CHAPTER V

DISCUSSION

In the present chapter attempt has been made to study critically the findings of present research in the background of the earlier studies and to present hypothetically the possible reasons for the present findings.

(A) Comparison of fitness status of the students of different regions (namely - Tarai, Hill and Himalaya) in selected physical fitness components:

a) Gradewise regional differences:

i) Muscular strength:

The result obtained within the limitation of the study revealed from the table 7, 12 and 17 indicated that there were significant differences on muscular strength between (Tarai and Himalaya; Hill and Himalaya) the students of eighth, ninth and tenth grades. But the differences were found to be non-significant between all the three grade students of Tarai and Hill.

The students of eighth grade of Hill were found to be significantly stronger than the students of Himalaya, but muscular strength was found similar between the students of
Tarei (22.76) and Hill (22.90).

In the case of ninth and tenth grades, the students of Tarei were found significantly stronger than the students of Himalaya (Table 12 and 17), but the students of Tarei were found similar in strength to the students of Hill.

The study of the anthropometric measure of the eighth grade students indicated that the students of Hill were small in height (151.58 cm), having short arm length (66.87) and short leg (60.78 cm) in comparison to the students of Tarei and Himalaya (Appendix - E).

The review of literature indicated that low gross strength groups had significantly higher octomorphy means (Borns, 1965)\(^1\), boys of medium builds were stronger than boys with linear and laterals builds (Baur, 1955), superior performing boys have relatively short legs and narrow hips and with a medium physique (Espenschade, 1940), the strongest boys were dominant mesomorphs (Jones, 1949). The results of present study regarding the muscular strength of eighth grade students agree with the findings of aforesaid researchers.

In the case of ninth and tenth grade students, as discussed earlier (Table 12 and 17) the study indicated that students of Tarei were found to be stronger but they did not

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\(^1\) Jan. B. L. Borns. "Relationships between selected Maturity, Physique, Body-size, and Motor factors and the gross and Relative strength of Ten-, Thirteen-, and Sixteen year old Boys" (Microcard of Master's Thesis; University of Oregon, 1965)
significantly differ from the students of Hill in both grades.

It was observed that dropout ratio in higher grade was greater in Hill and Himalaya region in comparison to Tarai region, because of socio-economic status, tendency to join Army service, family poverty and responsibility, which might affect the performance of muscular strength of the students of Hill.

Besides it, the tests used to measure the muscular strength was only for upper extremity (especially arm strength) and not for lower extremity, so they couldn't predicted effectively for gross strength.

The present researcher could not come across any study on reviewing the available literature on regionwise comparison of muscular strength of the students.

ii) Muscular Endurance :-

As mentioned earlier (Tables 8, 13 and 18) the eighth and ninth grade students of Himalaya were found significantly superior in muscular endurance to the Tarai and Hill students, whereas the tenth grade students of Tarai were significantly superior in muscular endurance to the remaining two groups.
The students of Himalaya walk daily longer distances up and down hilly tracks to attend schools and to meet their daily needs. Because of topographical structure of land, and up and down hilly tracks, it is natural that while walking upper body automatically bends forward in angle which might be affecting their abdominal muscle endurance efficiency positively. Besides it, due to lack of proper transport they carry the goods on their back, the students get more involvement in religious and cultural activities which might be affecting the muscular endurance efficiency of eighth and ninth grade students of Himalaya positively.

In the case of tenth grade, the students of Tarai were found significantly superior. The students of Tarai were observed to be mainly from middle and higher socio-economic classes and continued the school life better in comparison to the students of Hill and Himalaya. The schools were near to their residential areas which facilitated them to participate in various physical activities and sport programmes conducted by the school which were mostly not available for the students of Hill and Himalaya, which might be affecting their muscular endurance efficiency positively. Besides it, it was observed that, mostly the students of Hill and Himalaya after completing eighth and ninth grade join the Army service due to their social and family tradition which causes low enrolment in school. So, the smaller number of sample size because of low
classroom enrolment in Himalaya region might affect the result of this study.

### iii) Cardio-Respiratory Endurance:

The main study of present research explored that the students of eighth and ninth grade of Himalaya were significantly superior in cardio-respiratory endurance, whereas the students of tenth grade of Hill were found to be significantly superior in cardio-respiratory endurance.

The study of anthropometric measure of eighth and ninth grade students of Himalaya indicated that (Appendix - E,F) they were tall in height (156.26 cm and 161.59 cm respectively) and had longer leg length (97.49 cm and 100.37 cm respectively) which might be helpful to them in performing the stepping test easily.

Besides it, the students of Himalaya get more involvement in religious and cultural activities. They walk daily for more than two and three hours for attending the school and returning home on up and down hilly tracks. In addition to this they have to walk longer distances to meet their daily needs which might be affecting their cardio-vascular efficiency positively.
The tenth grade students of Hill were found significantly superior (71.13) to the students of Tarai but they did not significantly differ from the students of Himalaya (70.74) in cardio-respiratory endurance. It was observed by the present researcher during their study that the class-room enrolments of tenth grade were comparatively too lower in Himalaya region than in the Hill and Tarai regions. The small sample size from the Himalaya region for the present study because of low class room enrolment might be the cause of differences in mean performances of cardio-respiratory endurance between the students of Hill and Himalaya by .01 which was very negligible.

iv) Speed:

The results, obtained within the limitation of the study revealed from the tables 10, 15 and 20, indicated that the students of all three grades of Tarai were significantly found to be faster than the Hill and Himalaya students. It was observed that the speed performances had the decreasing pattern with the increasing altitude of regions.

It was observed by the present researcher during the investigation of present study that the students from Hill and Himalaya come from a longer distance to attend the classes which may make them tired. Generally the schools of Hill and
Himalaya had not the facilities of large size play-fields which may affect the school physical education programme. The participation of the students of Tarai was more common in running activities. The motivational factors - because the national champions on short distance running were from Tarai region, all of these above factors might be affecting the speed performance efficiency of the students of Tarai positively.

(b) Inter-grade national differences:

The main study of the present research explored that the students of tenth grade of Nepal significantly excelled in physical fitness tests the students of ninth and eighth grades.

The study of anthropometric measures of all three grades of national samples indicated that (Appendix - E,F and G) the students of tenth grade were taller (160.87 cm), had longer upper limbs (arm length : 71.62 cm), longer leg length (97.08 cm), broader chest girth (78.09 cm) and were greater by chronological age (191 months) than the ninth and eighth grade students.

Besides it, it was observed that the students of tenth grade had more participation in sports activities in their school programmes as well as in local sports activities because of
seniority and maturity, which might be affecting their physical fitness efficiency positively.

(B) Determination of the Norms on selected Tests :

i) Muscular Strength (push-ups):

The record of muscular strength (push-ups) was collected to find out the fitness standard of the students in respect of the percentile. The study of the muscular strength of eighth grade students showed that scores of the students of Tarai were higher than those of the students of Hill and Himalaya. The highest score on muscular strength test was 35 (Tarai) on 99th percentile, whereas the lowest score was 16 (Himalaya) on 5th percentile (Table - 26); but the national norms that had been developed were found to be similar to those of Hill region.

The study of the muscular strength revealed that (Table- 31) the percentile scores developed for ninth grade had a unique pattern and did not match each other. The students of Hill had high score for each percentile scale in comparison to students of Tarai and Himalaya. The national norm for ninth grade at 99th percentile was 37 and at 5th percentile was 20.

As mentioned earlier (Table- 36) the tenth grade students of Tarai were found to be high score achievers for each
percentile level (44 for 99th and 25 for 5th percentile) in comparison to Hill, Himalaya and National groups.

The causes of these variations in percentile scores for different regions were the product of performance and the result of mean differences analysed by one way analysis of variance.

The present researcher could not come across any study on percentile norms developed in Nepal. The available physical fitness norms developed in European countries are age-wise and not grade-wise, but while calculating the age of each grade of Nepal the present researcher found that the mean age of eighth grade students were 14 years, ninth grade students were 15 years old an the tenth grade were 16 years old. Thus comparison of muscular strength of the students of Nepal with American children showed that the students of Nepal are too weak.

**TABLE - 44**

**COMPARISON OF NATIONAL NORMS FOR NEPAL WITH DGWS TEST NORMS ON MUSCULAR STRENGTH**

<table>
<thead>
<tr>
<th>Percentile</th>
<th>DGWS¹</th>
<th>Norms for Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>14 years</td>
</tr>
<tr>
<td>95th</td>
<td>58</td>
<td>30</td>
</tr>
<tr>
<td>70th</td>
<td>39</td>
<td>25</td>
</tr>
<tr>
<td>20th</td>
<td>2</td>
<td>19</td>
</tr>
</tbody>
</table>

Scores are numbers of push-ups.

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It is revealed from the table- 44 that the students of Nepal are comparatively weak in muscular strength against the developed norms of Division for Girl's and Women's sports test (DGWS) at 70th (39:33) and 95th (56:37) percentile. The students are found superior at the 20th percentile (2:27) but not for the upper percentile. It is revealed from the Table -44 that Boy students of Nepal are so weak in muscular strength that they are unable to meet the norms of physical fitness developed for American girls in the year 1945.

ii) Muscular endurance (sit-ups):

The study of muscular endurance fitness status explored that the eighth grade students of Himalaya had secured highest score on 99th percentile (37), whereas the students of Hill had secured lowest score on 10th percentile (21). But the developed national norms exhibited a pattern similar to that of the students of Tarai (Table 27).

It is revealed from the Table -32 that the norms developed for ninth grade students were found to be similar to those of eighth grade. But the results of study on muscular strength of tenth grade students were found just opposite to those of eighth and ninth grade, where the students of Tarai secured highest score (44: 99th percentile) and the students of
Himalaya were found having the lowest (18: 5th percentile) score (Table - 36).

**TABLE - 45**

**COMPARISON OF NATIONAL NORMS FOR NEPAL WITH N.C.Y.F.S. TEST NORMS ON MUSCULAR ENDURANCE**

<table>
<thead>
<tr>
<th>Percentile</th>
<th>NCVPS Test Norms</th>
<th>Norms for Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 14</td>
<td>15</td>
</tr>
<tr>
<td>99th</td>
<td>64</td>
<td>65</td>
</tr>
<tr>
<td>70th</td>
<td>45</td>
<td>46</td>
</tr>
<tr>
<td>50th</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>30th</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>10th</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

Scores are numbers of successful sit-ups.

It was seen from the review of literature that the students of Nepal were not fulfilling the European physical fitness norms, which are presented in table - 45.

It is revealed from the table - 45 that the norms developed from National children and Youth Fitness Test are higher in each age group. The norms developed from National children and Youth fitness test show that at the 99th percentile the scores are 64, 65 and 65 for age groups of 14, 15 and 16 respectively, whereas the norms developed for the students of

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Nepal at same percentile (99) are 34, 38 and 39 for the age group of 14, 15 and 16 respectively. Similarly on the 50th percentile the scores are 41:26, 42:29 and 43:32 for the age group of 14, 15 and 16 respectively. It was concluded that the students of Nepal did not fulfill the developed physical fitness norms of European countries and were found comparatively poor in muscular endurance.

iii) Cardio Respiratory Endurance:

The study of Cardio-respiratory endurance of eighth and ninth grade students (Table 29 and 34) indicated that the fitness standard of the students of Himalaya was superior in comparison to that of Hill and Tarai students, whereas the performance of tenth grade students of Hill was significantly superior (Table 39) to that of Himalaya and Tarai students. The standard developed for each three grades differ from each other because of the variation in mean performances.

The present researcher could not come across any study that dealt with the cardio-respiratory standard gradewise. The researcher tried to compare the Developed National standard on cardio-respiratory endurance for Nepal with the Harvard step test standard produced by Brouha and associates.

It is revealed from the Table- 46 that the students of
eighth and ninth grade of Nepal are too inferior in cardio-respiratory endurance to prove excellent (above 77 and above 79 respectively) in comparison to the standard developed by Brouha and associates (above 90). The students of tenth grade are approximately fulfilling the standard (on average 68-74) and excellent (above 82) in relation to standard developed by Brouha and associates (average: 65-79; excellent: Above 90).

It was concluded that the students of Nepal were observed to be so poor in cardio-respiratory endurance that they could not fulfil the standard developed for the U.S.A. students by Brouha and associates during World War II.

### TABLE - 46

**COMPARISON OF NATIONAL STANDARD ON CARDIO-RESPIRATORY ENDURANCE WITH HARVARD STEP TEST NORMS**

<table>
<thead>
<tr>
<th>Standard</th>
<th>H.S.Test (^3)</th>
<th>Standard for Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Excellent</td>
<td>Above 90</td>
<td>above 77</td>
</tr>
<tr>
<td>Average</td>
<td>65 - 79</td>
<td>56 - 65</td>
</tr>
<tr>
<td>Poor</td>
<td>Below 55</td>
<td>Below 47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>above 79</td>
<td>above 82</td>
</tr>
<tr>
<td>Average</td>
<td>63 - 69</td>
<td>68 - 74</td>
</tr>
<tr>
<td>Poor</td>
<td>Below 54</td>
<td>Below 59</td>
</tr>
</tbody>
</table>

### IV) Speed:

The statistical analysis of speed performance of the students of different regions of Nepal indicated that there were

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similar patterns in each three age groups where the students of Tarai were found superior on each percentile level. The performance given by the students of Tarai of 14 years (grade eight) was less than 7.0 sec.; 99th and 6.4 sec.; 10th percentile) the performance of Hill and Himalaya students (Table - 30). In the same way ninth and tenth grade students were found to be faster in speed than the students of Hill and Himalaya.

The performance revealed by the Table 30, 35 and 40 indicated that, of course the students of Tarai were faster than the Hill and Himalaya students, but they were inferior in speed performance to the U.S.A. children.

**TABLE - 47**

**COMPARISON OF NATIONAL NORMS FOR NEPAL WITH AAHPER TEST NORMS ON SPEED PERFORMANCE**

<table>
<thead>
<tr>
<th>Percentile</th>
<th>AAHPER Norms&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Norms for Nepal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>95th</td>
<td>6.2</td>
<td>6.0</td>
</tr>
<tr>
<td>70th</td>
<td>6.9</td>
<td>6.6</td>
</tr>
<tr>
<td>50th</td>
<td>7.2</td>
<td>6.9</td>
</tr>
<tr>
<td>30th</td>
<td>7.6</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Scores are in seconds.

<sup>4</sup>Ibid P. 471
It is seen from the Table - 47 that none of the mentioned three age groups of Nepal is similar to American children in speed performance. It is observed that the 14 and 15 years age group students of Nepal have been given 7.5 and 7.2 seconds timing on 95 percentile but the American students are on the 30th percentile with the timing of 7.6 and 7.2 seconds respectively. The students of 16 years age group of Nepal are approximately similar, at 95 percentile (6.1 seconds) to the American 16 years age group children (6.0) in speed performance.

Thus it may be concluded that the students of Nepal might be inferior to their counterparts in American speed performance.

(C) Relationship between the Physical Fitness performance and selected Anthropometric measure of secondary school students:

It was observed from the Table - 41, that the physical fitness performance and anthropometric measure of eighth grade students of Nepal were not found to be significantly correlated. The relationship of muscular strength was found to be negatively correlated with selected anthropometric measure, where the highest correlation was seen (+0.036) with arm girth. In the same way the anthropometric measures were found to be correlated with muscular endurance, cardio-respiratory endurance
and speed at low level, where the highest correlation value was +0.092 (foreleg length vs muscular endurance), +0.126 (Age vs cardio-respiratory endurance) and -0.053 (forearm length vs speed).

It was revealed from the intercorrelation matrix of ninth grade students (Table - 42), that correlations of anthropometric measure with muscular strength, muscular endurance, cardio-respiratory endurance and speed were found low. The established high correlation value was +0.019 (Thigh girth vs muscular strength), +0.077 (Foreleg length vs muscular endurance), +0.099 (Age vs cardio-respiratory endurance) and -0.052 (forearm length vs speed). It was noted that correlations between anthropometric measure and muscular strength of ninth grade students were found mostly negative.

In the study regarding the relationship between the anthropometric measure and physical fitness performance of tenth grade students it was found that (Table - 43) the muscular strength was always negatively correlated with selected anthropometric measure, where the highest correlations value was +0.023 (forearm length vs muscular strength). The correlation of anthropometric measure with muscular endurance, cardio-respiratory endurance and speed were non-significant. The highest correlation value was found +0.039 (Hand length vs
muscular endurance), +0.057 (chest girth vs cardio-respiratory endurance). The speed performance was found to be significantly correlated with age (-0.114) and forearm length (-0.077).

The earlier studies related with the measurements of body segments and physical performance indicated low correlation. The findings of Hindmarch (1960), Terrel (1968), Yoest (1973), Nicholson (1964), Burley (1961), Bookwalter (1948) and Cureton indicated that it was insufficient for effective prediction to determine the relationship of selected anthropometric measurements to physical fitness performance because of low correlation. The results of present study agree with the findings of aforesaid researchers.