CHAPTER : FOUR
ANALYSIS AND RESULTS

A total of 9,708 subjects of either sex (Males: 4,952, 51% and Females 4,756, 49%) in nearly equal proportions in the age range of newborn to 21 years and above who constitute the study sample represent the three geographical zones (Table 3). The main tribes covered are Bhils from Jhabua and Gonds from Bastar and Sarguja. The larger bulk of the sample consists of Gonds of Bastar (59%) and Sarguja (22%), the rest being the Bhils of Jhabua. Majority of them are adults aged 20 years and above (4,643 subjects, 47.8%), those in the adolescent (12-20 year age 18.3%) and school age (5-11 year age, 18.7%) groups are represented in equal proportions and the rest are children below 5 years age (15.3%).

The above samples have been subjected to different anthropometric measurements, which have been analysed and the results are represented as follows in order of preschool children, school age children, adolescents and adults under the categories of means followed by analysis of variance, nutritional status and results of discriminant analysis.

Preschool Children

The mean heights of Sarguja preschoolers (Table 4) ranging from 72 cms. in one year age group to 89 cms. in 3 year age group are higher than the means of their counterparts in Jhabua (69 cm to 83 cm) and Bastar (71 cm to 87 cm) respectively. Similar trends are observed in mean weights too.
<table>
<thead>
<tr>
<th>Age Group (Years)</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>0 - 4</td>
<td>762</td>
<td>719</td>
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<tr>
<td>5 - 11</td>
<td>927</td>
<td>884</td>
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<td>12 - 20</td>
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<td>882</td>
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<td>21 +</td>
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<td>2,271</td>
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### TABLE 4: MEAN ANTHROPOMETRIC MEASUREMENTS OF PRESCHOOL CHILDREN BY AGE AND TRIBE - MALES

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<tr>
<th>Age Yrs.</th>
<th>Tribe</th>
<th>No.</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Arm circumference (cm)</th>
<th>Fat fold at triceps (mm)</th>
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**MEAN + S.D.**
### Table 5: Mean Anthropometric Measurements of Preschool Children by Age and Tribe - Females

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<th>No.</th>
<th>Height cm</th>
<th>Weight kg</th>
<th>Arm circumference cm</th>
<th>Fat fold at triceps mm</th>
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<td>5.34</td>
<td>1.61</td>
<td>0.86</td>
<td>2.04</td>
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</tbody>
</table>

Mean + S.D.
The preschool Gonds of Sarguja are taller and slightly heavier than the tribal preschoolers (1-3 years) studied by Gopal Das (1975). However, the Gonds of Bastar and the Bhils of Jhabua are similar in both height and weight (Tables 4 and 5). Thus the preschoolers of Sarguja are taller and heavier while those from Bastar and Jhabua are either similar or shorter and lighter compared to those of Udaipur studied by Gupta and Bhandari (1972), who concluded that tribal children are relatively more malnourished than the non-tribal children.

The preschool Gond boys and girls from Sarguja and Bhils of Jhabua are taller and heavier, while their counterparts from Bastar are shorter and lighter (Fig. 2-5) than the rural children of Madhya Pradesh (NNMB, 1979). Further, the mid-upper arm circumference values are lower while those of fat fold at triceps (FFT) are higher in both sexes and in all the three zones compared to the rural children of Madhya Pradesh (Tables 4 and 5; Fig. 6-9).

On the whole, the tribal preschool children of either sex present better nutritional status than their rural counterparts of the study region in the state as shown by the above analysis of anthropometric measurements, of course, with the exception of Gonds of Bastar who were found to be shorter and lighter.

School age children (5-11 years)

The mean heights of Sarguja school age boys range from 101.2 cm at 5 years to 135.9 cms at 11 years which are closely comparable with those of Jhabua children (101.1 cm to 135.9 cm); these are however, slightly higher than those of Bastar (98.5 cm to 132.4 cm). The mean weights of these boys
FIG. 2: DISTANCE CHART OF HEIGHT—PRE-SCHOOL BOYS
COMPARISON BETWEEN TRIBAL, RURAL (M.P) & HYD WELL-TO-DO

HEIGHT IN CENTIMETERS

1-2  2-3  3-4  4-5
AGE IN YEARS

C.B.  G.S.  RURAL(WP)  HYD WELL-TO-DO
FIG. 3: DISTANCE CHART OF HEIGHT—PRE-SCHOOL GIRLS
COMPARISON BETWEEN TRIBAL, RURAL (M.P.) & HYD WELL-TO-DO

HEIGHT IN CENTIMETERS

70  75  80  85  90  95  100  105

1-2  3-4  4-5

△ G.B  ◯ G.S  △ RURAL (M.P)  ◯ HYD.WH
FIG. 4: DISTANCE CHART OF WEIGHT—PRE-SCHOOL BOYS
COMPARISON BETWEEN TRIBAL, RURAL (M.P) & HYD WELL-TO-DO
FIG. 5: DISTANCE CHART OF WEIGHT PRE-SCHOOL GIRLS
COMPARISON BETWEEN TRIBAL, RURAL(M.P.) & HYD WELL-TO-DO

WEIGHT IN KILOGRAMS

AGE IN YEARS

D B + G.S. C G.S. A RURAL(M.F.)
FIG. 6: DISTANCE CHART OF ARM CIRCUMFERENCE---PRE-SCHOOL BOYS
COMPARISON BETWEEN TRIBAL, RURAL(M.P.) & HYD WELL-TO-DO
FIG. 7: DISTANCE CHART OF ARM CIRCUMFERENCE—PRE-SCHOOL GIRLS COMPARISON BETWEEN TRIBAL, RURAL(M.P) & HYD WELL-TO-DO
FIG. 8: DISTANCE CHART OF FAT FOLD AT TRICEPS---PRE-SCHOOL BOYS COMPARISON BETWEEN TRIBAL, RURAL(M.P) & HYD WELL-TO-DO
FIG. 9: DISTANCE CHART OF FAT FOLD AT TRICEPS—PRE-SCHOOL GIRLS COMPARISON BETWEEN TRIBAL, RURAL (M.P) & HYD WELL-TO-DO
range from 14.6 kg at 5 years to 27.3 kg at 11 years which are slightly higher than those of Jhabua (15.0 to 25.5 kg) and Bastar (13.7 to 24.7 kg) children (Table 6). Similar is the case with girls (Table 7).

Compared with Madhya Pradesh rural children the school age boys and girls of the Gonds of Sarguja, Batar and Bhils of Jhabua are taller and heavier than their age and sex counterparts (Fig. 10-13). However, Bastar Gonds are similar to the rural Madhya Pradesh counterparts. The mid-upper arm circumference values are low in all zones except in Gonds girls in certain ages from Sarguja (Fig. 14, 15). However, the FFT of both sexes of Sarguja Gonds and Jhabua Bhils are higher, while those of Bastar Gonds are lower than in their rural counterparts (Fig. 16, 17) (NNMB, 1979), while in heights and weights, the school age Gonds of Sarguja and Bastar and Bhils of Jhabua seem to exceed their rural counterparts. In FFT, the Gonds of Bastar alone present lesser muscle mass than the latter. The overall trend is similar to the one noticed in the preschool children.

Adolescent (12-20 years) Age

The mean heights of adolescent boys of Sarguja range from 139.6 cms at 12 years to 163.7 cms at 20 years, which are slightly higher in certain age groups than those of Jhabua (139.0 cms. to 161.6 cms.) and Bastar (135.9 cms. to 159.9 cms.). The corresponding mean figures for weights are 29.7 kg. to 46.6 kg., which are higher than those of Jhabua and Bastar adolescent boys in certain age groups only. Similar observations are noticed in the case of adolescent girls too (Tables 8 and 9). The mean heights of boys and girls
TABLE 6: MEAN ANTHROPOMETRIC MEASUREMENTS OF SCHOOL AGE CHILDREN BY AGE AND TRIBE - MALES

<table>
<thead>
<tr>
<th>Age Yrs.</th>
<th>Tribe</th>
<th>No.</th>
<th>Height cm.</th>
<th>Weight kg.</th>
<th>Arm circumference cm.</th>
<th>Fat fold at triceps mm.</th>
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**MEAN + S.D.**
## TABLE 7: MEAN ANTHROPOMETRIC MEASUREMENTS OF SCHOOL AGE CHILDREN BY AGE AND TRIBE - FEMALES

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**MEAN ± S.D.**

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MEAN ± S.D.
FIG. 10: DISTANCE CHART OF HEIGHT---SCHOOL AGE BOYS
COMPARISON BETWEEN TRIBAL, TURAI (M.P) & WELL-TO-DO INDIANS
FIG. 11: DISTANCE CHART OF HEIGHT—SCHOOL AGE GIRLS
COMPARISON BETWEEN TRIBAL, RURAL (M.P.) & WELL-TO-DO INDIANS
FIG. 12: DISTANCE CHART OF WEIGHT---SCHOOL AGE BOYS
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 13: DISTANCE CHART OF WEIGHT----SCHOOL AGE GIRLS
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 14: DISTANCE CHART OF ARM CIRCUMFERENCE—SCHOOL AGE BOYS COMPARISON BETWEEN TRIBAL, RURAL (M.P.) & WELL-TO-DO INDIANS
FIG. 15: DISTANCE CHART OF ARM CIRCUMFERENCE----SCHOOL AGE GIRLS COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 18: DISTANCE CHART OF FAT FOLD AT TRICEPS——SCHOOL AGE BOYS
COMPARISON BETWEEN TRIBAL, RURAL (M.P) & WELL-TO-DO INDIANS
FIG. 17: DISTANCE CHART OF FAT FOLD AT TRICEPS----SCHOOL AGE GIRLS COMPARISON BETWEEN TRIBAL, RURAL (M.P) & WELL-TO-DO INDIANS
### TABLE 8: MEAN ANTHROPOMETRIC MEASUREMENTS OF ADOLESCENTS BY AGE AND TRIBE - MALES

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**MEAN ± S.D.**
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<th>Arm circumference cm.</th>
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**Table 9: Mean Anthropometric Measurements of Adolescents by Age and Tribe - Females**

**Mean ± S.D.**

contd.
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<th>Age Yrs.</th>
<th>Tribe</th>
<th>No.</th>
<th>Height cm.</th>
<th>Weight kg.</th>
<th>Arm circumference cm.</th>
<th>Fat fold at triceps mm.</th>
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of Sarguja Gonds and Jhabua Bhils are higher than in the rural areas of Madhya Pradesh up to 14-16 years and then became more or less similar (Fig. 18, 19). The mean body weight values are slightly more, though at some ages in some of the groups, the values are lower (Fig. 20, 21). The mid-upper arm circumference values are higher in both sexes of Sarguja Gonds while in the Bastar Gonds and Jhabua Bhils, these values are more or less similar compared to the adolescents of rural Madhya Pradesh (Fig. 22, 23) (NNMB, 1979). The mean FFT values in all the three groups, irrespective of age and sex are similar (Fig. 24, 25). The mean heights and weights of adolescents of the present study are lesser compared to their counterpart Bhils of Udaipur, Rajasthan (Nirmalananda Reddy, 1980).

Adults

On an average, the heights of adult men of Jhabua (160.6 cms) and Sarguja (160.8 cms) are comparable (Table 10) but slightly higher than that found in men of Bastar (159.6 cms). In the case of weight, Sarguja men (48.4 kg) are heavier than those of Jhabua (45.2 kg) and Bastar (46.0 kg) (Table 10). The adult women of Sarguja (149.1 cms) are taller than those of Jhabua (149.1 cms) and Bastar (148.3 cms). The adult women of Bastar weigh (39.5 kg) less than the Jhabua women (Table 11). The height of adults of the study continues to present the same trend as that of adolescents. But the weight which is very sensitive to and a direct reflection of health and environment varies between the tribal groups. The adults of either sex from all the zones are shorter, lighter (Fig. 26, 27) with lower arm circumferences (Fig. 30, 31) and similar FFT (Fig. 32, 33) compared to the adults of rural Madhya Pradesh (NNMB, 1979).
FIG. 18: DISTANCE CHART OF HEIGHT—ADOLESCENT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 19: DISTANCE CHART OF HEIGHT—ADOLESCENT FEMALES
COMPARISON BETWEEN TRIBAL, RURAL (M.P) & WELL-TO-DO INDIANS
FIG. 20: DISTANCE CHART OF WEIGHT---ADOLESCENT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P)& WELL-TO-DO INDIANS
FIG. 21: DISTANCE CHART OF WEIGHT---ADOLESCENT FEMALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 22: DISTANCE CHART OF ARM CIRCUMFERENCE—ADOLESCENT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P.) & WELL-TO-DO INDIANS
FIG. 23: DISTANCE CHART OF ARM CIRCUMFERENCE—ADOLESCENT FEMALES COMPARISON BETWEEN TRIBAL, RURAL (M.P.) & WELL-TO-DO INDIANS
FIG. 24: DISTANCE CHART OF FAT FOLD AT TRICEPS---ADOLESCENT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & WELL-TO-DO INDIANS
FIG. 25: DISTANCE CHART OF FAT FOLD AT TRICEPS—ADOLESCENT FEMALES COMPARISON BETWEEN TRIBAL, RURAL(M.P.) & WELL-TO-DO INDIANS
### TABLE 10: MEAN ANTHROPOMETRIC MEASUREMENTS OF ADULTS

**BY AGE AND TRIBE - MALES**

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<thead>
<tr>
<th>Age Yrs.</th>
<th>Tribe</th>
<th>No.</th>
<th>Height cm.</th>
<th>Weight kg.</th>
<th>Arm circumference cm.</th>
<th>Fat fold at triceps mm.</th>
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**Mean + S.D.**
### TABLE 11: MEAN ANTHROPOMETRIC MEASUREMENTS OF ADULTS BY AGE AND TRIBE - FEMALES

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<th>Age Yrs.</th>
<th>Tribe</th>
<th>No.</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Arm circumference (cm)</th>
<th>Fat fold at triceps (mm)</th>
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Mean ± S.D.
FIG. 28: DISTANCE CHART OF HEIGHT---ADULT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P.) & TSNS
FIG. 27: DISTANCE CHART OF HEIGHT----ADULT FEMALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P)&TSNS

[Graph showing height in centimeters against age in years for different groups.]

LEGEND
- G.B.
- G.B.
- PUR-L(MP)
- TSN

[Graph data points and line symbols indicating different groups and age groups.]
FIG. 28: DISTANCE CHART OF WEIGHT----ADULT MALES
COMPARISON BETWEEN TRIBAL, RURAL(M.E) & TSNSS
FIG. 29: DISTANCE CHART OF WEIGHT——ADULT FEMALES
COMPARISON BETWEEN TRIBAL, RURAL(M.P) & TSNS
FIG. 30: DISTANCE CHART OF ARM CIRCUMFERENCE——ADULT MALES
COMPARISON BETWEEN TRIBAL & RURAL (M.P)
FIG. 31: DISTANCE CHART OF ARM CIRCUMFERENCE—ADULT FEMALES COMPARISON BETWEEN TRIBAL & RURAL (H.P.)

- Arm Circumference in Centimeters
- Age in Years:
  - 21-39
  - 30-39
  - 40-49
  - 50-59
  - 60+

- Symbols:
  - □ E.H.L.
  - + GB
  - ◊ 33
  - △ UP (RURAL)
FIG. 32: DISTANCE CHART OF FAT FOLD AT TRICEPS—ADULT MALES
COMPARISON BETWEEN TRIBAL & RURAL (M.P.)

FATFOLDS AT TRICEPS IN mm

AGE IN YEARS

diamond = BHILS  + GS  ○ GS  △ MP (RURAL)
FIG. 33: DISTANCE CHART OF FAT FOLD AT TRICEPS—ADULT FEMALES
COMPARISON BETWEEN TRIBAL & RURAL (M.F.)
The mean height values reported by different workers for Bhils of Rajasthan Rajputana and Panch Mahal District of Gujarat (Biswas and Bhattacharya, 1961: Males 161.63 cms.; Risley, 1915; 162.9 cms.; Majumdar, 1941: 157.8 cms.; Rakshit, 1963: 161.8 cms.) and for Hill Marias (Roy, 1938; Rakshit, 1960: 162.7 cms.) present slight variations from one another. The present study groups from Madhya Pradesh too more or less agree with these populations in their mean heights.

Analysis of Variance

The analysis of variance has been applied to test the statistical significance of variation in the anthropometric measurements of the tribes from the three zones. Eight of the 26 age groups present statistically significant values for height, 16 age group for weight, 18 age groups for mid-upper arm circumference and all ages except the males aged 50-60 years for FFB. In the mean height, weight and the arm circumference the tribal groups of the three zones do not differ from each other in their adolescent period (Tables 18, 19) whereas the preschoolers (Tables 12, 13) and school age children (Tables 16, 17) in certain ages and adults (Tables 20-21) in all ages show statistically significant differences. The between group differences are significant for all the measurements in the 21-30 year group (Tables 22-24) with the exception of sub-scapular skin fold in the 40-50 year group, calf circumference and sub-scapular fat fold in the 50-60 year group and head and chest circumferences bi-acromial diameter and fat fold at sub-scapular region in the age group of 60+.

Measurement Differences

The Gond boys of Bastar and Sarguja are taller than the Bhils only in the above 3 year group while the Gonds of Sarguja are heavier than the
### TABLE 12: RESULTS OF TESTS OF SIGNIFICANCE* BETWEEN GROUP MEANS OF PRESCHOOL CHILDREN BY ANTHROPOMETRIC MEASUREMENTS AND AGE - MALES

<table>
<thead>
<tr>
<th>Age (Yrs.)</th>
<th>Height</th>
<th>Weight</th>
<th>Arm Circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 +</td>
<td>N.S.</td>
<td>N.S.</td>
<td>P / 0.05 GS: GB</td>
<td>P / 0.001 GB: B</td>
</tr>
<tr>
<td>2 +</td>
<td>P / 0.05 GS: GB</td>
<td>P / 0.01 GB: B</td>
<td>P / 0.01 GS: GB</td>
<td>P / 0.001 GB: B</td>
</tr>
<tr>
<td>3 +</td>
<td>P / 0.01 GS: GB</td>
<td>N.S.</td>
<td>N.S.</td>
<td>P / 0.001 GS: GB</td>
</tr>
<tr>
<td>4 +</td>
<td>N.S.</td>
<td>P / 0.05 GS: GB</td>
<td>P / 0.001 GS: GB</td>
<td>P / 0.001 GS: GB</td>
</tr>
</tbody>
</table>

Notes: *Tests of significance were carried out by analysis of variance coupled with studentized range test.

GS: Sarguja Gonds  GB: Bastar Gonds  B: Bhils

Continuous line indicates the similarity between the groups.
### TABLE 13: RESULTS OF TESTS OF SIGNIFICANCE* BETWEEN GROUP MEANS OF PRESCHOOL CHILDREN BY ANTHROPOMETRIC MEASUREMENTS AND AGE - FEMALES

<table>
<thead>
<tr>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 +</td>
<td>N.S.</td>
<td>P/ 0.05</td>
<td>B GS GB</td>
<td>P / 0.001</td>
</tr>
<tr>
<td>2 +</td>
<td>P/ 0.05</td>
<td>N.S.</td>
<td>B GS GB</td>
<td>P / 0.01</td>
</tr>
<tr>
<td>3 +</td>
<td>P / 0.01</td>
<td>P / 0.001</td>
<td>B GS GB</td>
<td>P / 0.001</td>
</tr>
<tr>
<td>4 +</td>
<td>N.S.</td>
<td>P / 0.05</td>
<td>B GS GB</td>
<td>P / 0.001</td>
</tr>
</tbody>
</table>

Notes: *Tests of significance were carried out by analysis of variance coupled with studentized range test.

GS : Sarguja Gonds  GB : Baster Gonds  B : Bhils

Continuous line indicates the similarity between the groups.
### TABLE 14: PERCENTAGE DISTRIBUTION OF PRESCHOOL CHILDREN ACCORDING TO GOMEZ CLASSIFICATION - DISTRICTS

<table>
<thead>
<tr>
<th>District</th>
<th>No.</th>
<th>Gomez Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt; 40</td>
</tr>
<tr>
<td>Jhabua&lt;sup&gt;a&lt;/sup&gt;</td>
<td>363</td>
<td>16.2</td>
</tr>
<tr>
<td>Bastar&lt;sup&gt;b&lt;/sup&gt;</td>
<td>725</td>
<td>9.3</td>
</tr>
<tr>
<td>Sarguja&lt;sup&gt;c&lt;/sup&gt;</td>
<td>339</td>
<td>24.5</td>
</tr>
<tr>
<td>Rural Madhya Pradesh&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>970</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Note: Independence of distributions were tested by $x^2$-test. The Gomez distribution of Jhabua and Bastar are significantly different from each other. This is denoted by different superscripts.
<table>
<thead>
<tr>
<th>District</th>
<th>No.</th>
<th>Normal</th>
<th>Stunted</th>
<th>Wasted</th>
<th>Stunted and wasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jhabua&lt;sup&gt;a&lt;/sup&gt;</td>
<td>363</td>
<td>26.7</td>
<td>59.8</td>
<td>5.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Bastar&lt;sup&gt;b&lt;/sup&gt;</td>
<td>725</td>
<td>41.1</td>
<td>51.3</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Sarguja&lt;sup&gt;b&lt;/sup&gt;</td>
<td>339</td>
<td>48.1</td>
<td>46.3</td>
<td>2.1</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Note: Independence of distributions were tested by $X^2$-test. The distributions having same superscript are not significantly different from each other.
FIG. 34: COMPARISON OF GOMEZ DISTRIBUTION BETWEEN TRIBAL, RURAL (M.P.) PRE-SCHOOL CHILDREN
FIG. 35: COMPARISON OF WATERLOW CLASSIFICATION BETWEEN TRIBAL, RURAL(M.P) PRE-SCHOOL CHILDREN

[Bar chart showing comparison of waterlow classification between different groups: Normal, Stunted, Wasted, Starved. Groups include Bhils, G.B., G.B., and Rural(MP).]
TABLE 16: RESULTS OF TESTS OF SIGNIFICANCE BETWEEN GROUP MEANS OF SCHOOL AGE CHILDREN BY ANTHROPOMETRIC MEASUREMENTS AND AGE - MALES

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01</td>
<td>B GS GB P / 0.001</td>
</tr>
<tr>
<td>6 +</td>
<td>NS</td>
<td>P / 0.01</td>
<td>B GS GB P / 0.001</td>
<td>GSB GB P / 0.001</td>
</tr>
<tr>
<td>7 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01</td>
<td>GSB GB P / 0.001</td>
</tr>
<tr>
<td>8 +</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>B GS GB P / 0.001</td>
</tr>
<tr>
<td>9 +</td>
<td>P / 0.05</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001 B GS GB</td>
</tr>
<tr>
<td>10 +</td>
<td>NS</td>
<td>P / 0.01</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>11 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01</td>
<td>B GS GB P / 0.001</td>
</tr>
</tbody>
</table>

* Tests of significance was carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
### TABLE 17: RESULTS OF TESTS OF SIGNIFICANCE BETWEEN GROUP MEANS OF SCHOOL AGE CHILDREN BY ANTHROPOMETRIC MEASUREMENT AND AGE - FEMALES

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 +</td>
<td>NS</td>
<td>P / 0.001 B GS GB</td>
<td>NS</td>
<td>P / 0.001 B GS GB</td>
</tr>
<tr>
<td>6 +</td>
<td>P / 0.01 GS B GB</td>
<td>P / 0.001 GS B GB</td>
<td>P / 0.001 GS B GB</td>
<td>P / 0.001 GS B GB</td>
</tr>
<tr>
<td>7 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01 GS B GB</td>
<td>P / 0.001 GS B GB</td>
</tr>
<tr>
<td>8 +</td>
<td>P / 0.001 GS B GB</td>
<td>P / 0.001 GS B GB</td>
<td>P / 0.001 GS B GB</td>
<td>P / 0.001 GS B GB</td>
</tr>
<tr>
<td>9 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01 GS B GB</td>
<td>P / 0.05 GS B GB</td>
</tr>
<tr>
<td>10 +</td>
<td>P / 0.05 GS B GB</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001 B GS GB</td>
</tr>
<tr>
<td>11 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.01 B GS GB</td>
</tr>
</tbody>
</table>

* Tests of significance was carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
### TABLE 18: RESULTS OF TESTS OF SIGNIFICANCE BETWEEN GROUP MEANS OF ADOLESCENTS BY ANTHROPOMETRIC MEASUREMENT AND AGE - MALES

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS B GB</td>
<td>B GS GB</td>
</tr>
<tr>
<td>13 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>14 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS B GB</td>
<td>GB</td>
</tr>
<tr>
<td>15 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS GB B</td>
<td>B B</td>
</tr>
<tr>
<td>16 +</td>
<td>P / 0.01</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>B GB</td>
<td></td>
<td></td>
<td>GB</td>
</tr>
<tr>
<td>17 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS B GB</td>
<td>GB B</td>
</tr>
<tr>
<td>18 +</td>
<td>NS</td>
<td>P / 0.01</td>
<td>P / 0.01</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GB B</td>
</tr>
<tr>
<td>19 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS B GB</td>
<td>GB B</td>
</tr>
<tr>
<td>20 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS B GB</td>
<td>GB B</td>
</tr>
</tbody>
</table>

* Tests of significance was carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B GS GB</td>
</tr>
<tr>
<td>13 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B GS GB</td>
</tr>
<tr>
<td>14 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS GB</td>
<td>GS GB</td>
</tr>
<tr>
<td>15 +</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.05</td>
<td>P / 0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GS GB</td>
<td>GS GB B</td>
</tr>
<tr>
<td>16 +</td>
<td>P / 0.001</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B GS GB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>18 +</td>
<td>NS</td>
<td>P / 0.05</td>
<td>P / 0.001</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B GS GB</td>
<td>B GS GB</td>
<td></td>
</tr>
<tr>
<td>19 +</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B GS GB</td>
</tr>
<tr>
<td>20 +</td>
<td>P / 0.05</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td></td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
</tbody>
</table>

* Tests of significance was carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-29</td>
<td>P / 0.05</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>B GS GB</td>
<td>GS D GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
<tr>
<td>30-39</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
<tr>
<td>40-49</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td>GS GB B</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
<tr>
<td>50-59</td>
<td>P / 0.05</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td>GS GB B</td>
<td>GS B GB</td>
<td>NS</td>
</tr>
<tr>
<td>70-60</td>
<td>NS</td>
<td>P / 0.01</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td>GS GB B</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
</tbody>
</table>

*Tests of significance were carried out by analysis of variance coupled with studentised range test.

Continuous line indicates the similarity between the groups.
<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Height</th>
<th>Weight</th>
<th>Arm circumference</th>
<th>Fat fold at triceps</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-29</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td>BG GS GB</td>
<td>BG GS GB</td>
<td>GS GB B</td>
</tr>
<tr>
<td>30-39</td>
<td>P / 0.01</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS GB B</td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
<tr>
<td>40-49</td>
<td>NS</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>BG GS GB</td>
<td>BG GS GB</td>
<td>BG GS GB</td>
<td>GS GB B</td>
</tr>
<tr>
<td>50-59</td>
<td>P / 0.05</td>
<td>P / 0.01</td>
<td>P / 0.01</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
<td>GS B GB</td>
</tr>
<tr>
<td>70-79</td>
<td>P / 0.05</td>
<td>NS</td>
<td>NS</td>
<td>P / 0.001</td>
</tr>
<tr>
<td></td>
<td>GS B GB</td>
<td>NS</td>
<td>NS</td>
<td>GS B GB</td>
</tr>
</tbody>
</table>

*Tests of significance was carried out by analysis of variance coupled with studentised range test.

Continuous line indicates the similarity between the groups.
### TABLE 22: MEAN ANTHROPOMETRIC MEASUREMENTS OF ADULT MALES BY AGE AND TRIBE

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Tribe</th>
<th>No.</th>
<th>Arm length cm.</th>
<th>Head circumference cm.</th>
<th>Chest circumference cm.</th>
<th>Transverse chest cm.</th>
<th>Antero-Chest cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-29</td>
<td>B</td>
<td>121</td>
<td>67.8</td>
<td>53.3</td>
<td>81.1</td>
<td>25.7</td>
<td>18.2</td>
</tr>
<tr>
<td></td>
<td>GB</td>
<td>339</td>
<td>76.8</td>
<td>52.7</td>
<td>77.6</td>
<td>24.4</td>
<td>18.3</td>
</tr>
<tr>
<td></td>
<td>GS</td>
<td>165</td>
<td>75.8</td>
<td>53.4</td>
<td>79.1</td>
<td>25.6</td>
<td>19.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.47</td>
<td>1.49</td>
<td>3.64</td>
<td>1.26</td>
<td>1.09</td>
</tr>
<tr>
<td>30-39</td>
<td>B</td>
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TABLE 23: TESTS OF SIGNIFICANCE* OF MEAN ANTHROPOMETRIC MEASUREMENTS BETWEEN TRIBES - ADULT MALES

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*Tests of significance were carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
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*Tests of significance were carried out by analysis of variance coupled with studentized range test.

Continuous line indicates the similarity between the groups.
Gonds of Bastar and the Bhils of Jhabua in the two year group (Table 12). Further, the Gonds of Sarguja as well as the Bhils of Jhabua are heavier than the Gonds of Bastar in the four year group (Table 12).

The arm circumference values of the Gonds of Sarguja and the Bhils of Jhabua are significantly higher than those of the Gonds of Bastar in all preschool ages except in the three year group. In all ages, the preschool Gonds of Sarguja and the Bhils of Jhabua show significantly higher values of FFT than the Gonds of Bastar (Table 12).

The two and three year age group Gond girls of Sarguja are significantly taller than the Bhils of Jhabua (Table 13). The differences are insignificant between the Gonds of Bastar and Sarguja. However, the mean weights of the Gonds of Sarguja are significantly higher than those of the Gonds of Bastar except in the first year and second year groups. The Bhil girls of Jhabua are significantly heavier than the Gonds of Bastar in the 1+ year age group. The Gonds of Bastar and Sarguja are significantly heavier than the Bhils of Jhabua in the 3+ year group.

The arm circumference values are significantly more in the Gond girls of Sarguja in the 3+ and 4+ year groups and those of the Bhils of Jhabua in all the age groups compared to the Gonds of Bastar (Table 13).

The mean FFT values are significantly more in the Gond girls of Sarguja in all the age groups and those of the Bhils of Jhabua in all but 2+ year group compared to those in the Gonds of Bastar (Table 13).

Thus it would appear that the Gond preschoolers of Sarguja and the Bhils of Jhabua are nutritionally better off than the Gonds of Bastar.
Nutritional Status of the Tribal Groups in the Three Zones: Preschool Children

The average values of body measurements, though reflect the general health and nutritional status, are not sensitive indicators of the extent and type of malnutrition. The distributional analyses of indices on body measurements have often been suggested not only to quantify malnutrition but also for inter-group comparisons. Of the many indices, body weight for age classification of Gomez and the classification suggested by Waterlow based on weight for height and height for age are often recommended for use in community studies. While Gomez distribution provides a measure of the extent only of the current undernutrition (short duration), Waterlow's classification on the other hand attempts to provide a picture of both current and chronic and current on chronic types of malnutrition.

The percentage of 'normal' children was significantly higher in the Gonds of Sarguja (24.5%) compared to Bhils of Jhabua (16.2%) and Gonds of Bastar (9.3%). The percentage of severely malnourished children was also significantly less in the Gonds of Sarguja compared to all other groups (Table 14 and Fig.34).

The percentage of children classified according to the types of malnutrition (Waterlow) is not significantly different between the Gonds of Sarguja and Bastar. However, the percentage of 'stunted', 'stunted and wasted' is significantly higher in the Bhils of Jhabua compared to the other Gonds (Table 15 and Fig.35).

School Age Children

The eight year old Sarguja Gond boys are significantly taller and heavier than the Gonds of Bastar. The six and 10 year old Gond girls of Sarguja are significantly taller than Gonds of Bastar. The nine year old Bhill boys are signifi-
cantly taller than the Gonds of Sarguja. In the school age the pattern differed from the preschool age (Tables 16 and 17).

The mean arm circumference values are significantly higher in the boys and girls of Sarguja Gonds in the 6th and 8th years compared to the Gonds of Bastar.

The mean FFT values in the boys and girls of the Gonds of Sarguja and the Bhils of Jhabua are significantly more than the Gonds of Bastar in most of the age groups.

Adolescents

There are no significant differences in mean heights and weights of adolescents of both sexes except for 16+ males and females and 20+ females in height and 18+ females and males in weight. The mean arm circumference values are significantly more in the male Gonds of Sarguja compared to the Gonds of Bastar in the 12+, 18+ and 19+ age groups (Tables 18, 19). The female Gonds of Sarguja and Bhils of Jhabua show significantly higher arm circumference values in the 14+, 18+ and 20+ age groups than the Gonds of Bastar. In the 15+ age group, the Gonds of Sarguja have significantly higher arm circumference values compared to the Gonds of Bastar.

The mean FFT values are significantly more in both sexes of Sarguja Gonds compared to the Gonds of Bastar except in the female age groups of 16+ to 18+ and male age groups of 17+. The mean FFT values are significantly higher in the male Gonds of Sarguja compared to the Bhils of Jhabua in the 14+, 15+, 16+, 18+ and 20+ age groups. The mean fatfolds of the male Bhils are significantly higher in the 12+ and 20+ age groups and females in the 12+ and 17+ age groups than the Gonds of Bastar. So far as the fat folds are concern-
ed, Sarguja folk are better than Jhabua and both the groups are better than the Bastar group in the case of adult males. The FFT, which is a reliable indicator of the current nutritional status, has shown the same trend as height.

Adults

The Bhil males of Jhabua of 21-29 and 30-39 year age groups are significantly taller than the Gonds of Bastar while the male Gonds of Sarguja are significantly taller in the 30-39 and 30-59 year groups compared to the Gonds of Bastar. Similarly the female Gonds of Sarguja are significantly taller than the Gonds of Bastar in all age groups excepting the 40-49 year group (Tables 20-24).

The male Gonds of Sarguja are significantly heavier than the Bhils of Jhabua and the Gonds of Bastar in all the age groups.

The female Bhils of Jhabua and Gonds of Sarguja are significantly heavier than the Gonds of Bastar in the 21-29, 30-39 and 40-49 year age groups. The Gond females of Sarguja are significantly heavier than the Gonds of Bastar and the Bhils of Jhabua in the 50-59 year group. However, the mean body weights are not significantly different in the 60 year group.

Arm Circumference

The mean arm circumference values are significantly higher in the Gond males of Sarguja than in the Bhils of Jhabua and the Gonds of Bastar in all the age groups except in 60+ year group in which they are similar to the Bhils of Jhabua (Table 20). The Bhil males also have significantly higher values compared to the Gonds of Bastar in the 21-29 and 30-39 year groups.

The mean arm circumference values are significantly higher in the Gond females of Sarguja and Bhil females of Jhabua compared to the Gonds of
Bastar in all the age groups excepting the 60+ year group (Table 21).

Fat Fold at Triceps

In the males, the mean fat folds at triceps of Sarguja Gonds are significantly higher than the Bastar Gonds in all the age groups and the Jhabua Bhils in 40-49 year group. The mean values of Jhabua Bhils are significantly higher than those of the Bastar Gonds of the 21-29, 30-39 and 40-49 year groups. However, there are no significant differences between the tribal groups of the three zones in the 50-59 year group (Table 20).

In the females, the triceps fat fold mean values of the Sarguja Gonds are significantly higher than in the Bastar Gonds and Jhabua Bhils in all age groups except in the 60+ year group, where only the Bastar Gonds have significantly lower values and Jhabua Bhils have similar values (Table 21).

Other Measurements

Arm Length

The Bhils of Jhabua of all age groups have significantly shorter arms compared to the Gonds of Sarguja and Bastar (Tables 22, 23 and Fig.36).

Head and Chest Circumference

The Sarguja Gonds have significantly higher head and chest circumference values compared to Bastar Gonds in all the age groups except in the 50-59 year group for chest circumference and also compared to Jhabua Bhils in 40-49 year group. The Jhabua Bhils have significantly higher chest circumference values in 21-29 and 30-39 year groups and head circumference values in the 21-29 year group compared to Bastar Gonds. The chest and head circumference values are not significant between the zones in the 60+ year group (Tables 22, 23 and Fig. 37).
FIG. 36: COMPARISON OF ARM LENGTH BETWEEN TRIBES---ADULT MALES

ятия

ARM-LENGTH IN CENTIMETERS

AGE IN YEARS

<table>
<thead>
<tr>
<th>21-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60+</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>HBILS</th>
<th>GONDS OF BASTAR</th>
<th>GONDS OF SARGUJA</th>
</tr>
</thead>
</table>
FIG. 37: COMPARISON OF CHEST CIRCUMFERENCE BETWEEN TRIBES
--ADULT MALES

[Graph showing comparison of chest circumference for different age groups and tribes]
Transverse Chest and Antero-Posterior Chest Diameter

The mean measurements of transverse chest and antero-posterior chest diameters of all the age groups are significantly higher in the Sarguja Gonds and Jhabua Bhils than the Bastar Gonds. In the age group 60+, the Bhils are not different from Bastar Gonds in the mean values of antero-posterior chest diameter. The mean antero-posterior chest diameter values of Sarguja Gonds are also significantly higher than the Jhabua Bhils in all the age groups except the 60+. However, the Bhils have significantly higher mean values of transverse chest diameter than the Sarguja Gonds in the 21-29 year age group (Tables 22, 23 and Figs.38, 39).

Bi-acromial and Bi-ilio Diameters

The mean bi-acromial diameter values of the Jhabua Bhils are significantly higher than the Sarguja and Bastar Gonds in all but the 60+ age group (Table 22, 23 and Fig.40). The mean values of bi-ilio diameter of the Sarguja Gonds and Jhabua Bhils are significantly higher than the Bastar Gonds in all the age groups (Tables 22, 24 and Fig. 41).

Calf Circumference

The mean calf circumference values of the Sarguja Gonds are significantly higher in 21-29, 30-39 and 60+ year groups than the Bastar Gonds and the Jhabua Bhils. However, the mean values in the 50-59 year group are not significantly different between the groups, while in the 40-49 year group, the mean values of Bastar Gonds are similar to the Sarguja Gonds and significantly higher compared to the Jhabua Bhils (Tables 22, 24 and Fig. 42).
FIG. 39: COMPARISON OF ANTERO-POSTERIOR CHEST BETWEEN TRIBES-ADULT MALES

- Anterior Chest in Centimeters

<table>
<thead>
<tr>
<th></th>
<th>21-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhils</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gonds of Bastar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gonds of Sarguja</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AGE IN YEARS: 21-29, 30-39, 40-49, 50-59, 60+
FIG. 40: COMPARISON OF BI-ACROMIAL DIA. BETWEEN TRIBES—ADULT MALES
FIG. 41: COMPARISON OF BI-ILIO. DIA. BETWEEN TRIBES—ADULT MALES

BI-ILIO DIAMETER IN CENTIMETERS

28
26
24
22
20
18
16
14
12
10
8
6
4
2
0

21-29
30-39
40-49
50-59
60+

PHILS
GONDS OF BASTAR
AGE IN YEARS
GONDS OF SARGLUA
FIG. 42: COMPARISON OF CALF CIRCUMFERENCE BETWEEN TRIBES
--ADULT MALES

Calf Circumference in Centimeters

Age in Years

- SHIV
- Gonds of Bastar
- Gonds of Sarguja
Fat Folds

The mean fatfold values at sub-scapular are not significantly different between the three groups in 40-49, 50-59 and 60+ year groups. The mean values of subscapular fat folds are significantly higher in the Sarguja Gonds of the 21-29 and 30-39 year groups than the Bastar Gonds and Jhabua Bhils and in the Bastar Gonds of the 30-39 year group than the Jhabua Bhils (Tables 22, 24 and Figs. 43-45).

The mean values of fatfold at supra-iliac and calf are significantly higher in the Sarguja Gonds of the 21-29 and 30-39 year groups than the Bastar Gonds and the Jhabua Bhils are show significantly higher values for fatfold at supra-iliac.

Correlation Coefficients

The correlation coefficient between height and weight was calculated for each sex over ages and tribal groups. The relationship is observed to be quite strong (Tables 25 and 26) in the Gonds of Bastar and Sarguja (ranging between 0.65 to 0.70) while it is relatively poor in the Bhils of Jhabua (0.46). This may indirectly indicate the influence of other variables on the height-weight relationship in the Bhils of Jhabua. To find out the real relationship between height and weight, the linear effect of arm circumference was removed and partial correlation coefficients are compared between ages and tribal groups. The values for the Bhils of Jhabua are lower than those for the Gonds of Bastar but the values of Gonds of Bastar are greater than the value of Gonds of Sarguja. Further, the influence of FFT has been removed from the correlation between height and weight. It is observed that the Gonds of Bastar have emerged as the superior group. But with increasing age, FFT's influence seems to be decreasing (Table 25 and Figs. 46-48).
FIG. 43: COMPARISON OF FF AT SUPRAILI, BETWEEN TRIBES---ADULT MALES
Figure 44: Comparison of FF at Sub-Scap between Tribes—Adult Males

Fatfold at Sub-Scapular in mm.

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Gonds of Bastar</th>
<th>Gonds of Sarguja</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Bials
- Gonds of Bastar
- Gonds of Sarguja
FIG. 45: COMPARISON OF FF AT CALF BETWEEN TRIBES—ADULT MALES

<table>
<thead>
<tr>
<th>AGE IN YEARS</th>
<th>BHILS</th>
<th>GONDS OF BASTAR</th>
<th>GONDS OF SARGuja</th>
</tr>
</thead>
<tbody>
<tr>
<td>-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FATFOLD AT CALF IN mm.
<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Height-Weight</th>
<th>Height-Weight (AC)</th>
<th>Height-Weight (AC-FFT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BJ  GB  GS</td>
<td>BJ  GB  GS</td>
<td>BJ  GB  GS</td>
</tr>
<tr>
<td>1 - 4</td>
<td>0.66 0.89 0.86</td>
<td>0.60 0.88 0.83</td>
<td>0.67 0.89 0.88</td>
</tr>
<tr>
<td>5 - 11</td>
<td>0.56 0.93 0.94</td>
<td>0.86 0.86 0.90</td>
<td>0.90 0.89 0.86</td>
</tr>
<tr>
<td>12 - 20</td>
<td>0.84 0.83 0.73</td>
<td>0.69 0.80 0.45</td>
<td>0.84 0.93 0.74</td>
</tr>
<tr>
<td>21 - 29</td>
<td>0.30 0.64 0.58</td>
<td>0.32 0.39 0.61</td>
<td>0.33 0.64 0.61</td>
</tr>
<tr>
<td>30 - 39</td>
<td>0.46 0.61 0.59</td>
<td>0.46 0.69 0.58</td>
<td>0.46 0.60 0.61</td>
</tr>
<tr>
<td>40 - 49</td>
<td>0.43 0.61 0.66</td>
<td>0.44 0.62 0.60</td>
<td>0.43 0.63 0.72</td>
</tr>
<tr>
<td>50 - 59</td>
<td>0.06 0.35 0.48</td>
<td>0.05 0.52 0.52</td>
<td>0.05 0.36 0.48</td>
</tr>
<tr>
<td>&gt;60</td>
<td>0.32 0.53 0.48</td>
<td>0.30 0.53 0.35</td>
<td>0.44 0.59 0.47</td>
</tr>
</tbody>
</table>

BJ : Bhils of Jhabua
GB : Gonds of Bastar
GS : Gonds of Sarguja
FIG. 46: COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - MALES
HT. VS. WT.
FIG. 47: COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - MALES
HT. VS. WT. AFTER REMOVING THE EFFECT OF AC

AGE IN YEARS

- BHILS
- GONDS-BASTAR
- GONDS-SAROJIA
FIG. 48 : COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - MALE: HT. VS. WT. AFTER REMOVING THE EFFECT OF AC AND FFT
<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>BJ</th>
<th>GB</th>
<th>GS</th>
<th>BJ</th>
<th>GB</th>
<th>GS</th>
<th>BJ</th>
<th>GB</th>
<th>GS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>0.66</td>
<td>0.87</td>
<td>0.91</td>
<td>0.61</td>
<td>0.82</td>
<td>0.87</td>
<td>0.71</td>
<td>0.88</td>
<td>0.91</td>
</tr>
<tr>
<td>5 - 11</td>
<td>0.86</td>
<td>0.94</td>
<td>0.94</td>
<td>0.58</td>
<td>0.83</td>
<td>0.84</td>
<td>0.86</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>12 - 20</td>
<td>0.77</td>
<td>0.79</td>
<td>0.81</td>
<td>0.47</td>
<td>0.63</td>
<td>0.67</td>
<td>0.78</td>
<td>0.77</td>
<td>0.82</td>
</tr>
<tr>
<td>21 - 29</td>
<td>0.43</td>
<td>0.54</td>
<td>0.52</td>
<td>0.36</td>
<td>0.59</td>
<td>0.50</td>
<td>0.40</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>30 - 39</td>
<td>0.30</td>
<td>0.51</td>
<td>0.43</td>
<td>0.34</td>
<td>0.54</td>
<td>0.47</td>
<td>0.30</td>
<td>0.54</td>
<td>0.50</td>
</tr>
<tr>
<td>40 - 49</td>
<td>0.26</td>
<td>0.52</td>
<td>0.44</td>
<td>0.24</td>
<td>0.53</td>
<td>0.44</td>
<td>0.25</td>
<td>0.35</td>
<td>0.49</td>
</tr>
<tr>
<td>50 - 59</td>
<td>0.19</td>
<td>0.70</td>
<td>0.54</td>
<td>0.19</td>
<td>0.69</td>
<td>0.56</td>
<td>0.18</td>
<td>0.73</td>
<td>0.58</td>
</tr>
<tr>
<td>60+</td>
<td>0.58</td>
<td>0.52</td>
<td>0.46</td>
<td>0.29</td>
<td>0.53</td>
<td>0.46</td>
<td>0.48</td>
<td>0.56</td>
<td>0.56</td>
</tr>
</tbody>
</table>

BJ : Bhils of Jhabua  
GB : Gonds of Bastar  
GS : Gonds of Sarguja
FIG. 49: COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - FEMALES
HT. VS. WT.
FIG. 50: COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - FEMALES
HT. VS. WT. AFTER REMOVING THE EFFECT OF AC

AGE IN YEARS

EHILS  GOND-S-BASTAR  GOND-S-SARGUJA
FIG. 51: COMPARISON OF CORRELATION BETWEEN TRIBES BY AGE - FEMALES
HT. VS. WT. AFTER REMOVING THE EFFECT OF AC AND FEI

AGE IN YEARS

BHILS
GONDS-BASTAR
GONDS-SARGULA
When the correlation coefficients and partial correlation coefficients between triabl groups are compared, the Bhils of Jhabua belonging to the earlier ages, showed higher values for the zero order than the partial correlation coefficients and have equalized with increasing age indicating lessening influence of Arm circumference in the latter age groups. In the Gonds of Bastar, the original correlation coefficient is greater than the partial correlation coefficient up to 29 years and there after the values are either equal or less than indicating the absence of AC effect during adulthood. The Gonds of Sarguja up to the age of 20 years present a trend similar to that of Gonds of Bastar. The original values are more or less similar to partial correlation coefficients, these indicating the lessened influence of AC with increasing age.

In all the three tribal groups, over the ages, the FFT did not bring any dent on the already existing correlation between height and weight. If at all FFT has any relationship, it is through weight and arm circumference. Hence it could not change the magnitude of relationship between height and weight.

Similar analysis for females has indicated the continued dominance of the Gonds of Bastar over the other two groups and the influence of AC is also strong in the Gonds of Bastar, while it has extended up to 29 years in the Gonds of Sarguja. Similar trend is observed when FFT's influence is removed from the relationship between height and weight. The analysis of height-weight values for females has brought out only one difference over the male values. The females of oldest age group retained higher relationship between height-weight (Table 26 and Figs. 49-51).
The correlation coefficients of weight with AC and the partial correlation coefficients by rendering the linear effect of height, F1T and both height and FFT are presented graphically for the three tribal groups of all ages of both the sexes. Upto the age group of 21-29 years in males, the Bhils of Jhабua and the Gonds of Bastar are similar with higher zero under correlation coefficient indicating considerable influence of height. This trend is reversed after 30 years. In the Gonds of Sarguja, values of weight and arm circumference with height and FFT are more or less same even in the above 50 year age groups. it indicates that the older people continued to be better nutritionally.

With respect to FFT, the partial correlation coefficient values are observed to be less than the zero order values in all age groups beyond 20 years indicating the influence of FFT over weight-arm circumference relationship. The better nutritional status of the Gonds of Sarguja is reflected through higher zero order and partial correlation coefficients between weight and arm circumference and weight, arm circumference and fat fold at triceps.

The zero order correlation between weight, arm circumference which appeared to be strong in the earlier ages decreased in the 20-40 year age and again increased beyond 40 years in the females in all the tribal groups. This increase started early and is more intensive in the Gonds of Bastar.

Discriminant Analysis

The Statistical Package for Social Sciences of London University was used for this discriminant analysis by METHOD = MAHAL, METHOD = RAO. The stepwise (step-up) analysis was adopted. The four variables: height, weight, arm circumference and fat fold at triceps for the three groups (i) Bhils of Jhabua, (ii) Gonds of Bastar and (iii) Gonds of Sarguja were used in the analysis.
In the case of adult males, 11 more variables, listed in Chapter III on Materials and Methods were added to the list of variables and the analysis was carried out again.

Eigen Values and Canonical Correlations

The results of Discriminant Analysis indicated that a maximum of only two functions could be derived. The two functions could contain all the information in the discrimination of variables in all age and sex groups with different sets of variables (Tables 27-29).

The sum of Eigen values in all age and sex groups with different sets of variables is always cent per cent indicating that the total variance existing in the dependant variables has been accounted for.

The relative percentage of Eigen values of the first function in the males ranged from 93.8 (preschool age group) to 80.5 (40-49 year age group) indicating a downward trend with increasing age and more or less stabilized at 81.2 to 83.3 after 50 years. The relative percentage of Eigen value is 85.9 in the case of all adult males. Thus, it is clear that function I is relatively the most important one and is capable of separating the groups, all by itself (Tables 27-28).

The canonical correlations associated with the Function I are moderately correlated ranging from 0.283 to 0.489 and did not show any trends with age.

The second function assumes importance in the older age groups where the relative percentage of Eigen values ranged between 16.7 and 19.5 and the associated canonical correlations are less moderately correlated.
<table>
<thead>
<tr>
<th>Age group</th>
<th>Function</th>
<th>Eigen value</th>
<th>% of variance explained</th>
<th>Canonical correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>$F_1$</td>
<td>0.510</td>
<td>93.8</td>
<td>0.3813</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.034</td>
<td>6.2</td>
<td>0.1800</td>
</tr>
<tr>
<td>5 - 12</td>
<td>$F_1$</td>
<td>0.403</td>
<td>97.8</td>
<td>0.536</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.009</td>
<td>2.2</td>
<td>0.093</td>
</tr>
<tr>
<td>12 - 20</td>
<td>$F_1$</td>
<td>0.355</td>
<td>94.3</td>
<td>0.512</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.022</td>
<td>5.7</td>
<td>0.145</td>
</tr>
<tr>
<td>21 - 29</td>
<td>$F_1$</td>
<td>0.408</td>
<td>90.7</td>
<td>0.538</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.042</td>
<td>9.3</td>
<td>0.201</td>
</tr>
<tr>
<td>30 - 39</td>
<td>$F_1$</td>
<td>0.358</td>
<td>87.1</td>
<td>0.513</td>
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<td></td>
<td>$F_2$</td>
<td>0.053</td>
<td>12.9</td>
<td>0.224</td>
</tr>
<tr>
<td>40 - 49</td>
<td>$F_1$</td>
<td>0.177</td>
<td>80.5</td>
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</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.043</td>
<td>19.5</td>
<td>0.203</td>
</tr>
<tr>
<td>50 - 59</td>
<td>$F_1$</td>
<td>0.266</td>
<td>81.2</td>
<td>0.458</td>
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<td></td>
<td>$F_2$</td>
<td>0.061</td>
<td>18.8</td>
<td>0.241</td>
</tr>
<tr>
<td>&gt;60</td>
<td>$F_1$</td>
<td>0.161</td>
<td>83.3</td>
<td>0.372</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.032</td>
<td>16.7</td>
<td>0.177</td>
</tr>
<tr>
<td>All adults</td>
<td>$F_1$</td>
<td>0.256</td>
<td>85.9</td>
<td>0.451</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.042</td>
<td>14.1</td>
<td>0.201</td>
</tr>
<tr>
<td>Age group</td>
<td>Functions</td>
<td>Eigen value</td>
<td>% of variance explained</td>
<td>Canonical correlation</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1 - 5</td>
<td>F₁</td>
<td>0.315</td>
<td>84.5</td>
<td>0.489</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.088</td>
<td>15.5</td>
<td>0.234</td>
</tr>
<tr>
<td>5 - 12</td>
<td>F₁</td>
<td>0.293</td>
<td>80.7</td>
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</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.070</td>
<td>19.3</td>
<td>0.256</td>
</tr>
<tr>
<td>12 - 20</td>
<td>F₁</td>
<td>0.088</td>
<td>76.6</td>
<td>0.285</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.027</td>
<td>23.4</td>
<td>0.162</td>
</tr>
<tr>
<td>21 - 29</td>
<td>F₁</td>
<td>0.203</td>
<td>62.6</td>
<td>0.411</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.121</td>
<td>37.4</td>
<td>0.329</td>
</tr>
<tr>
<td>30 - 39</td>
<td>F₁</td>
<td>0.161</td>
<td>66.7</td>
<td>0.372</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.080</td>
<td>33.3</td>
<td>0.272</td>
</tr>
<tr>
<td>40 - 49</td>
<td>F₁</td>
<td>0.219</td>
<td>56.3</td>
<td>0.424</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.170</td>
<td>43.7</td>
<td>0.382</td>
</tr>
<tr>
<td>50 - 59</td>
<td>F₁</td>
<td>0.124</td>
<td>70.1</td>
<td>0.332</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.053</td>
<td>29.9</td>
<td>0.224</td>
</tr>
<tr>
<td>≥60</td>
<td>F₁</td>
<td>0.256</td>
<td>93.9</td>
<td>0.451</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.016</td>
<td>6.1</td>
<td>0.127</td>
</tr>
<tr>
<td>All adults</td>
<td>F₁</td>
<td>0.149</td>
<td>57.6</td>
<td>0.360</td>
</tr>
<tr>
<td></td>
<td>F₂</td>
<td>0.110</td>
<td>42.4</td>
<td>0.315</td>
</tr>
<tr>
<td>Age group</td>
<td>Functions</td>
<td>Eigen value</td>
<td>% of variance explained</td>
<td>Canonical correlations</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>21 - 29</td>
<td>$F_1$</td>
<td>3.429</td>
<td>77.4</td>
<td>0.880</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>1.002</td>
<td>22.6</td>
<td>0.707</td>
</tr>
<tr>
<td>30 - 39</td>
<td>$F_1$</td>
<td>3.284</td>
<td>82.7</td>
<td>0.876</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.687</td>
<td>17.3</td>
<td>0.638</td>
</tr>
<tr>
<td>40 - 49</td>
<td>$F_1$</td>
<td>3.613</td>
<td>71.0</td>
<td>0.885</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>1.479</td>
<td>29.0</td>
<td>0.772</td>
</tr>
<tr>
<td>50 - 59</td>
<td>$F_1$</td>
<td>2.768</td>
<td>82.6</td>
<td>0.857</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.582</td>
<td>17.4</td>
<td>0.607</td>
</tr>
<tr>
<td>≥ 60</td>
<td>$F_1$</td>
<td>2.570</td>
<td>59.2</td>
<td>0.848</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>1.771</td>
<td>40.8</td>
<td>0.799</td>
</tr>
<tr>
<td>All Ages</td>
<td>$F_1$</td>
<td>2.923</td>
<td>78.3</td>
<td>0.863</td>
</tr>
<tr>
<td></td>
<td>$F_2$</td>
<td>0.808</td>
<td>21.7</td>
<td>0.669</td>
</tr>
</tbody>
</table>
The two functions contained all the information of the full set of 13 discriminating variables in the case of adult males (Table 29). However, the relative percentage of Eigen values is lower in the case of Function I and relatively higher in the case of Function II. Though, there are no clear-cut age trends in the 60+ age group the relative percentage of Eigen value is very low with 59.2 on Function I and very high with 40.8 on Function II compared to other age groups.

However, the associated canonical correlations indicated that both the discriminant functions are highly correlated with sets of variables which discriminate the group membership.

The relative percentage of Eigen values on Function I decreased from 84.5 (preschool age) to 56.3 (40-49 age). Then it increased to 70.1 in 50-59 year age group and 93.9 in 60+ age groups. In females it indicated the reverse trend with relative percentage of Eigen value on Function II. The relative percentages of Eigen values on Functions I and II are 57.6 and 42.4 respectively when all adult females are treated as one group.

The associated canonical correlations are moderately correlated with the sets of the discriminating variables.

The relative percentages of Eigen values on Function I are much higher in males than in females and decreased with increasing age in males up to 40-49 and again increased afterwards in females.

The stepwise (step-up) discriminant analysis has indicated that weight is the single powerful discriminating variable in 1-4 and 50-59 year old age groups while fat fold at triceps is the single and most powerful discriminator in many of the age groups of males when the four variables used were: height,
weight, arm circumference and fat fold at triceps (Tables 30 and 31).

However, the fat fold at calf is the most powerful discriminator in most of the age groups of adult males except in 21-29 and 60+ age groups when all the 15 variables are included (Table 32). Arm circumference in 1-4, 5-12, 12-20, 30-39 and 40-49 year age groups; body weight in 5-11 and 21-29; height in 50-59 and fat fold at triceps in 60+ are indicated as the most powerful discriminators in the case of females. When all adult females are pooled, height emerges as the best discriminator.

Standardized Discriminant Coefficients

The standardized discriminant coefficients represent the relative contribution of each variable to that function. In the males, the fat fold at triceps has the maximum contribution to the Function I in all the age groups except in 50-59 and 60+ in which arm circumference has the maximum contribution, thus the help of the coefficients identifying the dominant characteristic measured by them. However, height in 1-4, 5-11 and 21-29 year age groups; arm circumference in 12-20 year age group and weight in the rest of the age groups have maximum contribution to Function II measuring the 'non-fat component' as the dominant characteristic.

In the case of adult males with as many as 15 variables, fat fold at calf has the maximum contribution to the Function I in all the age groups. Thus the Function I continue to measure 'fat component' as the dominant characteristic of that function. The bi-acrominal diameter has the maximum contribution to the Function II in the 21-29, 30-39, 40-49 year age groups and pooled adult males, while arm length in the 50-59 age group and height in the 60+ age
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Anthropometric variable that has maximum discriminatory power</th>
<th>Anthropometric variables that has maximum contribution to functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>Weight</td>
<td>FFT, Ht</td>
</tr>
<tr>
<td>5 - 12</td>
<td>FFT</td>
<td>FFT, Ht</td>
</tr>
<tr>
<td>12 - 20</td>
<td>FFT</td>
<td>FFT, AC</td>
</tr>
<tr>
<td>21 - 29</td>
<td>FFT</td>
<td>FFT, Ht</td>
</tr>
<tr>
<td>30 - 39</td>
<td>FFT</td>
<td>FFT, Wt</td>
</tr>
<tr>
<td>40 - 49</td>
<td>FFT</td>
<td>FFT, Wt</td>
</tr>
<tr>
<td>50 - 59</td>
<td>Wt</td>
<td>AC, Wt</td>
</tr>
<tr>
<td>≥ 60</td>
<td>FFT</td>
<td>AC, Wt</td>
</tr>
<tr>
<td>21 and above</td>
<td>FFT</td>
<td>FFT, Wt</td>
</tr>
</tbody>
</table>
**TABLE 31: DETAILS OF ANTHROPOMETRIC VARIABLES WITH MAXIMUM DISCRIMINATING POWER CONTRIBUTING MAXIMUM TO THE FUNCTIONS BY AGE (4 MEASUREMENTS) - FEMALES**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Anthropometric variable that has maximum discriminatory power</th>
<th>Anthropometric variables that has maximum contribution to functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>AC</td>
<td>FFT</td>
</tr>
<tr>
<td>5 - 12</td>
<td>Wt</td>
<td>FFT</td>
</tr>
<tr>
<td>12 - 20</td>
<td>AC</td>
<td>FFT</td>
</tr>
<tr>
<td>21 - 29</td>
<td>Wt</td>
<td>AC</td>
</tr>
<tr>
<td>30 - 39</td>
<td>AC</td>
<td>AC</td>
</tr>
<tr>
<td>40 - 49</td>
<td>AC</td>
<td>FFT</td>
</tr>
<tr>
<td>50 - 59</td>
<td>Ht</td>
<td>FFT</td>
</tr>
<tr>
<td>≥60</td>
<td>FFT</td>
<td>AC</td>
</tr>
<tr>
<td>21 years and above</td>
<td>Ht</td>
<td>FFT</td>
</tr>
<tr>
<td>Age Group</td>
<td>Anthropometric variable that has maximum discriminatory power</td>
<td>Anthropometric variables that has maximum contribution to functions</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>21 - 29</td>
<td>FFT</td>
<td>FF Calf</td>
</tr>
<tr>
<td>30 - 39</td>
<td>FF Calf</td>
<td>FF Calf</td>
</tr>
<tr>
<td>40 - 49</td>
<td>FFC</td>
<td>FF Calf</td>
</tr>
<tr>
<td>50 - 59</td>
<td>FFC</td>
<td>FF Calf</td>
</tr>
<tr>
<td>≥ 60</td>
<td>BI IIJO</td>
<td>FF Calf</td>
</tr>
<tr>
<td>All ages</td>
<td>FF Calf</td>
<td>FF Calf</td>
</tr>
</tbody>
</table>
group have the maximum contribution. Thus the dominant characteristic measured by the Function II can be denoted as 'bony and soft tissue component' represented by height, arm length and bi-acromial diameter respectively.

As in the case of males, in the females also, the fat fold at triceps has contributed maximum to the Function I expressing the 'Fat Component' in all age groups except in 21-29 and 30-39 year age groups and also where all the adult females are treated as a single group. The variables contributing maximum to the Function II varied from arm circumference in 1-4 and 12-20 year age groups, height in 5-11 and 60+ age groups, weight in 30-39 and 40-49 year age groups to fat fold at triceps in 21-29 year age groups all indicating no clear-cut dominant characteristic measured by that function.

Discrimination Between Tribal Groups in the Three Zones

The very idea of using the discriminant analysis was to see whether the Gonds of Sarguja and Bastar, and the Bhils of Jhabua living in different ecological situations could be morphologically discriminated using one set of variables in females and two sets of variables in the males.

The results of the analysis clearly indicated that the males of the three tribal groups from the three zones are significantly different from each other morphologically excepting the 5-11 year age group where the Gonds of Sarguja and the Bhils of Jhabua are similar. But the females of the tribal groups from the three zones are significantly discriminated morphologically from each other except the Gonds of Sarguja from the Bhils of Jhabua and the Bhils of Jhabua from the Gonds of Bastar in the 60+ year group.
The results thus indicate that the Gonds of Sarguja are morphologically different from the Gonds of Bastar as well as the Bhils of Jhabua and the latter two groups are also different from each other. However, this analysis has not indicated the gradation among the tribal groups from the three zones. The group centroids on the two functions provide the comparative status of the three groups. These group centroids are the 'mean discriminant scores' for each group on the respective function. The group means on each function are compared to assess how much apart are the groups along the dimension, from each other. The higher the mean the better is the group on that function. The tests of significance are done after calculating standard deviation for the group means on both the functions (Tables 33-35).

The means of the Gonds of Sarguja and the Bhils of Jhabua are significantly higher in the age groups 1-4, 5-11 and 12-20 of females on the function I compared to the Gonds of Bastar. In the age groups 30-39, 50-59 and 60+ the means of the Gonds of Sarguja are significantly higher than both the Gonds of Bastar and the Bhils of Jhabua, the latter two being similar. However, in the age group 40-49, the means of the Bhils of Jhabua are significantly higher than those of the Gonds of Sarguja and Bastar, these two being similar. In the case of adults of all ages, the means of the Sarguja Gonds on the function I are significantly more than those of the Bhils of Jhabua and the Gonds of Bastar and of the Bhils of Jhabua than those of the Gonds of Bastar.

The variation explained by the function II is considerable only in the adults. The means, on the function II of the Gonds of Sarguja and Bastar are similar and are significantly higher than those of the Jhabua in the 21-29, 30-39
### TABLE 33: MEAN VALUES OF GROUP CENTROIDS OF DISCRIMINANT SCORES OF TRIBAL GROUPS BY AGE (4 MEASUREMENTS) - MALES

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Function I Sarguja Gonds</th>
<th>Jhabela Bhils</th>
<th>Bastar Gonds</th>
<th>Function II Sarguja Gonds</th>
<th>Jhabela Bhils</th>
<th>Bastar Gonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>0.953</td>
<td>0.933</td>
<td>-0.537</td>
<td>0.270</td>
<td>-0.339</td>
<td>-0.001</td>
</tr>
<tr>
<td>5 - 12</td>
<td>0.677</td>
<td>0.905</td>
<td>-0.528</td>
<td>0.116</td>
<td>-0.197</td>
<td>-0.006</td>
</tr>
<tr>
<td>12 - 20</td>
<td>0.957</td>
<td>0.323</td>
<td>-0.422</td>
<td>-0.097</td>
<td>0.415</td>
<td>-0.032</td>
</tr>
<tr>
<td>21 - 29</td>
<td>0.866</td>
<td>0.157</td>
<td>-0.584</td>
<td>-0.132</td>
<td>0.419</td>
<td>-0.077</td>
</tr>
<tr>
<td>30 - 39</td>
<td>0.846</td>
<td>0.202</td>
<td>-0.523</td>
<td>0.163</td>
<td>-0.473</td>
<td>0.078</td>
</tr>
<tr>
<td>40 - 49</td>
<td>0.713</td>
<td>0.024</td>
<td>-0.330</td>
<td>0.129</td>
<td>-0.362</td>
<td>0.112</td>
</tr>
<tr>
<td>50 - 59</td>
<td>0.713</td>
<td>-0.282</td>
<td>-0.409</td>
<td>-0.033</td>
<td>0.429</td>
<td>-0.204</td>
</tr>
<tr>
<td>&gt; 60</td>
<td></td>
<td>-0.011</td>
<td>-0.526</td>
<td>-0.075</td>
<td>-0.407</td>
<td>0.080</td>
</tr>
<tr>
<td>All ages</td>
<td>0.725</td>
<td>0.030</td>
<td>-0.447</td>
<td>-0.114</td>
<td>0.401</td>
<td>-0.099</td>
</tr>
<tr>
<td>Age Group</td>
<td>Function I</td>
<td></td>
<td></td>
<td>Function II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>-------</td>
<td>-------</td>
<td>-------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Sarguja</td>
<td>Jhabua</td>
<td>Bastar</td>
<td>Sarguja</td>
<td>Jhabua</td>
<td>Bastar</td>
</tr>
<tr>
<td></td>
<td>Gonds</td>
<td>Bhils</td>
<td>Gonds</td>
<td>Gonds</td>
<td>Bhils</td>
<td>Gonds</td>
</tr>
<tr>
<td>1 - 4</td>
<td>0.798</td>
<td>0.734</td>
<td>-0.405</td>
<td>0.318</td>
<td>-0.006</td>
<td>-0.518</td>
</tr>
<tr>
<td>5 - 12</td>
<td>0.676</td>
<td>0.569</td>
<td>-0.448</td>
<td>0.219</td>
<td>-0.741</td>
<td>0.012</td>
</tr>
<tr>
<td>12 - 20</td>
<td>0.492</td>
<td>0.243</td>
<td>-0.202</td>
<td>-0.136</td>
<td>0.468</td>
<td>-0.025</td>
</tr>
<tr>
<td>21 - 29</td>
<td>0.573</td>
<td>0.412</td>
<td>-0.395</td>
<td>0.400</td>
<td>-0.640</td>
<td>0.036</td>
</tr>
<tr>
<td>30 - 39</td>
<td>0.696</td>
<td>0.164</td>
<td>-0.287</td>
<td>0.219</td>
<td>-0.623</td>
<td>0.090</td>
</tr>
<tr>
<td>40 - 49</td>
<td>-0.228</td>
<td>0.972</td>
<td>-0.222</td>
<td>0.681</td>
<td>0.004</td>
<td>-0.304</td>
</tr>
<tr>
<td>50 - 60</td>
<td>0.539</td>
<td>-0.163</td>
<td>-0.255</td>
<td>-0.037</td>
<td>0.389</td>
<td>-0.179</td>
</tr>
<tr>
<td>&gt;60</td>
<td>0.629</td>
<td>0.021</td>
<td>-0.449</td>
<td>0.045</td>
<td>0.339</td>
<td>-0.049</td>
</tr>
<tr>
<td>All Adults</td>
<td>0.625</td>
<td>0.075</td>
<td>-0.299</td>
<td>0.207</td>
<td>-0.697</td>
<td>0.138</td>
</tr>
<tr>
<td>Age (Years)</td>
<td>Function I Centroids of Group</td>
<td>Function II Centroids of Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sarguja Gonds</td>
<td>Jhabua Bhils</td>
<td>Bastar Gonds</td>
<td>Sarguja Gonds</td>
<td>Jhabua Bhils</td>
<td>Bastar Gonds</td>
</tr>
<tr>
<td>21 - 29</td>
<td>2.213</td>
<td>-0.488</td>
<td>-1.654</td>
<td>-0.206</td>
<td>3.289</td>
<td>-0.374</td>
</tr>
<tr>
<td>30 - 39</td>
<td>2.230</td>
<td>0.220</td>
<td>-1.562</td>
<td>-0.247</td>
<td>3.175</td>
<td>-0.192</td>
</tr>
<tr>
<td>40 - 49</td>
<td>2.489</td>
<td>-0.785</td>
<td>-1.590</td>
<td>0.239</td>
<td>-2.943</td>
<td>0.662</td>
</tr>
<tr>
<td>50 - 60</td>
<td>1.747</td>
<td>-0.611</td>
<td>-1.666</td>
<td>0.135</td>
<td>-2.556</td>
<td>0.307</td>
</tr>
<tr>
<td>70 - 80</td>
<td>0.960</td>
<td>-3.520</td>
<td>-1.845</td>
<td>0.220</td>
<td>2.893</td>
<td>-2.132</td>
</tr>
<tr>
<td>All ages</td>
<td>2.002</td>
<td>-0.418</td>
<td>-1.584</td>
<td>-0.203</td>
<td>2.833</td>
<td>-0.349</td>
</tr>
</tbody>
</table>
and all adults pooled. In the age group 40-49, the means of the Sarguja Gonds are significantly higher than those of Bastar Gonds and Jhabua Bhils and of the Jhabua Bhils than those of the Bastar Gonds. In the case of 50-59 year group, the means of the Jhabua Bhils are significantly higher than those of the Gonds of Sarguja and Bastar.

In the case of males, the means of Gonds of Sarguja and the Bhils of Jhabua, on function I, are similar but significantly higher than in the case of the Gonds of Bastar of the age groups 1-4, 5-11 and 60+. However, in the adolescent and adult groups like 12-20, 21-29, 30-39, 40-49, the means of Gonds of Sarguja are significantly higher than those of the Bhils of Jhabua and the Gonds of Bastar and the means of Bhils of Jhabua are in turn significantly higher than those of the Gonds of Bastar. Similar trend is observed when all adult males are pooled.

The means of Bastar and Sarguja Gonds on function II are not significantly different from each other in all the age groups excepting 1-5 and 21-29 year age groups. The Bhils of Jhabua had significantly higher values in 12-20, 21-29, 50-59 as well in the case of adults (pooled) but significantly lower in the other age groups when compared to the other two groups.

Discriminant analysis reveals that fat fold thickness at triceps (FFT) is one of the best predictor variable in distinguishing the three groups; Bhils, Gonds of Bastar and Gonds of Sarguja. Bhil and Gond preschool children and school going children of Sarguja are fatter than the Gonds of Bastar as judged by the fat fold thickness at triceps. From early adolescent growth period onwards (i.e., 12th year onwards) the Gonds of Sarguja present higher values of fat fold thickness at triceps compared to Bhils and Gonds of Bastar.
The Bhils to start with are as plumpy as Gonds of Sargoda upto twelve year of age and start losing fat finally becoming lean and tall by the age of adulthood.

Classification of cases

The discriminant analysis is also a powerful classification technique. It is the process of identifying the likely group membership of a case when the only information is the values on the discriminating variables. The success of discrimination is measured by observing the proportion of correct classification.

The classification equations are derived from the pooled within groups covariance matrix and the centroids for the discriminating variables. The resulting classification coefficients are multiplied by the raw variable values summed together and added on to a constant. The equation for each group is:

$$C_i = C_{i1} V_1 + C_{i2} V_2 + C_{i3} V_3 + C_{i4} V_4$$

Where $C_i$ is the classification score for group $i$ the $C_{ij}$ are the classification coefficients with $C_{io}$ being the constant and $V$'s are raw scores on the discriminating variables. There is a separate equation for each group. Each case will have scores equivalent to the number of groups and the case will be classified into the group with the highest score. The results of classification indicated that the percent of correct classification varied with age, sex and the number of variables used for discriminant analysis.

The percent of correct classification is generally high upto 30-40 year groups in both sexes and then tended to be less, i.e., the value being more than 60 in the former and then dropping to 50 in the latter group (Table 36).

The percent of correctly classified cases is usually less by 5-10 in the females than in the males.
TABLE 36: PER CENT OF GROUPED CASES CLASSIFIED CORRECTLY BY DISCRIMINATING FUNCTION (4 MEASUREMENTS) BY AGE AND SEX

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>66.2</td>
<td>63.2</td>
</tr>
<tr>
<td>5 - 12</td>
<td>60.8</td>
<td>60.4</td>
</tr>
<tr>
<td>12 - 20</td>
<td>63.3</td>
<td>51.4</td>
</tr>
<tr>
<td>21 - 29</td>
<td>68.6</td>
<td>58.5</td>
</tr>
<tr>
<td>30 - 39</td>
<td>62.5</td>
<td>57.1</td>
</tr>
<tr>
<td>40 - 49</td>
<td>56.4</td>
<td>59.7</td>
</tr>
<tr>
<td>50 - 59</td>
<td>55.4</td>
<td>51.6</td>
</tr>
<tr>
<td>60 - 79</td>
<td>52.2</td>
<td>48.6</td>
</tr>
<tr>
<td>All ages</td>
<td>59.2</td>
<td>56.7</td>
</tr>
</tbody>
</table>
The percent of correctly classified cases also varied between the three groups. The Gonds of Bastar, had the highest per cent of correctly classified cases while the Gonds of Sarguja and the Bhils of Jhabua had always lower per cent of correctly classified cases. This can be expected as in most of the variables the Gonds of Bastar are always distinct from the other two groups being similar in some and significantly different in some other variables.

However, the percent of correctly classified cases ranged between 89-97 in the adult males with addition of 11 more variables. The "between age" and "group differences" became less prominent (Table 37).

Linear Discriminant Functions

The linear discriminant functions can be used for classifying unknown tribal individual of any age and tribe by using ten respective equations (Tables 38 and 39).
<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Per cent correctly classified</th>
</tr>
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<tbody>
<tr>
<td>21 - 29</td>
<td>94.5</td>
</tr>
<tr>
<td>30 - 39</td>
<td>94.4</td>
</tr>
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<td>40 - 49</td>
<td>95.2</td>
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<tr>
<td>50 - 59</td>
<td>88.9</td>
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<tr>
<td>70+</td>
<td>97.1</td>
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<td>All Ages</td>
<td>92.4</td>
</tr>
<tr>
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<td>Anthropometric variable</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------</td>
</tr>
<tr>
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<td>HT</td>
</tr>
<tr>
<td></td>
<td>WT</td>
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<tr>
<td></td>
<td>AC</td>
</tr>
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<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
</tr>
<tr>
<td>5 - 12</td>
<td>HT</td>
</tr>
<tr>
<td></td>
<td>AC</td>
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<tr>
<td></td>
<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
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<tr>
<td>12 - 20</td>
<td>HT</td>
</tr>
<tr>
<td></td>
<td>WT</td>
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<td></td>
<td>AC</td>
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<td></td>
<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
</tr>
<tr>
<td>21 - 29</td>
<td>HT</td>
</tr>
<tr>
<td></td>
<td>WT</td>
</tr>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
</tr>
<tr>
<td></td>
<td>WT</td>
</tr>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
</tr>
<tr>
<td>40 - 49</td>
<td>HT</td>
</tr>
<tr>
<td></td>
<td>WT</td>
</tr>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>FFT</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
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</table>

contd.
<table>
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<th>Age</th>
<th>Anthropometric variable</th>
<th>Hills of Jhabua</th>
<th>Gonds of Bastar</th>
<th>Gonds of Surguja</th>
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</thead>
<tbody>
<tr>
<td>50 - 59</td>
<td>HT</td>
<td>4.261</td>
<td>4.338</td>
<td>3.423</td>
</tr>
<tr>
<td></td>
<td>WT</td>
<td>3.673</td>
<td>3.346</td>
<td>0.158</td>
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<td></td>
<td>FFT</td>
<td>-0.166</td>
<td>-0.042</td>
<td>0.799</td>
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<td></td>
<td>Constant</td>
<td>-355.3837</td>
<td>-396.7495</td>
<td>-363.7391</td>
</tr>
<tr>
<td>60</td>
<td>HT</td>
<td>5.807</td>
<td>5.702</td>
<td>5.827</td>
</tr>
<tr>
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<td>WT</td>
<td>-2.353</td>
<td>-2.316</td>
<td>-2.483</td>
</tr>
<tr>
<td></td>
<td>FFT</td>
<td>1.862</td>
<td>1.752</td>
<td>2.243</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>-393.1744</td>
<td>-378.4623</td>
<td>-393.8583</td>
</tr>
<tr>
<td>21 years and above</td>
<td>HT</td>
<td>5.7130</td>
<td>5.7244</td>
<td>5.7910</td>
</tr>
<tr>
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<td>WT</td>
<td>-3.7003</td>
<td>-3.7242</td>
<td>-3.7920</td>
</tr>
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<td></td>
<td>AC</td>
<td>11.2142</td>
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<td>10.9765</td>
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<td>FFT</td>
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<td>-0.2275</td>
<td>-0.1939</td>
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<td>Constant</td>
<td>-469.3228</td>
<td>-459.5215</td>
<td>-475.3057</td>
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</table>
### TABLE 39: LINEAR DISCRIMINANT FUNCTIONS FOR TRIBAL GROUPS IN THREE ZONES BY AGE - FEMALES

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Anthropometric Variable</th>
<th>Bihils of Jharia</th>
<th>Gonds of Bastar</th>
<th>Gonds of Sarguja</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4</td>
<td>HT</td>
<td>1.788</td>
<td>1.835</td>
<td>1.866</td>
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<tr>
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<td>WT</td>
<td>-7.664</td>
<td>-7.386</td>
<td>-7.679</td>
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<tr>
<td></td>
<td>AC</td>
<td>13.560</td>
<td>12.890</td>
<td>12.529</td>
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<td>FFT</td>
<td>1.630</td>
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<td>3.125</td>
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<td>6.740</td>
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<td>-161.3836</td>
<td>-174.6642</td>
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<tr>
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<td>5.308</td>
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<td>12.410</td>
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<td>0.270</td>
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<td>6.345</td>
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<td>6.4865</td>
<td>6.5110</td>
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<td>WT</td>
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<td>-4.6503</td>
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<td>AC</td>
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<td>9.3147</td>
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<td>-522.5428</td>
<td>-535.3577</td>
</tr>
</tbody>
</table>

contd.
<table>
<thead>
<tr>
<th>Age</th>
<th>Anthropometric variable</th>
<th>Bhils of Jhabua</th>
<th>Gonds of Bastar</th>
<th>Gonds of Surguja</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 - 59</td>
<td>HT</td>
<td>4.5795</td>
<td>4.4936</td>
<td>4.5760</td>
</tr>
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<tr>
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<td>AC</td>
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<td>8.4403</td>
<td>8.9695</td>
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<td>1.0614</td>
<td>1.0491</td>
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<td>-426.0647</td>
</tr>
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<td>4.0198</td>
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<td>WT</td>
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<td>-1.7851</td>
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</tr>
<tr>
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<td>AC</td>
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<td>4.4338</td>
<td>4.7192</td>
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<td>5.0868</td>
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