MATERIALS AND METHODS
Material for the present study consisted of 1464 subjects belonging to Chandigarh zone (Punjab, Haryana, Himachal Pradesh and Union Territory of Chandigarh), which were selected at random on the basis of their age (12 to 49 years), sex and socioeconomic status as given below.

<table>
<thead>
<tr>
<th>Age-groups</th>
<th>Males No.</th>
<th>Females No.</th>
<th>Males No.</th>
<th>Females No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-17 Adolescents</td>
<td>214</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>18-29</td>
<td>70</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>30-39 Adults</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>40-49</td>
<td>50</td>
<td>50</td>
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<td>50</td>
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</tbody>
</table>

Upper and lower socioeconomic groups were identified on the basis given below.

**Upper socioeconomic group** - had the following criteria:

1. Income Rs. 3000/- p.m. or more,
2. Family size up to 5 members, and
3. Education of adults being graduation, and in adolescents above 6th standard according to age.
Lower socioeconomic group - The criteria were:

1. Income below Rs. 600/- p.m. (basic),
2. Family size above 5 members.

An income of Rs. 100/- p.m. per member was added to the total basic income of the family, which have members above 5, to make the case fall in this group.

3. Education below primary including illiterate person. Those subjects were not included in the study in which parents spent substantial amount of money in self indulgence and other vices or were sending money outside the family to support other dependents. As the criteria for socioeconomic status published by the ICMR (1956-65, published in 1984) did not fit in 1987, the author had to modify the same. As regards income, it was primarily based on ICMR criterion of 1956-65 as applicable in 1988-89.

Girls belonging to high socioeconomic group* between the ages of 12 and 17 years were taken from Carmel Convent School, Sector 9 and St. Stephensen School, Sector 8, Chandigarh and girls between the ages

*In Chandigarh, there is a considerable class distinction regarding selection of school for educating a child, whereas the children of well-to-do families get their education in schools which charge very heavy tuition fees, the unprivileged parents send their children to the schools run by the state which charge a nominal tuition fee.
of 16 and 22 years were taken from Government College for Girls, Sector 11, Chandigarh, which caters for the education of girls belonging to well-to-do families. Adult females of well-to-do families between the ages of 23 and 49 years were from posh localities of Chandigarh and its suburbs (Panchkula and Parwanoo). They were wives of managers, industrialists, doctors, engineers, chartered accountants, high military officials and well placed government servants etc.

Similarly boys belonging to high socioeconomic status between the ages of 12 and 17 years were taken from DAV Higher Secondary School, Sector 8, Chandigarh. About half of the two hundred subjects in the above mentioned group were school students, who had been staying in hostels for 1 to 4 years. Male subjects of high socioeconomic status in the different age-groups (18-29, 30-39 and 40-49 years) were taken from Chandigarh and its suburbs (Panchkula and Parwanoo). Subjects of the above mentioned group were managers, industrialists, doctors, engineers, chartered accountants, high military officials and well placed government servants etc.

Boys and girls of low socioeconomic status between the ages of 12 and 17 years were from the
Government Higher Secondary School, Dadoo Majra (near Sector 40) and Government High School, Sector 11, Chandigarh. Subjects of two schools were children of the peons, semi- and unskilled workers, hawkers, rickshaw pullers, safaiwalas (cleaners), chowkidars (watchmen) etc.

Adult males and females of low socioeconomic status in different age-groups (18-29, 30-39 and 40-49 years) were taken from the Labour Colony (Rajiv Colony) near Sector 17, Panchkula, Haryana. Most of the residents were illiterates and a few of them had studied up to 4-5 standard.

**Methods**

The following measurements were taken:

1. **Height and weight**

   1. **Body height** - Anthropometer was used to measure the standing body height of the subjects. The technique for taking body height described by Tanner, Hiernaux and Jarman (1969) was followed. The subject was made to stand on a smooth floor (without any slop) with heels together. Frankfort plane (between the lower border of the orbit and upper margin of external auditory meatus)
FIG. 2 TRANSVERSE SECTION OF THE MIDDLE OF LEFT THIGH SHOWING DOUBLE LAYER OF SUBCUTANEOUS FAT AND SKIN AS MEASURED BY A LANGE CALIPER

FIG. 1 SHOWS THE TECHNIQUE OF MEASURING HEIGHT BY AN ANTHROPOMETER. THE SUBJECT WAS MADE TO STRETCH UPWARDS TO THE FULLEST EXTENT AND WAS AIDED WITH GENTLE TRACTION BY THE WORKER ON THE MASTOID PROCESSES.
was marked on the subject with the help of a demographic pencil. The subject was made to stretched upwards to the fullest extent and was aided with gentle traction by the worker on the mastoid processes. The back of the subject was kept as straight as possible, which could be achieved by relaxing the shoulders and manipulating the posture. While one person held the anthropometer in vertical position, its horizontal arm was brought down in contact with the head of the subject. Precaution was taken that the heels remained in touch with the floor and were not raised (Fig. 1).

2. **Body weight** - Female children and males were weighed while wearing underwears (provided by the investigator), the weight of which was later subtracted from the total weight. The female subjects were made to wear standard Punjabi dress, pyjama (salwar), shirt (kameez) and brassier, provided by the worker, the weight of these garments was subtracted from the total weight of the subject. The weight of the subject was measured with the help of standard portable weighing machine.
II. Skinfold thicknesses

At the specific points skin of the subject was pinched with a firm grip holding between the thumb and forefinger of the left hand placed about 2 cm apart. Plain threshold was not reached. The muscle underneath was not lifted at all. This could be achieved with a little practice. The caliper was applied with right hand at the base of the pinch trying to keep the two sides of the pinch as much parallel as possible (Fig. 2). No specific distance from the crest of the pinch to the point of applying the caliper could be prescribed as it varied from one place to another. Attempt was made to achieve the definition as given by Brozek (1960) which runs as follow "Distance from the crest is minimal distance which a true fold with surfaces approximately parallel to each other and to the contact surfaces of the caliper, is obtained upon the application of the caliper to the skin". All the skinfold measurements, mentioned below, were taken with Lange skinfold caliper manufactured by Cambridge Scientific Industries, Cambridge, Maryland, U.S.A.
1. **Triceps skinfold** - It was taken midway between the lower edge of lateral border of acromion and the tip of the olecranon process. The fold was raised vertically (Fig. 3).

2. **Subscapular skinfold** - It was raised vertically just below the inferior angle of left scapula and measured (Fig. 4).

3. **Abdominal skinfold** - It was picked up horizontally 5 cm to the left of the umbilicus (Fig. 5).

4. **Iliac-crest skinfold** - It was pinched horizontally just above the point where iliac-crest meets the mid-axillary line (Fig. 6).

5. **Thigh skinfold** - It was raised vertically on the anterior aspect of thigh midway between the mid-inguinal point (midway between pubis symphysis and lower border of the anterior superior iliac spine) and the uppermost point of the patella, when the subject was sitting (Fig. 7).

6. **Medial calf skinfold** - It was raised vertically at the level of the maximum circumference of the leg (calf) at a point midway between the mid-popliteal line and posterior border of the medial surface of the tibia in a sitting subject (Fig. 8).
FIG. 3 MEASURING THE TRICEPS SKINFOLD THICKNESS

FIG. 4 MEASURING THE SUBSCAPULAR SKINFOLD THICKNESS
FIG. 5 MEASURING THE ABDOMINAL SKINFOLD THICKNESS AT A POINT 5 cm. LEFT OF UMBILICUS

FIG. 6 MEASURING THE ILIAC-CREST SKINFOLD THICKNESS AT A POINT ABOVE THE ILIAC-CREST
FIG. 7 MEASURING THE THIGH SKINFOLD THICKNESS AT THE SITE MIDWAY BETWEEN MID-INGUINAL POINT AND PATELLA

FIG. 8 MEASURING THE MEDIAL CALF SKINFOLD THICKNESS AT MAXIMUM CIRCUMFERENCE OF CALF MIDWAY BETWEEN MID-POPLITEAL LINE AND POSTERIOR BORDER OF MEDIAL SURFACE OF TIBIA
III. **Circumferences**

All the circumferences, described below, were measured in a horizontal plane with a standard steel tape.

1. **Upper arm circumference** - It was measured midway between the lower edge of lateral border of acromian and the tip of the olecranon process. This corresponds to the point where the triceps skinfold was measured (Fig. 9).

2. **Chest circumference** - It was taken at the level of nipples at right angle to the axis of body, at the end of a normal expiration. In case of adult females, it was taken just above the breasts (Fig. 10).

3. **Waist circumference** - It was measured midway between the anterior superior iliac spine and the costal margin above it (Fig. 11).

4. **Hip circumference** - It was taken at the level of two greater trochanters where the value was the greatest (Fig. 12).

5. **Thigh circumference** - It was measured midway between lower border of greater trochanter and lateral epicondyle of femur in a standing subject (position of
FIG. 9 MEASURING THE UPPER ARM CIRCUMFERENCE MIDWAY BETWEEN LATERAL BORDER OF ACROMION AND OLECRANON

FIG. 10 MEASURING THE CHEST CIRCUMFERENCE AT LEVEL OF NIPPLES IN MALES
FIG. 11 MEASURING THE WAIST CIRCUMFERENCE MIDWAY BETWEEN ANTERIOR SUPERIOR ILIAC SPINE AND COSTAL MARGIN

FIG. 12 MEASURING HIP CIRCUMFERENCE AT LEVEL OF GREATER TROCHANTERS OF FEMUR
FIG. 13 MEASURING THE THIGH CIRCUMFERENCE MIDWAY BETWEEN GREATER TROCHANTER AND LATERAL FEMORAL EPICONDYLE

FIG. 14 MAXIMUM CALF CIRCUMFERENCE
gluteal fold varied on account of development of gluteal muscles) Fig. 13.

6. **Calf circumference** - It was taken at the level of greatest circumference of the calf in a standing subject (Fig. 14).

A proforma (enclosed inside) was prepared to note the personnel data as well as measurements. A rapport was made with each subject so that maximum information regarding age, family size, educational background, income, occupation, caste, religion and region etc. could be noted with accuracy. Above mentioned information was utilized in deciding the socioeconomic status of the subject. Age of a subject was converted into decimal age (Tanner and Whitehouse, 1966) and computed in complete whole year. If the fraction was less than 0.5, it was ignored, but if 0.5 or more, it was taken as one whole year. In case of school children the age was noted from the admission registers and later verified from the parents. The age of the adults was noted from their school and service
records and sometimes from horoscopes. Some subjects could give their dates of births according to Indian Calendar which were converted into Christian Calendar by calculations. Sometimes family history was also helpful. In case of doubt, the subjects were excluded from the study.

All skinfold measurements were transformed into log (conversion table given by Edwards, Hammond and Healy, 1955) to give a normal (Gaussian) distribution. The 't' test was applied to study the difference between two comparable groups of log converted values in skinfold thicknesses and absolute values in height, weight and circumferences. Coefficient of correlation 'r' was calculated between height, weight, absolute values of skinfold thicknesses and circumferences. In addition to mean, the percentiles were also calculated for skinfold thicknesses.