore, be inferred that the difference between the affluent and non-affluent Meitei boys in terms of skinfold thickness are quite distinct.

The present finding on socio-economic differentiation of subcutaneous fat pattering among adolescent boys is in conformity with the findings of Malina et al. (1981) among Mexican children of the state of Oaxaca, Bogin and MacVean (1981), and Bogin and Sullivan (1986) among Guatemalan children. It has been observed in the present study that the affluent Meitei boys have thicker subcutaneous fat layers, presumably due to higher consumption of fat-rich food stuffs among affluent families. Moreover, luxurious lifestyle of the affluent boys with modern amenities including motor vehicles may have restricted body movement and exercise in compare to their coevals from non-affluent families. Lesser body movement may also have contribution to greater accumulation of subcutaneous fat among the boys of affluent families.

KEY WORDS Meitei. Skinfold Thickness. Affluent Families. Non-affluent Families. Manipur.

ABSTRACT Six skinfold measurements such as triceps, anterior thigh, medial calf, subscapular, suprailiac and umbilical were taken from 969 Meitei boys of 12 to 18 years of age. 488 of the boys belong to affluent families and 481 to non-affluent families. The affluent boys possess thicker skinfolds than their non-affluent counterparts in all the measurements and age groups. Peak adolescent growth spurt could not be seen for separate skinfolds in both the boys' categories. But, when sum of six skinfolds was considered, peak growth spurt could be noted during 12 to 13 years.

REFERENCES

Albrink, M.J. and Meigs, J.W.: Serum lipids, skinfold thickness, body bulk and body weight of native Cape Verdeans, New England Cape Verdeans, and United States factory workers. *Am. J. Clin. Nutr.*, **24**: 344-352 (1971).

Amusa, L.O., Agbonjinmi, A.P. and Osafehinti, B.A.: Relationship between skinfold measures, percent body fat and total plasma cholesterol in University athletes. *J. Nigerian Association of Sports Sci. and Med.*, **3**: 103-114 (1989).

Amusa, L.O., Agbonjinmi, A.P. and Osafahinti, B.A.: Weight -height indices, measures of body fat and blood cholesterol in soccer players. *J. Phy. Edn. & Sports Sciences*, **2**: 23-30 (1990).

Bailey, S.M.: Human physique and susceptibility to non-Infectious disease. *Yearbk. Phys. Anthrop.*, **28**: 149-173 (1985).

Balgir, R.S.: Skinfold measurements of the high and low altitude Gujjar populations of north -western India. *J. Hum. Ecol.*, **7**: 191-194 (1996).

Berry, J.N.: Use of skinfold thickness for the estimation of body fat. *Ind. J. Med. Res.*, **62**: 233-239 (1974).

Bhasin, M.K. and Singh L.P.: Study of physical growth and respiratory functions in two high altitude populatitons Bodhs and Baltis of Ladakh, Jammu and Kashmir, India, *J. Hum. Ecol.*, **3**: 27-34 (1992).

Bogin, B. and MacVean, R.B.: Body composition and nutritional status of urban Guatemalan children of high and low socio-economic class. *Am. J. Phys. Anthrop.*, **55**: 543-551 (1981).

Bogin, B. and Sullivan, T.: Socio-economic status, sex, age and ethnicity as determinants of body fat distribution for Guatemalan children. *Am. J. Phys. Anthrop.*, **69**: 527-535 (1986).

Bouchard, C., Savard, R. and Despres, J.P.: Body composition in adopted and biological siblings. *Hum, Biol.*, **57**: 61-75 (1985)

Carter, J.E.L.: *Physical Structure of Olympic Athletes Part I. The Montreal Olympic Games Anthropological Project. Medicine and Sport Vol. 16* Karger, Basel (1982).

Carter, J.E.L, and Yuhasz, M.S.: Skinfolds and body composition of Olympic athletes. In: *Physical Structure of Olympic Athletes Part II Kinanthropometry of Olympic Athletes. Medicine and Sport Science Vol. 18.* J.E.L. Carter (Ed.). Karger, Basel (1984).

DeGaray, A.L., Levine, L. and Carter, J.E.L.: *Genetic and Anthropological Studies of Olympic Athletes.* Academic Press, New York (1974).

Dharma Rao, B., Rao, V.L.N. and Busi, B.R.: A study of growth in physical and physiological variables among Koya Dora tribal boys of Andhra Pradesh. *J. Hum. Ecol.*, **8**: 95-100 (1997).

Durnin, J.V.G.A. and Rahaman, M.M.: Percentage of fat corresponding to the total value of skinfolds. *Brit. J. Nutr.*, **21**: 681 (1967).

Durnin, J.V.G.A. and Womerslay, J.: Body fat assessed from total body density and its estimation from skinfold thickness: Measurement on 481 men and women aged from 16-72 years. *Brit. J. Nutr.*, **32**: 77-97 (1974).

Garn, S.M.: Fat patterning and fat intercorrelations in the adult man. *Hum. Biol.*, **26**: 56-59 (1954).

Garn, S.M.: Relative fat patternings: An individual characteristic *Hum. Biol.*, **27**: 75-89 (1955).

Greaves, K.A., Puhl, J., Baranowski, T., Gruben, D, and Scale, D.: Ethnic differences in anthropometric characteristics of young children and their parents. *Hum. Biol.*, **61**: 459-477 (1989).

Lohman, T.G.: Skinfolds and body density and their relation to body fatness: a review. *Hum. Biol.*, **53**: 181-225 (1981).

Mass, G.D.: *The Physique of Athletes,* Leiden University Press, Leiden (1974).

Malina, R.M., Himes, J.H., Stepick, C.D., Lopez, F.G. and Buscheng, P.H.: Growth of rural and urban children in the valley of Oaxaca, Mexico. *Am.J. Phys. Anthrop.*, **55**: 269-280 (1981).

McGarvey, S.T.: Subcutaneous fat distribution and blood pressure of Samoans. *Am. J. Phys. Anthrop.*, **63**: 192 (abstract) (1984).

Mokha, R. and Sidhu, L.S.: Fat and fat patterning of Indian female athletes at different levels of competition. In: *Kinaanthropometry III.* T. Reilly, J. Watkins and J. Borms (Eds.). E. & F.N. Spon Ltd., London (1986).

Paul, O., Lepper, M.H., Plelan, W.H., Dupertius, G.W., MacMillan, A., Mokean, H. and Park, H.: Logitudinal study of coronary heart disease. *Circulation* **28**: 20-31 (1963).

Piscopo, J.: Skinfold and other anthropometric measurements of pre-adolescent boys from three ethnic groups. *Res. Quarterly.*, **33**: 255-264 (1962).

Selby, J.V., Newman , B., Quesenberry, C.P. Jr., Fabsitz, R.R., King, M.C. and Meaney, F.J.: Evidence of genetic influence on central body fat in middle-aged twins. *Hum. Biol.*, **61**: 179-193 (1989).

Sodhi, H..S.: Skinfold patterns of top Indian athletes and sportsman. In: *Modern perspectives in Physical Education & Sport Sciences.* L.S. Sidhu (Ed.) Harnam Publications, New Delhi (1986).

Stallones, L., Mueller, W.H. and Christensen, B.L.: Blood pressure, fatness and fat patterning among USA adolescents from two ethnic groups. *Hypertension,* **4**: 483-486 (1982).

Tanner, J.M., Whitehouse, R.H. and Takaishi, M.: Standards from birth to maturity for height, weight, height velocity and weight velocity, British children 1965. *Arch. Dis. Child.*, **41**: 454-471 (1966).

Weinsier, R.L., Fuchs, R.J., Kay, T.D., Triebwasser, J.H. and Lancaster, M.C.: Body fat: Its relationship to coronary heart disease,. blood pressure, lipids and other risk factors measured in a large male population. *Am. J. Med.* **61**: 815-824 (1976).

Authors' Address: **L. Dibamani Singh**, Department of Sports, Assam University, Dargakona, Silchar 788 011, Assam, India

T. Shyamacharan Singh, Department of Anthropology, Manipur University, Cachipur 795 003, Manipur, India

L. Rajendra Singh, Department of Anthropology, D.M. College of Science, Imphal 795 001, Manipur, India