MATERIAL AND METHODS
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MATERIAL

The present cross-sectional investigation is based on selected anthropometric measurements and physical performances which were carried out on a sample of 520 school going Tibetan girls, aged between 5 to 18 years, residing in a village in Dharamsala, Distt. Kangra (Himachal Pradesh). The village is known as TCV (Tibetan Children Village) and is situated near McLeod Gunj. The data for the present study was collected during 1986-87. Since this region is inhabited by Tibetan population and also due to their easy and ready availability, it was convenient to conduct the study on them. Moreover, the girls of this age range were selected because of their cooperative nature and sufficient amount of uncommitted time.

The data have been collected with a view to provide information on the anthropometric characteristics of Tibetan girls as well as to assess if there exists any relationship between various anthropometric measurements and physical performances; physiological parameters and sexual maturity. According to Jokl et al. (1941) training seems to affect the performance of an individual. Hence only untrained girls were taken for the present study.

In all twenty anthropometric measurements were taken on each subject. The anthropometric measurements include twelve absolute measurements, three circumferences and five skinfold measurements taken on each individual by the investigator.
herself on the left side of the subject. Besides the anthropometric data, six performance tests were also taken on each individual. In addition to this, physiological tests like blood pressure and pulse rate were also recorded. The information regarding age at menarche (i.e. onset of menstruation period) was also obtained from each girl.

The subjects taken in the present study belongs to the same socio-economic status and their selection was based on the criteria that they should not be physically disabled or suffering from any serious disorders.

**LAND AND PEOPLE**

Kangra district of Himachal Pradesh lies between the North latitudes of 31° 21' and 32° 25' and the East longitude of 75° 39' and 77° 55' (Fig. 1). It is about 2,900 ft above sea level. Dharamsala is the headquarters of Kangra district. Its area in sq Km is 10.63.

The mountain system of Dharamsala is comprised of long high ridges with sharp crests and steep sides. The main ranges are the continuations of the surrounding Himalayas, and it is a part of Dhaula Dhar Range.

Upper Dharamsala remains covered with snow during winters. The maximum temperature is 36.7°C and minimum temperature is 2.0°C. Summers are usually pleasant though it is slightly cold at high altitudes. The annual rainfall in Dharamsala works out to be 2,944.1 mm (Census of Kangra Distt., 1981).
The population of Dharamsala is 14,522 out of which 8,141 are males and 6,381 are females. The sex ratio is 7.84. Number of households including houseless households are 3,404. About 92.39% population lives in the villages (Census, 1981). General socio-economic status of people is low. The main occupation of population includes spinning and weaving of wool, carrying loads, work in forests and in road construction. Principal communities are Rajputs, Brahmins, Gaddis and Tibetans. Among these Tibetans are predominant. The local dialect is Pahari, though Hindi and Punjabi are also spoken.

The nearest city from Dharamsala with one lakh population or more is Pathankot (88 Kms). Although the nearest airport is at Amritsar but a new airport is also under construction at Gagal. The nearest railway station is at Kangra Mandir (21 Kms).

Dharamsala provides habitation and sustenance for numerous fauna. Both tropical and temperate fauna are found as a result of climatic conditions which vary from modified tropical to cold temperate according to altitude. In mammals, panthers, leopards, wolf and porcupine are common. Birds includes crows, sparrows, owls, kites and vultures. Insects like mosquito, common housefly, ticks are plentiful. Snakes, lizards, frogs and toads are also found in Dharamsala. The most common poisonous snake found in this region is cobra. Flora includes scrub forests, Chir Pine, Deodar, Oak, Fir and Pinus longifolia.
Dharamsala was a small sleepy town near the famous Kangra valley before H.H. Dalai Lama arrived in 1960. But ever since His Holiness had made this place his temporary headquarters this remote, obscure village has risen to international fame as a "Little Lhasa in India".

The considerable altitude (5,400 ft) and the cool climate weather have contributed enormously towards the creation of a nostalgically Tibetan environment. Today the whole area particularly upper Dharamsala, pulsates with Tibetan atmosphere, though modified but life is still basically and authentically Tibetan in character. Number of western and Indian tourist come to see the re-birth of an exotic civilisation that fascinates not only scholars but also anyone who has come in contact with the Tibetans. Streams of Tibetan refugees from various parts of India and distant Himalayan kingdom come here on pilgrimage. Furthermore, to the Tibetans the residence of His Holiness symbolises the seat of their Government-in-exile, no matter whether nations legally recognise it or not. Tibetans everywhere look towards Dharamsala as their spiritual anchor and the bastion of their hope for Tibet.

According to the office of H.H. Dalai Lama security and Passport Muleod Gunj, the total population of Tibetans in Dharamsala on 30th Sept., 1990 was 5864. Out of which males are 1871, females 1130 and children 2963. Most of them live in Muleod Gunj in Upper Dharamsala which in the last decade or so has transformed from a small hamlet to a constantly expanding
township in its own right. Growing number of residential buildings, restaurants, antique shops, hotels and open air-stalls are responsible for this.

TIBETANS

Tibetans are the immigrants from Tibet. Physically they are mongoloid type with yellow skin colour, marked epicanthic fold, straight hair and broad and high cheek bones etc. Tibetans are a polyandrous society. Women have the influence both in home-life and in business. They are mainly agriculturists and labourers. Tibetan men are fond of Barley beer, which is the most common alcoholic drink. They eat steamed bread, rice and porridge. The meat of pig is relished by Tibetans. They are fond of singing songs on all occasions whether on work, journey, wedding or war.

The arts of Tibet is mostly confined to painting, sculptures, architecture and music. The theme of this art is mostly religious. The paintings on canvas or silk hung on walls and carried in processions as banners and known as 'thanka' meaning 'rolled up' in Tibetan.

The Tibetan language resembles the Burmese language. Tibetan alphabets are devised on the model of Nagari and Bengali alphabets. They are the followers of Buddha, so most of the literature is confined to religion. Gromle literature is an important branch of Tibetan literary activities. It includes
those works which lay down guidelines to a layman which he might follow in his life so that he might not be led astray.

Tibetan Buddhism consists of two main sects - the 'red' and the 'yellow'. The followers of the former belong to the non-reformed school and are known so by the red hat they wear on formal occasions. The others belonging to the refined school are followers of the Dalai Lama and wear yellow hats. The monks of the 'yellow' hat observe strict discipline in their daily lives, abhor alcohol, remain unmarried and devote their lives to reading the holy scriptures from childhood. They follow the tradition of Indian and Nepali Buddhism. Tibetans believe in magical or tantric practices. They practice yoga and meditation. Lama or teacher plays a vital role in the life of Tibetans. He is the guide who would not lead them astray from righteous path. It takes years of hard training in a monastery before a person attains the status of a monk.

TIBETAN CHILDRENS VILLAGE, (TCV) DHARAMSALA

The Tibetan Children's Village, Dharamsala is a registered, non-profit, charitable institution for the care of orphans, semi-orphans and destitute Tibetan children. The village is a member of the SOS Kinderdorf International, Vienna. The village school is affiliated with the Central Board of Secondary Education, New Delhi. It is situated on a hill top about two kilometers west of Moolad Gunj. There are '33' homes in the village each accommodating about 35 boys and
girls of varying ages. Each home has foster parents or home mother to take care of the children. TCV has several school houses, playground, staff quarters, a hospital- cum- dispensary, a handicraft- cum- vocational training centre and a temple. TCV looks after the physical, mental and spiritual needs of the children. It imparts the best of modern education along with a deep and intimate understanding of the rich cultural heritage of Tibet. It also helps young boys and girls to become self radiant, contributing members of society and of the world-wide human community. There main aim is to cultivate a sense of national identity that will enable the children to share the hopes and aspirations of the Tibetan people to return someday to a free and independent Tibet.

METHODS

General information recorded for the present study includes age, sex, date of birth, religion, caste, etc. of the subject. In addition, information about some socio-economic variables such as educational status, occupation of parents, family income, types of family, etc. were also recorded. The dates of birth of the girls under study were collected from the school admission register and were further verified from the subjects and teachers. The ascertainment of age has been particularly taken care of, as for growth studies, the information on current age is extremely important (Tanner, 1962). Tibetans have their own 'Tibetan Calendar' but the age in the present
<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Groups considered as</th>
<th>Mean age (years)</th>
<th>Number of girls studied</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5-5.499</td>
<td>5 years</td>
<td>5.072</td>
<td>30</td>
<td>0.227</td>
</tr>
<tr>
<td>5.5-6.499</td>
<td>6</td>
<td>6.019</td>
<td>30</td>
<td>0.349</td>
</tr>
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<td>6.5-7.499</td>
<td>7</td>
<td>7.087</td>
<td>30</td>
<td>0.292</td>
</tr>
<tr>
<td>7.5-8.499</td>
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<td>7.937</td>
<td>33</td>
<td>0.356</td>
</tr>
<tr>
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<td>9</td>
<td>9.052</td>
<td>37</td>
<td>0.260</td>
</tr>
<tr>
<td>9.5-10.499</td>
<td>10</td>
<td>10.139</td>
<td>35</td>
<td>0.253</td>
</tr>
<tr>
<td>10.5-11.499</td>
<td>11</td>
<td>11.054</td>
<td>38</td>
<td>0.300</td>
</tr>
<tr>
<td>11.5-12.499</td>
<td>12</td>
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<td>40</td>
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<tr>
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<td>0.253</td>
</tr>
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<td>0.239</td>
</tr>
<tr>
<td>16.5-17.499</td>
<td>17</td>
<td>17.036</td>
<td>34</td>
<td>0.251</td>
</tr>
<tr>
<td>17.5-18.499</td>
<td>18</td>
<td>18.133</td>
<td>30</td>
<td>0.244</td>
</tr>
</tbody>
</table>

Total $N = 520$
study is taken according to the English calendar. All those girls whose ages were considered to be doubtful were excluded from the study. The decimal age was calculated from the date of birth and date on which investigation was carried out using 'Decimal Age Calendar' (Tanner et al., 1966). The decimal age was calculated up to three decimal places and the grouping is done with one year interval, i.e. all the individuals who ranged between 4.556-5.499 have been grouped into one age group of 5 years. Similarly those above 5.556 and below 6.499 were kept in the age group of 6 years and so on. Table 1 shows the age group-wise distribution of the Tibetan girls and the number of individuals studied in each age group.

Morphological measurements, performance tests and physiological parameters were taken on each individual and the information about these aspects was recorded on a specially designed proforma.

**ANTHROPOMETRIC MEASUREMENTS**

Anthropometry is the best technique to study the growth and physique of an individual. For the present study all the measurements were taken according to the method described by Weiner and Lourie (1969). All necessary precautions were taken for recording the accurate measurement. While taking the measurements it was kept in mind that the subjects under study is wearing the minimum clothing. Anthropometric measurements were recorded in centimeters, skinfolds in millimeters and weight in kilograms.
Various anthropometric measurements, performance tests and physiological parameters taken on each individual are given below:

a) **Anthropometric Measurements**

1. Weight
2. Height vertex
3. Sitting height
4. Biaxial diameter
5. Bicristal diameter
6. Arm length
7. Foot length
8. Foot breadth
9. Femur bicondylar breadth
10. Humerus bicondylar breadth
11. Biroygomatic diameter
12. Facial length

b) **Circumferential Measurements**

13. Upper arm circumference
14. Calf circumference
15. Head circumference

**Subcutaneous fat measurements or skinfolds**

16. Biceps skinfold
17. Triceps skinfold
18. Calf skinfold
19. Suprailiac skinfold
20. Subscapular skinfold
b) **Performance Tests:**

1. Sargent jump
2. Standing broad jump
3. Shotput distance
4. Modified pull ups
5. Shuttle run
6. 50 metre dash

Performance tests like sargent jump, standing broad jump and shotput distances were measured in centimeters; shuttle run, 50 m dash and modified pull ups in seconds. While performing the physical tests, all the subjects were barefooted.

c) **Physiological parameters:**

1. Blood pressure
   (a) Resting systolic
   (b) Resting diastolic
2. Pulse rate

Blood pressure was recorded in Hg/mm and pulse rate in one minute or 60 seconds.

In addition to the above measurements, the information regarding age at menarche was also obtained from each girl.

A detailed description of the landmarks, techniques applied and various equipments used in the present study are given in Appendix I & II respectively.
Various statistical methods constitute a major part of the subject of growth. According to Churchill (1966), "Human growth is a process of change that has to be observed and followed by means of multiplicity of measurements. It is a process to be summarised, evaluated and understood through careful and resourceful interpretation and analysis of the data created by these measurements".

For the present study, various statistical methods have been employed to interpret the data in numerical terms. Different statistical methods are used for calculating, organising and analysing numerical data for understanding a phenomenon and consists of mainly two parts, i.e.

(a) Statistical analysis, which describes the group characteristics of the particular data;
(b) Statistical inference, that describes the judgements based on statistical analysis.

These methods provide significant and comprehensive quantitative information about physical growth, performance, physiological activities and sexual maturity.

In order to obtain the correct information the computer was used. The following types of statistical considerations have been incorporated:

(1) Mean
(2) Standard deviation
(3) Coefficient of variation
Details of the statistics used in the present study are as follows:

(1) **ARITHMETIC MEAN OR AVERAGE** :-

Mean is a single figure which sums up the characteristics of a whole group of figures. Since in average sum characteristics of the whole group, its value always lies between the minimum and maximum values and generally it is located in the centre of the distribution. Hence it is the measure of central tendency of a parameter and gives the 'typical value' in the distribution of a particular parameter.

Arithmetic mean or average can be obtained by adding up all the individual observations, and dividing their total by number of observations.

Symbolically $\bar{X}$ or A.M. = $\frac{\sum X}{n}$

Where $\bar{X}$ = Arithmetic mean or A.M.

$\sum X$ = Sum of all the values of the variable $X$

$n$ = The number of values.

(2) **STANDARD DEVIATION (S.D.)** :-

It is a useful measure of dispersion probability about the highest point. In other words, it measures the absolute
dispersion or variability of a distribution. The greater the amount of dispersion, the greater is the standard deviation. It represents the homogeneity or heterogeneity of the sample. If most of the data is closer to the mean value the standard deviation would be smaller, but on the other hand if the value of the individual is much higher or lesser than the mean value, the standard deviation will also be larger. Standard deviation is denoted by Sigma and it is the positive square root of the arithmetic mean of the squares of the deviations of the given values from their arithmetic mean.

$$S.D \ or \ \sigma = \sqrt{\frac{\sum (X-\bar{X})^2}{N-1}}$$

Where \( X \) is the individual value
\( \bar{X} \) is the mean as stated above
\( N \) is the total number of subjects or individuals

(3) COEFFICIENT OF VARIATION (C.V.) :-

The standard deviation is always expressed in terms of units. This absolute measure of dispersion cannot be used for purpose of comparing the variability of two or more series, because, (i) the standard deviation of the two series may be in two different units; and (ii) the mean of two distributions may be quite different. Thus whenever it is desired to compare the dispersions of two or more series which are not expressed in the same units, we need to compute coefficient of variation.

The series for which the coefficient of variation is greater, is said to be more variable or conversely less consistent, less uniform less stable or less homogeneous; on the
other hand reverse is true for a series having less coefficient of variation. Coefficient of variation $V$ can be obtained as follows:

Coefficient of variation, $V = \frac{\sigma}{\bar{X}} \times 100$

Where $\sigma$ = Standard deviation of the sample studied
$\bar{X}$ = Arithmetic mean

(4) **Gain per year**:

Gain per year can be expressed as

$$M_2 - M_1$$

Where $M_1$ and $M_2$ are the mean values of any measurements in two subsequent age groups.

(5) **Range**:

The simplest measure of dispersion is the range which is given by the difference between the highest and the lowest value in a set of given data.

(6) **Coefficient of Correlation**:

The coefficient of correlation measures the degree of correlation between two variables. It not only describes the magnitude of correlation but also its direction. It does not depend on the units employed i.e. it is a dimensionless quantity.

The value of coefficient of correlation varies between -1 and +1. When $r = 0$, there is no correlation; when $r = +1$ there is a positive correlation and when $r = -1$ there is perfect
negative correlation. The closer \( r \) is to +1 or -1 the closer the relationship between variables and the relationship is less if it is closer to 0. Falkner (1962) cautions against relating causation with correlation. Even a high degree of correlation does not necessarily mean that a relationship of cause and effect exists between the variables.

In the present study, the degrees of relationship between 2 variables, as measured by correlation is taken as under:

\[
\begin{align*}
r & = 0.00 - 0.39 \text{ low} \\
r & = 0.40 - 0.79 \text{ moderate} \\
r & = 0.80 - 1.00 \text{ high}
\end{align*}
\]

(Falkner, 1962)

\[
r = \frac{\sum XY - (\sum X)(\sum Y)}{N} \frac{\sqrt{\sum X^2 - (\sum X)^2}}{\sqrt{\sum Y^2 - (\sum Y)^2}}
\]

Where

\[
XY = \text{Sum of multiplication of 1st parameter and the 2nd parameter.}
\]

\[
X = \text{Sum of all the values of the variable } X
\]

\[
Y = \text{Sum of all the values of the variable } Y
\]

\[
N = \text{Total number of individuals}
\]

\[
X^2 = \text{Sum of square of the variable } X
\]

\[
Y^2 = \text{Sum of square of the variable } Y
\]
### (7) PROBIT ANALYSIS

<table>
<thead>
<tr>
<th>Age</th>
<th>% Percentile</th>
<th>Probit</th>
<th>Weighting</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Y = wx</th>
<th>wy</th>
<th>wx²</th>
<th>wxwy</th>
</tr>
</thead>
<tbody>
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<td>X₁</td>
<td>21</td>
<td>P₁</td>
<td>W₁</td>
<td>Y₀₁</td>
<td>A₁</td>
<td>Y₁</td>
<td>wx₁</td>
<td>wy₁</td>
<td>wx₁²</td>
<td>wx₁wy₁</td>
</tr>
<tr>
<td>X₂</td>
<td>22</td>
<td>P₂</td>
<td>W₂</td>
<td>Y₀₂</td>
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<td>Y₂</td>
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<td>P₃</td>
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<td>Y₀₃</td>
<td>A₃</td>
<td>Y₃</td>
<td>wx₃</td>
<td>wy₃</td>
<td>wx₃²</td>
<td>wx₃wy₃</td>
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<table>
<thead>
<tr>
<th>X²</th>
<th>EW</th>
<th>XY</th>
<th>EWₓ</th>
<th>EWᵧ</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(i) From Fischer and Yates Statistical Tables

(ii) By plotting the value of empirical probit against age on the graph.

\[
\begin{align*}
EXX &= EWx² - \frac{(Ewx)^2}{EW²} \\
SXY &= Ewx'y - \frac{(Ewx)(Ewx')}{EW²}
\end{align*}
\]

Regression coefficient 'b' = \( SW'y/SXY \)

\[
a = Y - bx \\
y = a + bx
\]

Substituting \( y = 5 \), we get \( 5 = a + bx \)

\[x₁, \text{ the median age } = 5 - a/b\]
(8) **LOG TRANSFORMATION**:

Reading on skinfolds were usually taken to the nearest 0.1 mm and routinely converted to a logarithmic scale because this brings the distribution of the measurements in the population more nearly to Gaussian form and takes cognizance of the measuring error being systematically greater for larger than for smaller readings (Tanner, 1962).

The transformation used is

\[
Z = 100 \log_{10} (\text{reading in } 1/10 \text{ mm} - 18)
\]

Where \( Z \) = skinfold transformation.