

## Study of Physical Growth and Respiratory Functions Among Five Population Groups of Jammu and Kashmir, India

M.K. Bhasin and L.P. Singh

*Department of Anthropology, University of Delhi, Delhi-110 007, India*

**KEY WORDS** Anthropometric Measurements. Respiratory Functions. Gujjars. Dogras. Tibetans. Jammu and Kashmir.

**ABSTRACT** In the present paper, anthropometric and respiratory variables among five population groups viz. Gujjars, Dogra-Brahmans, Dogra-Rajputs and Dogra-Scheduled Castes and Tibetans are being reported. 1025 male subjects from age 8+ to 55+ years have been included in the study. The subjects were studied for 23 anthropometric measurements and three lung functions following standard techniques. General growth trend for anthropometric measurements is: Dogra-Scheduled Castes show maximum growth, followed by Dogra-Rajputs, Dogra-Brahmans, Gujjars and Tibetans. For respiratory functions however, Tibetans and Gujjars show higher values than Dogra groups.

Human growth and development, though chiefly determined by inherent growth potential, are equally influenced by environmental stresses, revealing that the two sets of factors are not entirely independent of each other. At all stages of life, environmental factors are constantly conditioning and modifying the expressions of inherited potentials. It is the basic principle that environment makes development possible and permit the genetic potential to find expression (Eveleth and Tanner, 1976).

The development of different parts of body can be measured metrically using anthropometric techniques to assess the growth patterns and nutritional status of different populations. A number of body measurements are selected for this purpose because the use of height and weight alone taken for simplicity of procedure in growth studies, has its limitations as it marks the fact that each organ and segment of body is growing at a rate that is uniquely its own. As each measurement has its own significance in growth study, they are divided into different groups accordingly as follows:

1. Weight
2. Projective height measurements
3. Diameters
4. Circumferences

### 5. Skinfolts

The physiological measurements also have their importance as biological response to the environment is invariably physiological regardless of age. The anthropometric and physiological variables are being reported here for five population groups (Gujjars, Dogra-Brahmans, -Rajputs, -Scheduled Castes and Tibetans) of Jammu and Kashmir.

**Gujjars:** Gujjars are a transhumant community, with winter headquarters in Jammu region and migrating to higher ranges during summer. Gujjars claim that their ancestor was a Chauhan Rajput, who married a Gujjar woman and that his descendants retained the tribal name while sinking to the rank of Gujjars owing to infringement of caste regulation (Ibbetson, 1916).

**Dogras:** The Dogras inhabiting the hilly tract bounding the mountain of Kashmir valley, on the south and extending up to the plain of Punjab, are descendants of Aryan stock. The origin of word Dogra is commonly stated by the people to have arisen from the fact that cradle of the Dogra race, lies between two holy lakes Surinsar and Mansar near Jammu. Drigatdesha or the country of two hollows was corrupted into

Dukyer and Dugra finally became Dogra. From Jammu stretching east along the plains of Punjab lies the land of Dogra and all, who live in this tract irrespective of their religion are referred as Dogras. They have certain national characteristics and a common language, which differentiates them from others. Some authorities doubt this derivation and say that Dogra is a corrupt form of Rajasthani word for hills Dungal, and that when Rajputs forced their way up north, they gave the name to this hilly area.

**Tibetans:** Tibetans are a refugee community, who migrated in 1962 from Tibet, which was taken over by China that time. These Tibetans settled mainly in the hilly regions of Himalayas. The group under study is settled in and around Leh town of Ladakh division of Jammu and Kashmir.

#### MATERIAL AND METHODS

In the present paper, five population groups of Jammu and Kashmir being reported are Gujjars, Dogra-Brahmans, Dogra-Rajputs, Dogra-Scheduled Castes and Tibetans. A cross-sectional sample of 1025 males was studied in 1989, the subjects selected were apparently healthy and

unrelated. The data were collected from Jammu and Leh districts of Jammu and Kashmir State. Dogra-Brahmans, Dogra-Rajputs and Dogra-Scheduled Castes sample were collected from Jammu district, located at comparatively low altitudes in Outer Himalayan Zone. Gujjars are a transhumant group, with winter headquarters in the lower ranges of Jammu district, while in summer they migrate to the higher ranges of Jammu valley; Kashmir valley and even to Ladakh ranges. Tibetan sample has been collected from in and around Leh, located in the Inner Himalayan range (altitude 3514 metres). The sample were collected for adolescent years as well as for adults. The adolescent sample ranged from 8+ to 18+ years; whereas all those subjects in 20th year and above were grouped as 19+ and above. All the subjects between age 8.00 to 8.99 were grouped in 8+ year age group, similar pattern was followed while grouping the subjects of other age-groups. Age-wise distribution of sample is given in table 1. The subjects were studied using standard techniques given by W.H.O. (1964); Weiner and Lourie (1969) and Singh and Bhasin (1989). Lung functions were studied using Morgans' portable spirometer.

Table 1: Sample size for anthropometric variables and lung functions in five population groups of Jammu and Kashmir

| Age<br>Years     | For Anthropometric Variables |                    |                   |                               |          | For Respiratory Functions |                    |                   |                               |          |
|------------------|------------------------------|--------------------|-------------------|-------------------------------|----------|---------------------------|--------------------|-------------------|-------------------------------|----------|
|                  | Gujjars                      | Dogra-<br>Brahmans | Dogra-<br>Rajputs | Dogra-<br>Scheduled<br>Castes | Tibetans | Gujjars                   | Dogra-<br>Brahmans | Dogra-<br>Rajputs | Dogra-<br>Scheduled<br>Castes | Tibetans |
| 8+               | -                            | 21                 | 24                | 22                            | 12       | -                         | 21                 | 24                | 22                            | 06       |
| 9+               | 06                           | 19                 | 20                | 17                            | 15       | 06                        | 19                 | 20                | 17                            | 05       |
| 10+              | 09                           | 20                 | 27                | 33                            | 11       | 09                        | 20                 | 27                | 33                            | 02       |
| 11+              | 08                           | 20                 | 22                | 32                            | 10       | 08                        | 20                 | 22                | 32                            | 07       |
| 12+              | 14                           | 23                 | 21                | 22                            | 10       | 14                        | 23                 | 21                | 22                            | 09       |
| 13+              | 10                           | 20                 | 20                | 27                            | 11       | 10                        | 20                 | 20                | 27                            | 10       |
| 14+              | 09                           | 21                 | 22                | 25                            | 07       | 09                        | 21                 | 22                | 25                            | 06       |
| 15+              | 08                           | 22                 | 22                | 25                            | 13       | 08                        | 22                 | 20                | 25                            | 10       |
| 16+              | 10                           | 20                 | 20                | 21                            | 20       | 10                        | 20                 | 20                | 21                            | 16       |
| 17+              | 04                           | 20                 | 20                | 20                            | 09       | 04                        | 20                 | 20                | 20                            | 09       |
| 18+              | 06                           | 20                 | 18                | 18                            | 05       | 06                        | 20                 | 18                | 18                            | 04       |
| 19+ and<br>above | 14                           | 21                 | 27                | 20                            | 12       | 14                        | 21                 | 27                | 20                            | 12       |

The following measurements were taken on each subject:

#### A. Anthropometric Variables

##### I. (1) Body weight

##### II. Projective Height Measurements

- (2) Height Vertex
- (3) Sitting Height Vertex

##### III. Diameters

- (4) Biacromial Diameter
- (5) Bicristal Diameter
- (6) Transverse Diameter of Chest
- (7) Antero-posterior Diameter of Chest
- (8) Humerus Bicondylar Diameter
- (9) Femur Bicondylar Diameter
- (10) Wrist Diameter
- (11) Ankle Diameter

##### IV. Circumferences

- (12) Chest Circumference—Normal
- (13) Chest Circumference—At maximum inspiration
- (14) Chest Circumference—At maximum expiration
- (15) Upper Arm Circumference—relaxed
- (16) Upper Arm Circumference—contracted
- (17) Calf Circumference

##### V. Skinfold Thickness

- (18) Biceps
- (19) Triceps
- (20) Subscapular
- (21) Supra-iliac
- (22) Calf
- (23) Forearm

#### B. Physiological Variables

##### VI. Lung Functions

- (24) Forced Vital Capacity (FVC)
- (25) Forced Expiratory Volume for one Second (FEV 1.0)
- (26) Peak Expiratory Flow (PEF)

In order to interpret the data numerically, means and standard deviation are reported in the present paper.

## RESULTS AND DISCUSSION

The results of the present investigation are represented in tables 2 and 3. It is mentioned here that the rate of growth is not uniform with respect to age either in the same measurement or between any two measurements. Some of the values even show decrements. These decrements may be due to sampling error and cross-sectional method of data collection.

#### A. Anthropometric Variables

##### I. Body weight

With a few exceptions, body weight shows gradual increase in all the population groups at all the yearly intervals, from 8+ to 18+ years. Increase in body weight is largest in Dogra-Scheduled Castes, followed by Dogra Rajputs, Gujjars, Dogra-Brahmans and Tibetans in the order given. Highest peak values corresponding to adolescent growth spurt has been observed between 13+ and 14+ years for Gujjars, Dogra-Brahmans, Dogra-Rajputs and Dogra-Scheduled Castes, whereas it is an year later in Tibetans (Table 2). In 19+ and above age group, highest weight has been recorded for Gujjars, followed by Dogra-Rajputs, Dogra-Brahmans, Tibetans and Dogra-Scheduled Castes.

##### II. Projective Height Measurements

For both height vertex and sitting height, there is a gradual growth at all the yearly intervals from 8+ to 18+ years in all the five population groups being studied. Dogra population groups show higher increments followed by Tibetans and Gujjars, in height vertex whereas for sitting height Dogras are followed by Gujjars and Tibetans. Highest peak value corresponding to adolescent growth spurt is seen between 10+ to 13+ years for both projective height measurements in Dogras as well as in Gujjars and Tibetans. For height vertex, 19+ and above group Gujjars are

Table 2. Anthropometric variables among five population groups of Jammu and Kashmir

| Age                                       | Gujjars |       | Dogra-Brahmans |      | Dogra-Rajputs |       | Dogra-Scheduled Castes |       | Tibetans |      |
|-------------------------------------------|---------|-------|----------------|------|---------------|-------|------------------------|-------|----------|------|
| Years                                     | Mean    | S.D.  | Mean           | S.D. | Mean          | S.D.  | Mean                   | S.D.  | Mean     | S.D. |
| <b>I. BODY WEIGHT (kg)</b>                |         |       |                |      |               |       |                        |       |          |      |
| 8+                                        | -       | -     | 20.64          | 1.69 | 21.91         | 3.84  | 20.45                  | 3.45  | 23.50    | 2.57 |
| 9+                                        | 28.41   | 3.77  | 22.23          | 2.52 | 22.37         | 2.24  | 22.52                  | 2.55  | 25.16    | 3.08 |
| 10+                                       | 27.38   | 3.47  | 25.80          | 3.45 | 25.11         | 4.50  | 22.83                  | 2.98  | 24.77    | 3.09 |
| 11+                                       | 30.87   | 5.43  | 27.40          | 3.42 | 27.70         | 5.47  | 27.73                  | 5.59  | 27.80    | 4.70 |
| 12+                                       | 35.53   | 6.14  | 31.10          | 3.87 | 32.45         | 9.74  | 29.59                  | 3.94  | 30.70    | 4.83 |
| 13+                                       | 38.75   | 5.08  | 33.27          | 5.52 | 34.77         | 6.02  | 35.12                  | 6.48  | 34.40    | 4.99 |
| 14+                                       | 42.94   | 4.55  | 39.61          | 5.76 | 40.25         | 6.78  | 40.54                  | 6.91  | 32.64    | 1.86 |
| 15+                                       | 48.50   | 8.35  | 46.18          | 6.04 | 43.11         | 1.22  | 46.84                  | 1.56  | 44.96    | 6.26 |
| 16+                                       | 51.45   | 4.83  | 46.25          | 5.09 | 48.25         | 3.79  | 46.14                  | 7.09  | 48.50    | 6.17 |
| 17+                                       | 51.37   | 4.57  | 47.25          | 5.04 | 52.27         | 6.67  | 49.00                  | 6.26  | 50.55    | 6.25 |
| 18+                                       | 48.83   | 0.81  | 50.92          | 5.66 | 52.97         | 7.60  | 52.52                  | 4.31  | 47.00    | 4.12 |
| 19+ and above                             | 61.00   | 3.36  | 60.26          | 4.11 | 60.35         | 16.24 | 55.67                  | 6.21  | 56.50    | 7.82 |
| <b>II. PROJECTIVE HEIGHT MEASUREMENTS</b> |         |       |                |      |               |       |                        |       |          |      |
| <b>2. HEIGHT VERTEX (cm)</b>              |         |       |                |      |               |       |                        |       |          |      |
| 8+                                        | -       | -     | 125.42         | 3.00 | 127.69        | 7.42  | 122.83                 | 8.78  | 125.60   | 4.04 |
| 9+                                        | 138.71  | 6.20  | 127.18         | 5.09 | 127.03        | 8.60  | 128.75                 | 4.45  | 127.99   | 4.64 |
| 10+                                       | 136.95  | 6.33  | 134.25         | 5.78 | 134.24        | 6.45  | 131.70                 | 5.65  | 128.26   | 5.40 |
| 11+                                       | 141.18  | 8.63  | 138.87         | 6.74 | 138.22        | 9.07  | 139.33                 | 8.83  | 132.56   | 7.43 |
| 12+                                       | 150.02  | 8.17  | 145.39         | 6.94 | 145.50        | 12.59 | 143.76                 | 7.77  | 137.94   | 7.24 |
| 13+                                       | 153.70  | 5.19  | 148.28         | 7.61 | 148.78        | 8.52  | 152.64                 | 9.80  | 145.10   | 8.34 |
| 14+                                       | 156.70  | 6.27  | 156.38         | 7.69 | 156.35        | 7.70  | 157.91                 | 7.17  | 139.92   | 9.49 |
| 15+                                       | 165.92  | 10.57 | 162.92         | 7.11 | 163.88        | 7.67  | 162.32                 | 5.09  | 154.84   | 7.50 |
| 16+                                       | 168.15  | 4.94  | 164.67         | 4.71 | 165.97        | 4.92  | 163.28                 | 6.93  | 160.28   | 6.89 |
| 17+                                       | 168.25  | 4.40  | 165.47         | 6.88 | 168.02        | 6.88  | 165.83                 | 6.57  | 161.42   | 4.21 |
| 18+                                       | 164.91  | 1.81  | 172.07         | 5.53 | 167.45        | 6.40  | 167.72                 | 6.42  | 159.04   | 4.80 |
| 19+ and above                             | 169.95  | 2.25  | 169.94         | 4.64 | 169.51        | 3.73  | 167.95                 | 5.26  | 161.62   | 4.77 |
| <b>3. SITTING HEIGHT (cm)</b>             |         |       |                |      |               |       |                        |       |          |      |
| 8+                                        | -       | -     | 65.93          | 2.56 | 66.24         | 3.82  | 66.76                  | 9.05  | 66.94    | 3.34 |
| 9+                                        | 75.53   | 8.30  | 67.46          | 4.85 | 65.22         | 3.96  | 67.27                  | 4.08  | 68.56    | 2.73 |
| 10+                                       | 69.63   | 3.76  | 70.37          | 5.74 | 70.39         | 4.90  | 67.40                  | 13.21 | 67.93    | 3.33 |
| 11+                                       | 72.01   | 3.78  | 70.62          | 3.16 | 68.74         | 7.76  | 68.20                  | 13.30 | 71.64    | 4.73 |
| 12+                                       | 75.83   | 3.64  | 74.46          | 4.43 | 75.72         | 7.52  | 73.49                  | 3.93  | 72.86    | 3.96 |
| 13+                                       | 77.74   | 2.94  | 75.95          | 4.04 | 76.02         | 3.80  | 78.22                  | 5.95  | 76.37    | 4.90 |
| 14+                                       | 80.55   | 3.10  | 79.71          | 4.38 | 76.27         | 17.66 | 80.12                  | 5.00  | 74.48    | 1.79 |
| 15+                                       | 82.25   | 5.92  | 82.25          | 3.83 | 84.13         | 5.26  | 83.93                  | 2.57  | 81.26    | 5.28 |
| 16+                                       | 85.74   | 3.01  | 84.40          | 3.46 | 86.51         | 2.89  | 83.99                  | 3.96  | 84.70    | 3.69 |
| 17+                                       | 84.67   | 1.95  | 84.20          | 3.54 | 86.81         | 3.07  | 84.55                  | 4.55  | 85.63    | 3.64 |
| 18+                                       | 80.90   | 2.53  | 86.72          | 3.29 | 86.60         | 4.12  | 85.75                  | 2.80  | 82.96    | 2.88 |
| 19+ and above                             | 83.75   | 1.78  | 85.11          | 3.10 | 85.62         | 2.66  | 84.01                  | 2.99  | 85.26    | 2.58 |
| <b>III. DIAMETERS</b>                     |         |       |                |      |               |       |                        |       |          |      |
| <b>4. BIACROMIAL DIAMETER (cm)</b>        |         |       |                |      |               |       |                        |       |          |      |
| 8+                                        | -       | -     | 26.60          | 1.70 | 26.74         | 1.97  | 26.25                  | 2.39  | 28.62    | 1.29 |
| 9+                                        | 28.63   | 2.59  | 27.54          | 1.37 | 27.64         | 1.35  | 27.68                  | 1.65  | 29.01    | 1.57 |
| 10+                                       | 29.66   | 1.36  | 29.25          | 1.80 | 28.26         | 2.45  | 28.38                  | 1.57  | 28.42    | 2.21 |



# STUDY OF PHYSICAL GROWTH AND RESPIRATORY FUNCTIONS

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| Age           | Gujjars |      | Dogra-Brahmans |      | Dogra-Rajputs |      | Dogra-Scheduled Castes |      | Tibetans |      |
|---------------|---------|------|----------------|------|---------------|------|------------------------|------|----------|------|
| Years         | Mean    | S.D. | Mean           | S.D. | Mean          | S.D. | Mean                   | S.D. | Mean     | S.D. |
| 11+           | 30.00   | 2.10 | 29.46          | 2.02 | 29.74         | 2.91 | 29.79                  | 2.61 | 29.37    | 2.16 |
| 12+           | 32.20   | 3.07 | 30.20          | 3.03 | 31.51         | 3.58 | 30.83                  | 2.01 | 30.37    | 1.73 |
| 13+           | 33.19   | 1.69 | 32.64          | 1.88 | 32.74         | 2.08 | 33.04                  | 2.51 | 31.34    | 2.15 |
| 14+           | 34.40   | 2.41 | 34.09          | 2.49 | 34.64         | 2.58 | 34.10                  | 3.38 | 30.08    | 3.29 |
| 15+           | 36.41   | 3.30 | 35.52          | 1.94 | 35.74         | 2.17 | 36.12                  | 1.50 | 34.56    | 4.20 |
| 16+           | 37.33   | 1.88 | 36.71          | 1.81 | 37.27         | 1.91 | 36.03                  | 2.03 | 36.61    | 2.09 |
| 17+           | 36.57   | 2.19 | 36.89          | 1.30 | 38.57         | 2.13 | 37.37                  | 2.75 | 36.12    | 4.46 |
| 18+           | 36.73   | 0.91 | 38.67          | 1.73 | 39.05         | 2.35 | 39.55                  | 1.89 | 36.06    | 2.13 |
| 19+ and above | 39.00   | 0.91 | 39.95          | 1.51 | 40.20         | 1.71 | 39.00                  | 1.60 | 37.79    | 2.14 |

## 5. BICRISTAL DIAMETER (cm)

|               |       |      |       |      |       |      |       |      |       |      |
|---------------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+            | -     | -    | 19.36 | 0.84 | 20.08 | 2.18 | 19.69 | 1.39 | 21.39 | 0.91 |
| 9+            | 21.06 | 0.99 | 20.43 | 2.69 | 19.75 | 0.98 | 20.40 | 1.04 | 21.78 | 1.80 |
| 10+           | 21.17 | 1.28 | 21.41 | 2.15 | 20.93 | 1.71 | 20.53 | 1.09 | 21.46 | 1.67 |
| 11+           | 22.25 | 1.70 | 21.49 | 1.48 | 21.84 | 1.96 | 22.30 | 1.81 | 22.21 | 1.79 |
| 12+           | 23.69 | 2.27 | 22.73 | 1.54 | 23.14 | 2.65 | 23.24 | 1.94 | 22.86 | 1.69 |
| 13+           | 24.83 | 1.49 | 23.44 | 2.15 | 23.89 | 1.64 | 24.27 | 2.02 | 24.24 | 1.46 |
| 14+           | 25.53 | 1.92 | 25.41 | 1.92 | 25.01 | 1.70 | 25.59 | 2.06 | 23.97 | 0.74 |
| 15+           | 26.53 | 1.67 | 27.01 | 2.85 | 26.94 | 1.77 | 26.80 | 2.63 | 26.58 | 1.45 |
| 16+           | 27.31 | 1.60 | 27.36 | 1.53 | 27.27 | 1.30 | 26.98 | 1.74 | 27.96 | 2.21 |
| 17+           | 27.50 | 2.34 | 27.16 | 1.24 | 28.48 | 1.54 | 27.23 | 1.84 | 27.27 | 1.83 |
| 18+           | 28.16 | 0.50 | 28.69 | 0.91 | 28.40 | 2.37 | 28.47 | 1.76 | 27.56 | 1.32 |
| 19+ and above | 28.45 | 1.21 | 29.07 | 1.55 | 28.57 | 2.28 | 28.93 | 2.74 | 29.45 | 1.93 |

## 6. TRANSVERSE DIAMETER OF CHEST (cm)

|               |       |      |       |      |       |      |       |      |       |      |
|---------------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+            | -     | -    | 18.57 | 0.89 | 18.18 | 0.93 | 18.31 | 0.92 | 20.26 | 0.84 |
| 9+            | 19.85 | 1.02 | 18.49 | 0.62 | 18.40 | 0.97 | 18.41 | 1.48 | 20.88 | 0.98 |
| 10+           | 19.92 | 0.90 | 18.92 | 1.19 | 19.19 | 1.55 | 19.34 | 1.71 | 20.71 | 1.36 |
| 11+           | 20.20 | 1.57 | 20.11 | 1.69 | 19.69 | 1.57 | 19.87 | 1.62 | 21.11 | 1.50 |
| 12+           | 21.30 | 1.31 | 20.35 | 1.06 | 20.86 | 2.31 | 20.16 | 1.01 | 21.47 | 1.23 |
| 13+           | 23.23 | 4.36 | 20.20 | 4.98 | 21.21 | 1.44 | 21.45 | 1.78 | 21.71 | 1.23 |
| 14+           | 23.20 | 1.35 | 22.16 | 1.44 | 22.37 | 1.64 | 22.44 | 2.14 | 22.47 | 1.53 |
| 15+           | 23.95 | 1.89 | 23.52 | 1.66 | 23.63 | 1.93 | 23.50 | 1.50 | 24.89 | 2.84 |
| 16+           | 24.53 | 1.34 | 23.39 | 1.84 | 23.89 | 1.77 | 23.85 | 1.75 | 25.20 | 2.04 |
| 17+           | 23.60 | 1.31 | 24.51 | 1.31 | 25.47 | 1.77 | 24.57 | 1.23 | 26.51 | 2.32 |
| 18+           | 25.68 | 0.85 | 25.78 | 1.44 | 25.95 | 1.75 | 25.47 | 1.63 | 25.36 | 1.64 |
| 19+ and above | 25.62 | 1.10 | 26.92 | 2.39 | 26.39 | 2.27 | 26.05 | 1.42 | 26.98 | 2.12 |

## 7. ANTERO-POSTERIOR DIAMETER OF CHEST (cm)

|     |       |      |       |      |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+  | -     | -    | 13.94 | 1.00 | 13.79 | 1.04 | 13.79 | 0.85 | 15.59 | 0.71 |
| 9+  | 14.35 | 1.03 | 14.27 | 0.85 | 14.15 | 1.01 | 13.72 | 1.18 | 16.16 | 0.93 |
| 10+ | 13.56 | 1.60 | 14.71 | 1.72 | 14.56 | 1.46 | 14.40 | 1.49 | 16.58 | 0.85 |
| 11+ | 14.77 | 1.12 | 15.31 | 1.98 | 14.78 | 1.13 | 14.93 | 1.13 | 16.78 | 0.88 |
| 12+ | 14.82 | 1.05 | 15.71 | 1.54 | 15.38 | 1.37 | 15.50 | 1.26 | 17.01 | 1.36 |
| 13+ | 15.63 | 1.45 | 15.09 | 3.86 | 16.22 | 1.23 | 16.17 | 1.40 | 16.23 | 1.57 |
| 14+ | 17.28 | 1.64 | 16.47 | 1.30 | 16.81 | 1.27 | 17.16 | 1.63 | 16.87 | 0.64 |
| 15+ | 17.33 | 1.33 | 17.94 | 1.12 | 17.15 | 1.50 | 17.74 | 1.26 | 18.80 | 1.27 |

| Age                                 | Gujjars |      | Dogra-Brahmans |      | Dogra-Rajputs |      | Dogra-Scheduled Castes |      | Tibetans |      |
|-------------------------------------|---------|------|----------------|------|---------------|------|------------------------|------|----------|------|
| Years                               | Mean    | S.D. | Mean           | S.D. | Mean          | S.D. | Mean                   | S.D. | Mean     | S.D. |
| 16+                                 | 18.09   | 0.82 | 18.14          | 1.32 | 17.66         | 0.73 | 17.81                  | 1.31 | 19.13    | 1.11 |
| 17+                                 | 17.17   | 0.74 | 18.37          | 1.89 | 18.87         | 1.38 | 18.50                  | 1.73 | 20.21    | 1.24 |
| 18+                                 | 17.93   | 0.56 | 18.31          | 1.99 | 19.29         | 2.60 | 21.21                  | 4.46 | 19.84    | 1.40 |
| 19+ and above                       | 17.75   | 2.98 | 20.02          | 1.37 | 20.46         | 2.67 | 19.21                  | 1.90 | 21.41    | 2.00 |
| 8. HUMERUS BICONDYLAR DIAMETER (mm) |         |      |                |      |               |      |                        |      |          |      |
| 8+                                  | -       | -    | 5.10           | 0.31 | 4.91          | 0.44 | 4.81                   | 0.38 | 4.90     | 0.36 |
| 9+                                  | 4.98    | 0.27 | 4.77           | 0.28 | 5.03          | 0.35 | 4.94                   | 0.22 | 4.91     | 0.27 |
| 10+                                 | 5.22    | 0.26 | 5.23           | 0.34 | 5.21          | 0.48 | 5.08                   | 0.34 | 4.91     | 0.27 |
| 11+                                 | 5.47    | 0.32 | 5.28           | 0.30 | 5.29          | 0.44 | 5.30                   | 0.50 | 5.06     | 0.40 |
| 12+                                 | 5.78    | 0.53 | 5.58           | 0.35 | 5.74          | 0.62 | 5.58                   | 0.42 | 5.37     | 0.36 |
| 13+                                 | 6.05    | 0.29 | 5.94           | 0.57 | 5.81          | 0.40 | 5.80                   | 0.46 | 5.58     | 0.36 |
| 14+                                 | 6.25    | 0.40 | 6.10           | 0.48 | 6.14          | 0.49 | 6.12                   | 0.48 | 5.58     | 0.31 |
| 15+                                 | 6.41    | 0.54 | 6.42           | 0.38 | 6.27          | 0.47 | 6.20                   | 0.34 | 6.19     | 0.34 |
| 16+                                 | 6.38    | 0.21 | 6.32           | 0.40 | 6.58          | 0.49 | 6.28                   | 0.36 | 6.41     | 0.38 |
| 17+                                 | 6.60    | 0.14 | 6.35           | 0.37 | 6.59          | 0.26 | 6.34                   | 0.44 | 6.44     | 0.34 |
| 18+                                 | 6.33    | 0.19 | 6.52           | 0.41 | 6.59          | 0.27 | 6.48                   | 0.29 | 6.32     | 0.23 |
| 19+ and above                       | 6.65    | 1.29 | 6.56           | 0.33 | 6.55          | 0.37 | 6.32                   | 0.56 | 6.38     | 0.27 |
| 9. FEMUR BICONDYLAR DIAMETER (cm)   |         |      |                |      |               |      |                        |      |          |      |
| 8+                                  | -       | -    | 7.52           | 0.35 | 7.56          | 0.49 | 7.46                   | 0.43 | 7.70     | 0.50 |
| 9+                                  | 7.50    | 0.74 | 7.46           | 0.52 | 7.64          | 0.34 | 7.74                   | 0.48 | 7.75     | 0.35 |
| 10+                                 | 8.03    | 0.46 | 7.96           | 0.33 | 7.82          | 0.43 | 7.78                   | 0.50 | 7.65     | 0.47 |
| 11+                                 | 8.48    | 0.41 | 7.97           | 0.44 | 8.12          | 0.51 | 8.09                   | 0.61 | 8.06     | 0.44 |
| 12+                                 | 8.70    | 0.49 | 8.39           | 0.43 | 8.38          | 0.60 | 8.32                   | 0.39 | 8.14     | 0.41 |
| 13+                                 | 8.80    | 0.31 | 8.54           | 0.53 | 8.64          | 0.45 | 8.52                   | 0.45 | 8.41     | 0.37 |
| 14+                                 | 8.95    | 0.42 | 8.80           | 0.37 | 8.85          | 0.47 | 8.73                   | 0.41 | 8.20     | 0.26 |
| 15+                                 | 8.91    | 0.67 | 8.96           | 0.42 | 8.90          | 0.51 | 8.83                   | 0.31 | 8.89     | 0.50 |
| 16+                                 | 9.20    | 0.24 | 8.84           | 0.52 | 9.02          | 0.36 | 8.87                   | 0.54 | 8.84     | 0.37 |
| 17+                                 | 9.20    | 0.55 | 8.91           | 0.51 | 9.31          | 0.49 | 8.99                   | 0.48 | 8.88     | 0.31 |
| 18+                                 | 8.70    | 0.15 | 9.32           | 0.43 | 9.28          | 0.55 | 9.26                   | 0.31 | 8.84     | 0.42 |
| 19+ and above                       | 8.80    | 0.53 | 9.12           | 0.27 | 9.23          | 0.43 | 8.85                   | 0.85 | 8.83     | 0.60 |
| 10. WRIST DIAMETER (cm)             |         |      |                |      |               |      |                        |      |          |      |
| 8+                                  | -       | -    | 4.03           | 0.19 | 3.99          | 0.33 | 3.80                   | 0.28 | 3.94     | 0.19 |
| 9+                                  | 4.16    | 0.33 | 3.93           | 0.29 | 3.93          | 0.24 | 4.14                   | 0.24 | 4.08     | 0.23 |
| 10+                                 | 4.11    | 0.34 | 4.29           | 0.42 | 4.22          | 0.37 | 4.08                   | 0.24 | 3.88     | 0.29 |
| 11+                                 | 4.47    | 0.30 | 4.31           | 0.42 | 4.29          | 0.36 | 4.39                   | 0.98 | 4.17     | 0.25 |
| 12+                                 | 4.66    | 0.44 | 4.49           | 0.28 | 4.53          | 0.51 | 4.45                   | 0.34 | 4.33     | 0.29 |
| 13+                                 | 4.83    | 0.31 | 4.57           | 0.30 | 4.68          | 0.34 | 4.74                   | 0.33 | 4.60     | 0.37 |
| 14+                                 | 4.98    | 0.32 | 4.92           | 0.30 | 4.95          | 0.35 | 4.76                   | 0.34 | 4.40     | 0.28 |
| 15+                                 | 5.11    | 0.48 | 5.01           | 0.35 | 4.96          | 0.34 | 4.90                   | 0.35 | 4.83     | 0.37 |
| 16+                                 | 5.00    | 0.20 | 5.00           | 0.28 | 5.15          | 0.35 | 5.02                   | 0.33 | 5.13     | 0.40 |
| 17+                                 | 4.92    | 0.22 | 5.16           | 0.33 | 5.07          | 0.60 | 5.06                   | 0.31 | 5.26     | 0.24 |
| 18+                                 | 5.35    | 0.32 | 5.25           | 0.33 | 5.17          | 0.57 | 5.28                   | 0.30 | 5.08     | 0.32 |
| 19+ and above                       | 5.45    | 0.25 | 5.24           | 0.43 | 5.35          | 0.24 | 5.12                   | 0.58 | 5.24     | 0.32 |

| Age                                          | Gujjars |      | Dogra-Brahmans |       | Dogra-Rajputs |       | Dogra-Scheduled Castes |       | Tibetans |      |
|----------------------------------------------|---------|------|----------------|-------|---------------|-------|------------------------|-------|----------|------|
| Years                                        | Mean    | S.D. | Mean           | S.D.  | Mean          | S.D.  | Mean                   | S.D.  | Mean     | S.D. |
| <b>11. ANKLE DIAMETER (cm)</b>               |         |      |                |       |               |       |                        |       |          |      |
| 8+                                           | -       | -    | 5.96           | 0.44  | 5.65          | 0.48  | 5.75                   | 0.46  | 5.85     | 0.51 |
| 9+                                           | 6.36    | 0.39 | 5.72           | 0.48  | 5.73          | 0.36  | 5.79                   | 0.40  | 5.86     | 0.39 |
| 10+                                          | 6.15    | 0.21 | 5.88           | 0.31  | 5.96          | 0.52  | 5.92                   | 0.36  | 5.95     | 0.39 |
| 11+                                          | 6.58    | 0.38 | 6.10           | 0.50  | 6.18          | 0.48  | 6.13                   | 0.44  | 5.74     | 0.62 |
| 12+                                          | 6.57    | 0.45 | 6.35           | 0.51  | 6.37          | 0.52  | 6.41                   | 0.40  | 6.16     | 0.50 |
| 13+                                          | 6.83    | 0.41 | 6.53           | 0.48  | 6.63          | 0.40  | 6.49                   | 0.39  | 6.51     | 0.36 |
| 14+                                          | 6.94    | 0.28 | 6.53           | 1.33  | 6.80          | 0.59  | 6.74                   | 0.33  | 6.41     | 0.51 |
| 15+                                          | 6.73    | 0.44 | 6.85           | 0.36  | 6.84          | 0.45  | 6.90                   | 0.37  | 6.80     | 0.29 |
| 16+                                          | 6.98    | 0.44 | 6.80           | 0.42  | 6.93          | 0.58  | 6.73                   | 0.42  | 6.98     | 0.48 |
| 17+                                          | 6.92    | 0.57 | 6.89           | 0.42  | 6.85          | 0.32  | 6.94                   | 0.47  | 6.95     | 0.53 |
| 18+                                          | 7.63    | 0.42 | 6.97           | 0.47  | 6.91          | 0.45  | 6.84                   | 0.36  | 7.10     | 0.39 |
| 19+ and above                                | 7.32    | 0.23 | 7.31           | 0.43  | 7.18          | 0.59  | 6.91                   | 0.56  | 6.80     | 0.31 |
| <b>IV. CIRCUMFERENCES</b>                    |         |      |                |       |               |       |                        |       |          |      |
| <b>12. CHEST CIRCUMFERENCE (Normal—cm)</b>   |         |      |                |       |               |       |                        |       |          |      |
| 8+                                           | -       | -    | 58.66          | 2.15  | 58.96         | 3.60  | 58.99                  | 3.43  | 66.88    | 2.26 |
| 9+                                           | 60.91   | 3.09 | 59.37          | 1.97  | 60.71         | 2.26  | 59.24                  | 2.58  | 69.38    | 4.09 |
| 10+                                          | 64.01   | 2.52 | 59.50          | 14.42 | 61.73         | 3.66  | 62.50                  | 2.91  | 67.90    | 4.21 |
| 11+                                          | 66.86   | 5.93 | 60.92          | 14.90 | 63.96         | 4.31  | 63.05                  | 11.40 | 68.50    | 3.87 |
| 12+                                          | 70.15   | 6.06 | 63.78          | 14.20 | 68.56         | 7.80  | 66.50                  | 3.42  | 69.68    | 3.32 |
| 13+                                          | 72.10   | 3.69 | 58.22          | 24.30 | 70.07         | 5.25  | 70.48                  | 5.15  | 70.82    | 3.18 |
| 14+                                          | 77.16   | 5.84 | 72.35          | 4.13  | 70.78         | 16.61 | 72.95                  | 6.02  | 70.47    | 3.70 |
| 15+                                          | 79.66   | 5.18 | 76.37          | 5.08  | 73.63         | 17.22 | 77.90                  | 4.62  | 80.43    | 5.52 |
| 16+                                          | 82.18   | 5.00 | 68.72          | 24.10 | 80.47         | 2.82  | 78.67                  | 4.87  | 81.33    | 4.55 |
| 17+                                          | 81.50   | 5.09 | 72.71          | 25.03 | 79.47         | 19.39 | 81.08                  | 5.01  | 84.31    | 5.26 |
| 18+                                          | 84.33   | 2.22 | 82.49          | 3.89  | 83.12         | 3.33  | 85.20                  | 4.80  | 80.30    | 3.72 |
| 19+ and above                                | 88.27   | 3.31 | 76.42          | 3.21  | 89.59         | 5.57  | 87.67                  | 0.45  | 90.04    | 4.88 |
| <b>13. CHEST CIRCUMFERENCE (Inspired—cm)</b> |         |      |                |       |               |       |                        |       |          |      |
| 8+                                           | -       | -    | 63.40          | 2.44  | 63.55         | 3.90  | 63.28                  | 3.51  | 71.76    | 2.21 |
| 9+                                           | 63.91   | 3.46 | 64.60          | 2.35  | 64.40         | 2.64  | 63.97                  | 2.63  | 73.50    | 4.17 |
| 10+                                          | 68.16   | 2.70 | 66.90          | 3.31  | 66.15         | 4.32  | 66.56                  | 3.11  | 73.48    | 4.84 |
| 11+                                          | 69.56   | 5.66 | 68.66          | 4.58  | 69.33         | 4.76  | 69.20                  | 4.48  | 73.31    | 3.56 |
| 12+                                          | 73.74   | 6.14 | 69.93          | 3.10  | 73.54         | 7.62  | 70.90                  | 3.46  | 74.30    | 3.98 |
| 13+                                          | 76.21   | 4.00 | 68.80          | 17.08 | 74.58         | 5.08  | 74.25                  | 5.48  | 75.49    | 3.34 |
| 14+                                          | 79.71   | 4.34 | 77.45          | 4.97  | 79.38         | 5.07  | 77.22                  | 6.51  | 74.21    | 4.34 |
| 15+                                          | 83.00   | 6.88 | 82.09          | 4.72  | 81.40         | 5.62  | 82.59                  | 4.65  | 84.96    | 5.57 |
| 16+                                          | 86.01   | 5.15 | 81.66          | 5.70  | 85.28         | 2.48  | 82.89                  | 4.96  | 86.19    | 5.10 |
| 17+                                          | 86.55   | 4.10 | 84.73          | 4.86  | 89.40         | 5.08  | 86.37                  | 5.22  | 89.91    | 5.48 |
| 18+                                          | 89.10   | 1.40 | 85.70          | 4.41  | 89.67         | 5.07  | 90.21                  | 5.04  | 86.46    | 3.35 |
| 19+ and above                                | 93.27   | 1.78 | 93.78          | 3.95  | 94.07         | 6.64  | 91.71                  | 4.86  | 94.21    | 6.27 |
| <b>14. CHEST CIRCUMFERENCE (Expired—cm)</b>  |         |      |                |       |               |       |                        |       |          |      |
| 8+                                           | -       | -    | 56.19          | 2.21  | 56.02         | 3.44  | 56.37                  | 3.20  | 64.08    | 2.12 |
| 9+                                           | 58.81   | 3.13 | 56.35          | 2.04  | 58.19         | 2.31  | 56.17                  | 2.79  | 66.82    | 3.79 |
| 10+                                          | 61.00   | 2.66 | 59.83          | 3.59  | 57.95         | 6.96  | 59.89                  | 3.18  | 65.20    | 3.91 |

| Age           | Gujjars |      | Dogra-Brahmans |       | Dogra-Rajputs |       | Dogra-Scheduled Castes |      | Tibetans |      |
|---------------|---------|------|----------------|-------|---------------|-------|------------------------|------|----------|------|
| Years         | Mean    | S.D. | Mean           | S.D.  | Mean          | S.D.  | Mean                   | S.D. | Mean     | S.D. |
| 11+           | 62.17   | 4.97 | 59.11          | 10.33 | 61.65         | 4.35  | 61.43                  | 3.95 | 66.36    | 4.02 |
| 12+           | 66.55   | 5.33 | 62.75          | 3.87  | 65.81         | 7.76  | 63.53                  | 3.01 | 67.45    | 3.79 |
| 13+           | 67.93   | 3.70 | 62.05          | 15.45 | 67.37         | 4.28  | 67.20                  | 4.85 | 67.93    | 2.75 |
| 14+           | 72.81   | 4.73 | 69.96          | 4.18  | 70.90         | 4.86  | 67.77                  | 5.97 | 67.72    | 3.94 |
| 15+           | 75.48   | 7.31 | 73.98          | 5.14  | 71.08         | 11.14 | 74.66                  | 4.35 | 77.73    | 5.42 |
| 16+           | 77.60   | 4.08 | 73.11          | 5.05  | 73.62         | 16.20 | 74.50                  | 5.24 | 78.34    | 4.24 |
| 17+           | 77.47   | 18   | 76.63          | 3.76  | 77.68         | 13.48 | 77.51                  | 4.97 | 81.22    | 5.01 |
| 18+           | 77.13   | 2.82 | 78.62          | 4.36  | 79.05         | 4.40  | 81.11                  | 5.08 | 78.00    | 3.95 |
| 19+ and above | 84.22   | 2.68 | 85.68          | 3.78  | 85.37         | 5.86  | 83.70                  | 5.00 | 90.04    | 4.88 |

## 15. UPPER ARM CIRCUMFERENCE RELAXED (cm)

|               |       |      |       |      |       |      |       |      |       |      |
|---------------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+            | -     | -    | 15.90 | 1.20 | 15.41 | 1.04 | 15.26 | 1.47 | 16.80 | 1.05 |
| 9+            | 16.31 | 0.71 | 16.00 | 2.19 | 15.26 | 0.72 | 15.24 | 1.07 | 17.12 | 1.11 |
| 10+           | 16.11 | 1.05 | 16.41 | 1.42 | 16.10 | 1.49 | 15.93 | 1.27 | 16.19 | 1.06 |
| 11+           | 17.13 | 1.26 | 16.85 | 1.88 | 16.60 | 1.33 | 16.09 | 3.47 | 17.18 | 1.29 |
| 12+           | 18.12 | 1.56 | 16.74 | 1.05 | 17.75 | 2.09 | 16.60 | 1.02 | 17.82 | 1.37 |
| 13+           | 18.57 | 1.19 | 17.65 | 1.56 | 18.45 | 1.66 | 17.89 | 1.62 | 18.18 | 1.11 |
| 14+           | 20.87 | 2.11 | 18.99 | 1.50 | 19.26 | 1.77 | 18.86 | 2.05 | 17.70 | 0.61 |
| 15+           | 20.71 | 2.12 | 19.87 | 1.83 | 19.81 | 2.06 | 20.15 | 1.38 | 20.29 | 1.82 |
| 16+           | 21.48 | 1.33 | 20.61 | 1.89 | 21.34 | 1.64 | 20.28 | 1.75 | 20.96 | 1.58 |
| 17+           | 21.37 | 0.94 | 20.88 | 1.44 | 21.84 | 1.47 | 21.61 | 2.45 | 21.74 | 0.80 |
| 18+           | 21.98 | 0.76 | 21.67 | 2.08 | 23.03 | 1.62 | 21.77 | 1.78 | 20.22 | 1.85 |
| 19+ and above | 24.20 | 0.72 | 23.78 | 1.43 | 24.23 | 2.92 | 22.64 | 2.13 | 23.39 | 1.85 |

## 16. ARM GIRTH CONTRACTED (cm)

|               |       |      |       |      |       |      |       |      |       |      |
|---------------|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+            | -     | -    | 17.40 | 1.34 | 15.95 | 3.59 | 16.65 | 1.80 | 18.53 | 0.97 |
| 9+            | 17.81 | 1.10 | 17.02 | 1.20 | 16.70 | 0.94 | 16.57 | 1.33 | 18.65 | 1.36 |
| 10+           | 17.87 | 1.46 | 18.34 | 1.95 | 17.74 | 1.68 | 17.47 | 1.37 | 17.74 | 1.04 |
| 11+           | 18.92 | 1.50 | 18.18 | 1.42 | 18.36 | 1.54 | 17.73 | 3.98 | 19.19 | 1.72 |
| 12+           | 20.44 | 2.51 | 18.57 | 1.14 | 19.34 | 2.60 | 18.36 | 1.16 | 19.53 | 1.59 |
| 13+           | 21.19 | 1.24 | 19.73 | 1.80 | 20.42 | 2.13 | 19.91 | 1.89 | 20.22 | 1.59 |
| 14+           | 23.03 | 2.33 | 21.13 | 2.14 | 21.88 | 2.25 | 21.24 | 2.53 | 19.74 | 0.65 |
| 15+           | 23.50 | 2.81 | 22.79 | 2.19 | 22.65 | 2.43 | 22.93 | 1.47 | 23.42 | 2.24 |
| 16+           | 24.67 | 1.70 | 22.83 | 2.38 | 24.19 | 1.73 | 22.83 | 1.98 | 23.76 | 2.13 |
| 17+           | 24.85 | 1.69 | 23.65 | 1.86 | 25.38 | 1.86 | 24.16 | 2.55 | 25.81 | 1.76 |
| 18+           | 25.71 | 0.62 | 24.35 | 2.51 | 26.35 | 2.24 | 25.10 | 1.60 | 23.48 | 1.28 |
| 19+ and above | 28.17 | 1.81 | 27.91 | 2.05 | 28.17 | 3.78 | 26.32 | 3.12 | 26.15 | 1.67 |

## 17. CALF GIRTH (cm)

|     |       |      |       |      |       |      |       |      |       |      |
|-----|-------|------|-------|------|-------|------|-------|------|-------|------|
| 8+  | -     | -    | 22.54 | 1.85 | 22.12 | 1.67 | 21.96 | 2.70 | 23.20 | 0.98 |
| 9+  | 23.41 | 1.27 | 22.43 | 1.74 | 21.48 | 1.78 | 22.22 | 1.65 | 23.75 | 0.88 |
| 10+ | 23.62 | 1.41 | 23.54 | 1.39 | 23.02 | 1.87 | 22.58 | 1.36 | 23.20 | 1.89 |
| 11+ | 25.31 | 1.64 | 22.89 | 2.88 | 24.15 | 1.83 | 24.10 | 2.20 | 24.99 | 1.69 |
| 12+ | 26.25 | 2.48 | 24.43 | 1.30 | 25.61 | 3.10 | 24.14 | 1.31 | 25.65 | 2.20 |
| 13+ | 27.62 | 1.79 | 25.46 | 1.95 | 26.20 | 2.26 | 26.15 | 2.36 | 26.36 | 1.84 |
| 14+ | 29.25 | 1.64 | 27.27 | 1.50 | 28.10 | 2.31 | 27.17 | 2.05 | 26.42 | 1.04 |
| 15+ | 30.41 | 2.30 | 29.38 | 2.25 | 29.10 | 2.28 | 28.72 | 1.74 | 30.05 | 1.43 |

| Age           | Gujjars |      | Dogra-Brahmans |      | Dogra-Rajputs |      | Dogra-Scheduled Castes |      | Tibetans |      |
|---------------|---------|------|----------------|------|---------------|------|------------------------|------|----------|------|
| Years         | Mean    | S.D. | Mean           | S.D. | Mean          | S.D. | Mean                   | S.D. | Mean     | S.D. |
| 16+           | 31.00   | 2.02 | 29.34          | 2.13 | 29.98         | 1.63 | 29.14                  | 2.21 | 31.16    | 1.89 |
| 17+           | 31.05   | 1.21 | 29.46          | 2.51 | 30.42         | 2.55 | 29.94                  | 2.21 | 31.17    | 1.52 |
| 18+           | 30.33   | 0.78 | 30.51          | 2.10 | 31.96         | 2.89 | 31.32                  | 1.94 | 29.90    | 0.60 |
| 19+ and above | 33.27   | 2.00 | 32.75          | 1.62 | 33.17         | 3.21 | 31.92                  | 3.32 | 29.66    | 3.44 |

## V. SKINFOLD THICKNESS

## 18. BICEPS SKINFOLD (mm)

|               |      |      |      |      |      |      |      |      |      |      |
|---------------|------|------|------|------|------|------|------|------|------|------|
| 8+            | -    | -    | 3.57 | 0.50 | 3.66 | 0.81 | 3.22 | 0.89 | 4.16 | 0.71 |
| 9+            | 3.38 | 0.51 | 3.94 | 0.97 | 3.75 | 0.91 | 3.35 | 0.70 | 4.13 | 0.91 |
| 10+           | 3.11 | 0.92 | 3.40 | 0.82 | 3.62 | 1.24 | 5.48 | 1.37 | 4.00 | 1.41 |
| 11+           | 4.62 | 1.40 | 3.85 | 1.38 | 3.59 | 0.90 | 5.81 | 1.61 | 3.80 | 0.78 |
| 12+           | 3.57 | 0.99 | 3.08 | 1.08 | 3.57 | 0.74 | 2.90 | 0.75 | 3.60 | 0.69 |
| 13+           | 3.00 | 0.67 | 3.45 | 1.27 | 3.75 | 1.94 | 3.11 | 1.12 | 3.54 | 0.93 |
| 14+           | 4.66 | 1.58 | 3.47 | 0.81 | 3.59 | 1.00 | 3.36 | 0.90 | 3.71 | 0.75 |
| 15+           | 4.00 | 1.06 | 3.81 | 2.03 | 3.27 | 0.98 | 5.52 | 1.99 | 3.23 | 0.43 |
| 16+           | 3.10 | 0.56 | 4.30 | 1.65 | 3.40 | 0.99 | 3.14 | 0.72 | 3.55 | 0.60 |
| 17+           | 3.50 | 0.57 | 3.45 | 0.60 | 3.85 | 0.81 | 3.55 | 1.05 | 3.33 | 1.00 |
| 18+           | 4.00 | 0.63 | 3.75 | 0.63 | 4.00 | 0.76 | 4.16 | 2.00 | 3.00 | 0.00 |
| 19+ and above | 3.00 | 1.41 | 4.52 | 1.66 | 4.92 | 3.03 | 4.35 | 2.10 | 4.08 | 1.62 |

## 19. TRICEPS SKINFOLD (mm)

|               |      |      |      |      |      |      |      |      |      |      |
|---------------|------|------|------|------|------|------|------|------|------|------|
| 8+            | -    | -    | 5.95 | 1.28 | 6.33 | 1.20 | 5.77 | 1.60 | 9.33 | 1.37 |
| 9+            | 6.00 | 1.09 | 6.52 | 1.30 | 6.10 | 1.29 | 5.88 | 0.85 | 8.53 | 2.03 |
| 10+           | 4.44 | 1.01 | 6.70 | 2.29 | 6.07 | 1.41 | 6.12 | 1.83 | 7.18 | 1.77 |
| 11+           | 6.62 | 2.38 | 6.00 | 1.68 | 6.45 | 1.76 | 6.68 | 3.0  | 7.10 | 1.19 |
| 12+           | 5.57 | 1.55 | 5.47 | 1.41 | 6.47 | 1.88 | 5.22 | 1.19 | 7.50 | 1.77 |
| 13+           | 5.30 | 1.05 | 5.75 | 1.88 | 7.00 | 3.71 | 5.44 | 1.39 | 7.00 | 2.14 |
| 14+           | 7.11 | 3.01 | 6.04 | 1.53 | 6.13 | 1.42 | 5.24 | 1.16 | 6.85 | 1.34 |
| 15+           | 5.50 | 2.32 | 6.40 | 2.98 | 5.40 | 1.59 | 5.64 | 1.25 | 7.00 | 2.58 |
| 16+           | 6.40 | 2.27 | 6.40 | 1.98 | 5.90 | 1.29 | 5.57 | 1.56 | 6.50 | 1.50 |
| 17+           | 6.25 | 1.70 | 6.25 | 1.51 | 7.05 | 2.45 | 5.75 | 1.88 | 6.66 | 1.73 |
| 18+           | 7.33 | 1.36 | 5.85 | 1.38 | 6.88 | 2.37 | 6.94 | 2.04 | 5.40 | 1.14 |
| 19+ and above | 5.25 | 1.89 | 8.00 | 2.16 | 8.48 | 4.70 | 7.15 | 2.45 | 7.83 | 2.72 |

## 20. SUBSCAPULAR SKINFOLD (mm)

|               |      |      |      |      |       |      |       |      |      |      |
|---------------|------|------|------|------|-------|------|-------|------|------|------|
| 8+            | -    | -    | 4.66 | 0.65 | 4.54  | 0.83 | 4.27  | 0.82 | 5.33 | 1.37 |
| 9+            | 4.33 | 0.51 | 4.68 | 0.82 | 4.30  | 1.03 | 4.17  | 0.88 | 5.26 | 2.03 |
| 10+           | 3.88 | 0.92 | 5.00 | 1.33 | 4.33  | 1.17 | 4.78  | 1.08 | 5.36 | 1.77 |
| 11+           | 4.87 | 1.35 | 4.50 | 0.76 | 4.77  | 0.92 | 5.37  | 2.26 | 5.40 | 1.19 |
| 12+           | 4.92 | 0.91 | 4.08 | 0.73 | 4.90  | 1.17 | 4.31  | 0.99 | 5.40 | 1.77 |
| 13+           | 4.70 | 0.82 | 4.95 | 0.94 | 5.35  | 2.05 | 5.37  | 1.14 | 5.45 | 2.14 |
| 14+           | 5.88 | 1.26 | 5.57 | 1.16 | 5.72  | 1.24 | 5.44  | 1.22 | 5.00 | 1.34 |
| 15+           | 6.25 | 1.66 | 6.18 | 1.40 | 5.54  | 1.47 | 6.32  | 1.65 | 6.30 | 2.58 |
| 16+           | 6.10 | 1.44 | 5.95 | 1.23 | 6.05  | 1.09 | 6.14  | 1.10 | 6.90 | 1.50 |
| 17+           | 6.50 | 0.57 | 6.25 | 1.37 | 7.15  | 2.13 | 6.55  | 1.53 | 7.22 | 1.73 |
| 18+           | 6.83 | 0.98 | 6.30 | 1.26 | 7.00  | 2.76 | 10.05 | 1.71 | 7.20 | 1.14 |
| 19+ and above | 8.25 | 1.50 | 7.95 | 2.26 | 11.40 | 4.80 | 8.35  | 3.23 | 9.18 | 1.99 |



| Age                           | Gujjars |      | Dogra-Brahmans |      | Dogra-Rajputs |      | Dogra-Scheduled Castes |      | Tibetans |      |
|-------------------------------|---------|------|----------------|------|---------------|------|------------------------|------|----------|------|
| Years                         | Mean    | S.D. | Mean           | S.D. | Mean          | S.D. | Mean                   | S.D. | Mean     | S.D. |
| 21. SUPRA-ILIAC SKINFOLD (mm) |         |      |                |      |               |      |                        |      |          |      |
| 8+                            | -       | -    | 3.71           | 0.96 | 3.66          | 0.76 | 3.81                   | 1.13 | 4.33     | 1.15 |
| 9+                            | 3.50    | 0.54 | 4.42           | 1.34 | 3.80          | 1.05 | 3.47                   | 0.71 | 4.13     | 1.18 |
| 10+                           | 3.66    | 1.58 | 4.05           | 1.02 | 3.81          | 1.14 | 3.93                   | 0.99 | 4.36     | 1.36 |
| 11+                           | 5.00    | 2.67 | 4.20           | 1.00 | 4.00          | 1.34 | 4.37                   | 1.77 | 3.90     | 0.87 |
| 12+                           | 4.28    | 1.89 | 3.86           | 1.05 | 4.32          | 1.66 | 3.45                   | 1.05 | 4.70     | 1.25 |
| 13+                           | 3.80    | 1.13 | 4.15           | 1.56 | 3.00          | 2.71 | 3.96                   | 1.45 | 4.45     | 1.21 |
| 14+                           | 5.77    | 2.99 | 4.76           | 1.44 | 4.34          | 1.05 | 4.16                   | 0.94 | 4.57     | 1.51 |
| 15+                           | 4.87    | 1.80 | 5.31           | 2.00 | 4.00          | 1.52 | 4.56                   | 1.47 | 4.84     | 1.34 |
| 16+                           | 4.20    | 0.91 | 5.95           | 2.06 | 4.00          | 1.56 | 4.66                   | 1.19 | 5.30     | 1.08 |
| 17+                           | 5.25    | 1.25 | 5.35           | 1.53 | 3.33          | 3.39 | 5.30                   | 1.71 | 5.11     | 0.78 |
| 18+                           | 4.16    | 0.40 | 5.75           | 2.40 | 3.94          | 2.33 | 5.16                   | 2.38 | 4.60     | 0.54 |
| 19+ and above                 | 6.25    | 4.57 | 6.28           | 2.30 | 7.74          | 4.33 | 6.00                   | 3.37 | 6.00     | 1.41 |
| 22. CALF SKINFOLD (mm)        |         |      |                |      |               |      |                        |      |          |      |
| 8+                            | -       | -    | 4.38           | 0.92 | 5.08          | 1.50 | 5.81                   | 1.65 | 6.58     | 1.56 |
| 9+                            | 4.50    | 1.51 | 5.63           | 1.34 | 4.30          | 0.97 | 4.88                   | 0.99 | 5.78     | 1.47 |
| 10+                           | 5.22    | 1.09 | 6.40           | 1.05 | 5.33          | 1.88 | 5.63                   | 1.74 | 4.72     | 1.61 |
| 11+                           | 7.25    | 2.25 | 5.70           | 1.60 | 5.45          | 1.40 | 6.12                   | 3.06 | 5.40     | 0.96 |
| 12+                           | 7.14    | 1.87 | 5.78           | 1.05 | 5.52          | 1.96 | 5.50                   | 1.40 | 6.40     | 2.06 |
| 13+                           | 5.50    | 1.43 | 5.95           | 1.56 | 6.20          | 3.12 | 5.92                   | 1.56 | 5.90     | 2.02 |
| 14+                           | 6.83    | 2.89 | 6.04           | 1.44 | 6.31          | 1.88 | 5.68                   | 1.24 | 5.33     | 0.81 |
| 15+                           | 6.25    | 2.43 | 7.04           | 2.60 | 5.72          | 2.22 | 6.00                   | 1.35 | 6.27     | 1.00 |
| 16+                           | 7.00    | 2.40 | 5.80           | 2.06 | 5.70          | 1.08 | 5.95                   | 1.39 | 5.81     | 1.37 |
| 17+                           | 6.50    | 1.29 | 6.00           | 1.53 | 6.20          | 2.76 | 6.45                   | 2.66 | 5.75     | 1.70 |
| 18+                           | 5.83    | 1.60 | 5.80           | 2.40 | 6.50          | 2.47 | 7.11                   | 1.78 | 5.20     | 0.83 |
| 19+ and above                 | 4.50    | 1.73 | 6.19           | 2.31 | 7.81          | 4.45 | 6.25                   | 3.20 | 5.09     | 1.44 |
| 23. FOREARM SKINFOLD (mm)     |         |      |                |      |               |      |                        |      |          |      |
| 8+                            | -       | -    | 3.57           | 1.39 | 3.95          | 0.99 | 3.95                   | 1.25 | 4.83     | 1.11 |
| 9+                            | 1.83    | 0.51 | 3.68           | 0.14 | 3.45          | 1.05 | 3.70                   | 0.84 | 4.86     | 1.24 |
| 10+                           | 1.71    | 0.31 | 4.35           | 1.22 | 3.81          | 1.27 | 4.03                   | 1.10 | 4.63     | 1.80 |
| 11+                           | 2.00    | 0.51 | 3.85           | 1.18 | 4.04          | 1.13 | 4.00                   | 1.24 | 4.90     | 1.66 |
| 12+                           | 2.15    | 0.44 | 3.69           | 0.76 | 3.85          | 1.10 | 3.54                   | 1.22 | 4.80     | 0.91 |
| 13+                           | 2.37    | 0.61 | 3.90           | 1.41 | 3.85          | 1.42 | 3.44                   | 0.89 | 4.45     | 1.12 |
| 14+                           | 2.44    | 0.54 | 3.57           | 0.92 | 3.59          | 0.79 | 3.60                   | 0.57 | 4.28     | 1.79 |
| 15+                           | 2.72    | 0.52 | 3.45           | 0.59 | 3.59          | 1.00 | 3.48                   | 0.77 | 4.00     | 0.57 |
| 16+                           | 3.08    | 0.71 | 3.55           | 1.60 | 3.25          | 0.44 | 3.38                   | 0.58 | 4.00     | 0.56 |
| 17+                           | 3.24    | 0.26 | 3.55           | 0.60 | 3.85          | 0.74 | 3.45                   | 0.51 | 3.55     | 0.72 |
| 18+                           | 3.65    | 0.24 | 3.45           | 0.68 | 3.83          | 1.33 | 3.94                   | 0.87 | 3.40     | 0.89 |
| 19+ and above                 | 3.25    | 1.25 | 4.09           | 1.41 | 4.14          | 1.48 | 3.80                   | 1.15 | 3.75     | 0.96 |

found to be taller than Dogras and Tibetans. For sitting height Dogra population groups precede the Gujjars. Tibetans show higher sitting height vertex than Dogra-Brahmans and Dogra-Scheduled Castes whereas Dogra-Rajputs show higher sitting than Tibetans (Table 2).

### III. Diameters

In all the eight diameters studied *i.e.* biacromial, bicristal, transverse and antero-posterior diameter of chest; humerus and femur bicondylar diameter, wrist and ankle diameter, with a few exceptions, there has been a regular increase at all the yearly intervals in all the population groups being reported (Table 2). In general for all the population groups, it has been observed that Dogras of Jammu show higher body diameters followed by Gujjars and Tibetans. Among Dogra population groups, the trend has been that the Dogra-Scheduled Castes show higher diameters, followed by Dogra-Rajputs and Dogra-Brahmans. For ankle diameter however, Gujjars show higher value than other population groups followed by Dogra-Rajputs, Dogra-Brahmans, Tibetans and Dogra-Scheduled Castes. In case of 19+ and above group in all the populations a mixed trend of growth has been observed for diameters. For chest diameters Tibetans show higher values than other groups (Table 2). Highest peak value corresponding to adolescent growth spurt has been observed between 10+ and 13+ years of age for all the population groups.

### IV. Circumferences

Chest circumferences have been studied at normal level; at the level of maximum inspiration and at the level of maximum expiration. Other circumferences studied include arm girth at relaxed and contracted site and calf circumference. For chest circumferences at various levels, growth has been in the order given, Dogra-Scheduled Castes showed higher chest circumference followed by Gujjars, Dogra-Brahmans, Dogra-Rajputs and Tibetans, except for expired chest circumference; where Dogra-Scheduled Castes are followed by Gujjars,

Dogra-Rajputs, Dogra-Brahmans and Tibetans. Among all the population groups, adolescent growth spurt has been observed between 13+ and 15+ years in case of chest circumferences. In case of 19+ and above age group Gujjars and Tibetans show more chest circumference than Dogra population groups.

For arm circumference relaxed, arm circumference contracted and calf circumference Dogra population groups are ahead of Gujjars and Tibetans. Dogra-Brahmans however have lower circumference than Gujjars in arm circumference relaxed and contracted and for calf circumference, Tibetans show higher value than Dogra-Brahmans. Adolescent growth spurt has been observed between 10+ and 16+ years for arm and calf circumference for all the population groups under study. In case of age group 19+ and above males, however no specific trend has been observed for circumferences of arm and calf. For arm circumference relaxed, Dogra-Rajputs are followed by Gujjars, Dogra-Brahmans, Tibetans and Dogra-Scheduled Castes. For arm girth contracted Gujjars show more circumferences followed by Dogra-Rajputs, Dogra-Brahmans, Dogra-Scheduled Castes and Tibetans. For calf girth Dogra-Rajputs show maximum value followed by Gujjars, Dogra-Brahmans, Dogra-Scheduled Castes and Tibetans (Table 2).

### V. Skinfold Thicknesses

In general, no regular trend has been observed for biceps, triceps, calf and forearm skinfolds, however for subscapular and suprailiac skinfolds (trunk skinfolds), there is a trend of regular increase at yearly intervals during adolescence in all the five population groups studied. For biceps skinfolds in Gujjars, Dogra-Brahmans and Dogra-Rajputs, no regular trend has been observed whereas in Dogra-Scheduled Castes it increases at yearly intervals and decreases successively for Tibetans. For triceps skinfold, no regular trend has been observed for any group except for Tibetans, where it decreases regularly at most of the successive yearly intervals. Subscapular and suprailiac skinfolds show gradual

increase at all yearly intervals for all the population groups being reported. For calf and forearm skinfolds again no trend has been observed except in Gujjars and Tibetans where a more or less regular increase have been observed. For 19+ and above sample, in general considerably higher values have been observed than shown during adolescent years showing that much fat is added during the post-adolescent phase. For all the skinfolds taken together it has been observed that Dogra-Rajputs have higher skinfolds followed by Dogra-Brahmans, Dogra-Scheduled Castes, Tibetans and Gujjars (Table 2).

### B. Physiological Variables

#### VI. Lung Functions

There has been gradual increment in case of all the three lung functions *i.e.* Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV<sub>1.0</sub>) and Peak Expiratory Flow (PEF) from 8+ through 18+ years for all the population groups reported (Table 3). Generally speaking, Tibetans and Gujjars show higher lung functions than Dogra population groups. For forced vital capacity and peak expiratory flow, Tibetans show highest values, followed by Gujjars and Dogra population groups. For forced expiratory volume, Gujjars show higher value followed by Tibetans and Dogra population groups (Table 3). In case 19+ and above sample varied trends have been observed. Gujjars and Tibetans show higher value than Dogra population groups for forced vital capacity. For forced expiratory volume, 19+ and above sample show higher value in Dogra population groups followed by Tibetans and Gujjars. In case of peak expiratory flow, Gujjars show higher value than Dogra groups followed by Tibetans (Table 3).

From the studies reported, it has been observed that period of accelerated growth varies from individual to individual, but every individual growing under normal circumstances must experience the period of accelerated growth between 12 and 17 years of age (Tanner, 1962; Tanner et al., 1966a, b; Miklashevskaya, 1966; Sidhu, 1969;

Marshall, 1977; Singh, 1978 and Singh, 1979). In the present study also among all the five population groups, it has been observed that they experience the accelerated period of growth between 10+ and 16+ years in most of the variables. The trend of growth, though varies for different population groups for the anthropometric variable being reported, in general Dogra-Scheduled Castes show higher values followed by Dogra-Rajputs, Dogra-Brahmans and Tibetans. It has also been reported in various studies that growth rate depends upon various environmental factors beside the genetic make-up. These differences may be due to their difference in their traditional occupation. Dogra Scheduled Castes are mostly artisan caste and agricultural labourers, whereas Dogra-Rajputs are a martial class and Brahmans are priestly class and also doing white-collar jobs. Tibetans are a highland population settled in and around Leh town. They have different nutritional value and different genetic make-up, which may lead to their varied growth rates. Delayed growth in Tibetans may be due to the characteristic feature of highlanders to exhibit delayed growth as reported in various studies (Kaul, 1975; Pawson 1977; Malik and Singh 1978; Singh, 1980).

For respiratory functions however, the highest growth rates have been observed in case of Tibetans (a high altitude population), which is followed by Dogra-Brahmans, Dogra-Scheduled Castes and Dogra-Rajputs. Several studies emphasized that respiratory functions are mainly governed by environmental factors and level of habitual activity (Cotes et al., 1973; Jones et al., 1977 and Anderson et al., 1978). Since Tibetans are a high altitude population, they show higher respiratory functions. These findings are in line with Malik and Singh (1979) and Singh (1979).

It may be evaluated from the above discussion that for anthropometric variables, Dogra groups show higher increase followed by Gujjars and Tibetans. Among Dogra groups, Dogra Scheduled Castes show maximum growth followed by Dogra Rajputs and Dogra Brahman respectively. For respiratory functions, Tibetans show

Table 3: Physiological variables among five population groups of Jammu and Kashmir

| Age<br>Years                              | Gujjars |        | Dogra-Brahmans |        | Dogra-Rajputs |       | Dogra-Scheduled<br>Castes |        | Tibetans |        |
|-------------------------------------------|---------|--------|----------------|--------|---------------|-------|---------------------------|--------|----------|--------|
|                                           | Mean    | S.D.   | Mean           | S.D.   | Mean          | S.D.  | Mean                      | S.D.   | Mean     | S.D.   |
| <b>VI. LUNG FUNCTIONS</b>                 |         |        |                |        |               |       |                           |        |          |        |
| <b>24. FORCED VITAL CAPACITY (lit)</b>    |         |        |                |        |               |       |                           |        |          |        |
| 8+                                        | -       | -      | 1.53           | 0.41   | 1.65          | 0.46  | 1.66                      | 0.48   | 1.64     | 0.36   |
| 9+                                        | 1.83    | 0.51   | 1.65           | 0.46   | 1.62          | 0.42  | 1.43                      | 0.38   | 1.13     | 0.25   |
| 10+                                       | 1.71    | 0.31   | 1.61           | 0.23   | 1.69          | 0.45  | 1.76                      | 0.44   | 1.60     | 0.11   |
| 11+                                       | 2.00    | 0.51   | 1.96           | 0.39   | 1.82          | 0.40  | 1.84                      | 0.39   | 1.44     | 0.32   |
| 12+                                       | 2.15    | 0.44   | 1.92           | 0.45   | 2.10          | 0.56  | 1.88                      | 0.39   | 2.02     | 0.62   |
| 13+                                       | 2.37    | 0.61   | 2.06           | 0.54   | 2.20          | 0.41  | 2.09                      | 0.65   | 2.08     | 0.54   |
| 14+                                       | 2.44    | 0.54   | 2.35           | 0.37   | 2.42          | 0.54  | 2.71                      | 0.49   | 1.91     | 0.44   |
| 15+                                       | 2.72    | 0.52   | 2.69           | 0.50   | 2.92          | 0.54  | 2.71                      | 0.49   | 2.46     | 0.33   |
| 16+                                       | 3.08    | 0.71   | 2.72           | 0.47   | 3.00          | 0.70  | 2.79                      | 0.65   | 2.92     | 0.95   |
| 17+                                       | 3.24    | 0.26   | 3.17           | 0.48   | 2.91          | 0.59  | 2.99                      | 0.70   | 3.25     | 0.57   |
| 18+                                       | 3.65    | 0.24   | 3.00           | 0.59   | 3.05          | 0.68  | 2.96                      | 0.48   | 3.35     | 0.93   |
| 19+ and<br>above                          | 4.10    | 1.37   | 3.35           | 1.11   | 3.36          | 0.56  | 3.31                      | 0.60   | 3.46     | 0.79   |
| <b>25. FORCED EXPIRATORY VOLUME (lit)</b> |         |        |                |        |               |       |                           |        |          |        |
| 8+                                        | -       | -      | 1.53           | 0.30   | 1.43          | 0.45  | 1.49                      | 0.47   | 1.44     | 0.43   |
| 9+                                        | 1.90    | 0.37   | 1.54           | 0.38   | 1.45          | 0.31  | 1.38                      | 0.35   | 1.20     | 0.36   |
| 10+                                       | 1.41    | 0.28   | 1.53           | 0.24   | 1.56          | 0.39  | 1.52                      | 0.31   | 1.59     | 0.11   |
| 11+                                       | 1.83    | 0.39   | 1.83           | 0.31   | 1.70          | 0.25  | 1.69                      | 0.34   | 1.43     | 0.32   |
| 12+                                       | 1.89    | 0.38   | 1.74           | 0.36   | 2.00          | 0.53  | 1.71                      | 0.42   | 1.76     | 0.40   |
| 13+                                       | 2.10    | 0.50   | 1.90           | 0.50   | 2.11          | 0.36  | 1.98                      | 0.55   | 1.83     | 0.51   |
| 14+                                       | 2.10    | 0.40   | 2.15           | 0.38   | 2.27          | 0.46  | 2.37                      | 0.52   | 1.85     | 0.44   |
| 15+                                       | 2.52    | 0.52   | 2.51           | 0.46   | 2.58          | 0.50  | 2.50                      | 0.45   | 2.41     | 0.63   |
| 16+                                       | 2.85    | 0.56   | 2.62           | 0.43   | 2.72          | 0.56  | 2.74                      | 0.65   | 2.68     | 0.65   |
| 17+                                       | 2.97    | 0.29   | 3.02           | 0.34   | 2.80          | 0.57  | 2.82                      | 0.63   | 3.06     | 0.50   |
| 18+                                       | 3.43    | 0.57   | 2.80           | 0.54   | 2.89          | 0.67  | 2.82                      | 0.42   | 3.16     | 0.78   |
| 19+ and<br>above                          | 2.72    | 0.62   | 2.88           | 1.19   | 2.88          | 0.53  | 2.94                      | 0.62   | 2.85     | 0.76   |
| <b>26. PEAK EXPIRATORY FLOW (ml)</b>      |         |        |                |        |               |       |                           |        |          |        |
| 8+                                        | -       | -      | 158.42         | 51.07  | 161.91        | 60.04 | 155.81                    | 51.86  | 138.33   | 50.11  |
| 9+                                        | 197.50  | 42.06  | 171.55         | 39.84  | 158.53        | 36.41 | 152.17                    | 34.38  | 117.60   | 32.33  |
| 10+                                       | 192.66  | 45.34  | 178.85         | 54.66  | 166.35        | 54.34 | 160.57                    | 41.05  | 210.00   | 33.94  |
| 11+                                       | 181.12  | 34.52  | 205.70         | 42.62  | 193.63        | 58.96 | 197.12                    | 70.40  | 187.00   | 57.59  |
| 12+                                       | 226.21  | 85.41  | 204.90         | 55.31  | 227.71        | 88.71 | 181.95                    | 59.47  | 170.66   | 60.40  |
| 13+                                       | 219.00  | 65.36  | 223.26         | 85.12  | 231.20        | 56.11 | 228.40                    | 67.04  | 201.40   | 67.41  |
| 14+                                       | 235.22  | 73.47  | 251.88         | 80.34  | 265.78        | 95.96 | 258.47                    | 91.68  | 208.00   | 95.77  |
| 15+                                       | 274.87  | 30.60  | 307.28         | 85.95  | 300.00        | 88.45 | 289.50                    | 60.45  | 297.10   | 108.28 |
| 16+                                       | 355.10  | 111.15 | 337.60         | 65.59  | 304.20        | 75.99 | 329.76                    | 10.70  | 308.12   | 74.82  |
| 17+                                       | 274.00  | 45.34  | 340.85         | 59.09  | 327.20        | 68.00 | 346.68                    | 80.22  | 351.33   | 99.91  |
| 18+                                       | 404.33  | 31.88  | 313.85         | 95.77  | 340.83        | 95.00 | 329.27                    | 64.21  | 330.50   | 86.35  |
| 19+ and<br>above                          | 356.00  | 104.65 | 345.38         | 170.57 | 327.13        | 91.42 | 330.15                    | 118.52 | 272.00   | 70.07  |

maximum increase, followed by Gujjars and Dogra groups. Similar findings have been reported in the other studies which shows that populations living at high altitude and populations with higher habitual activity show higher lung functions than population groups inhabiting plains.

### ACKNOWLEDGEMENTS

The financial assistance is provided by Ministry of Environment and Forests, Government of India; for the project entitled, "Environment, Human Settlement and Human Activities in Jammu and Kashmir Himalayas with special reference to Ladakh" under MAB (Man and Biosphere Programme, UNESCO) Ref. No. 14/122/84 RE-MAB under the guidance of Dr. M.K. Bhasin (Principal Investigator, Department of Anthropology, University of Delhi, Delhi-110 067).

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