Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Athletes train regularly with increasing amount and intensity of work during the training sessions, in their attempt to achieve the best possible results. The development of "sports form", a final high level of training, is related to the positive changes which their bodies have undergone. If the requirement of the training and the total amount of effort in everyday life and the training programme are in accordance with the abilities of the athlete, a normal development of "sports form" will occur and the athlete will produce good results, thus gradually improving his performance both in training and competitions. If, however, the total amount and intensity of the effort surpass the body's limits, a progressive fatigue may set in which may impair the performance of the athlete on certain psychophysiological variables. Thus, the present study was undertaken with the purpose of investigating the effects of induced physical fatigue and mental fatigue on selected psychophysiological variables of reaction time, speed of movement, hand steadiness, and
depth perception of high and low fitness groups, as by studying the performance under artificially induced fatigue conditions simulate the real game like conditions under which the performance may be expected.

Two fitness groups \((n = 30\) each) acted as subjects for the purpose of this study. Subjects in these groups were selected on the basis of their performances on the AAHPER Youth Fitness Test. For this purpose the AAHPER Test was administered to all the male students of classes 9, 10 and 11 of the Kendriya Vidyalaya No.1, Gwalior. In all 140 students who completed the AAHPER test, were ranked in order from high to low on the basis of their scores on this test. The top 20 percent and the bottom 20 percent were finally selected as the high and low fitness groups respectively in order to have real differences in their fitness levels \((t = 24.76\) against \(t_{01}\) df 58 = 2.67).

The data on the selected psychophysiological variables of reaction time, speed of movement, hand steadiness and depth perception, before and after inducing physical and mental fatigues were collected by administering the tests related to these variables in the Research Laboratory of the Lakshmibai National
College of Physical Education, Gwalior. Reaction time was measured by Anand Electronic Reaction Time Apparatus; speed of movement by Nelson Speed of Movement Test; hand steadiness by Steadiness Tester; and depth perception by Depth Perception Box. Before collecting the data, the reliability of the data was established.

In this study the physical and mental fatigues were considered the experimental variables, the effects of which were studied on the said psychophysiological variables. Consequently three performance scores for each variable were obtained - without fatigue performance on a particular variable, after physical fatigue performance, and after mental fatigue performance on that variable. After inducing a particular fatigue the data on a single variable only was collected on a particular day and to avoid the fatigue effects being carried over at least one day's gap was provided to all the subjects. The physical fatigue was induced by cycle ergometer pedalling exercise (continuous loading method) and the mental fatigue by a standard test of mental fatigue.

The data pertaining to the selected variables collected under three conditions (non-fatigue, physical fatigue and mental fatigue) for both the high and low fitness groups were analysed by two-way analysis of
variance for each variable separately. The F ratios obtained by two-way analysis of variance were tested for significance at .05 level of confidence. To test the significance of differences between the paired means, where F ratio was found significant, the Scheffe's S Test of Post Hoc significance was applied.

Analysis of the data revealed that there were significant differences at .05 level on the reaction time performances of the subjects under different fatigue conditions (F = 330, against F .05 = 3.05), whereas fitness groups did not exhibit significant difference on the reaction time before and after physical and mental fatigues (F = 0.00, against F .05 = 3.90). Further, physical fatigue significantly improved the reaction time performances of subjects (Mean diff. = .05, against I .05 = .007), whereas mental fatigue impaired the reaction time performances of subjects significantly (Mean Diff. = .03, against I .05 = .007), thus showing significant differences in their effects on reaction time performances (Mean Diff. = .08, against I .05 = .007).

The findings pertaining to speed of movement revealed that the high and the low fitness groups did not show significant difference on this variable (F = 1.14, as against F .05 = 3.90) before and after
physical and mental fatigues, while speed of movement performances of subjects showed significant differences at .05 level when these performances were measured under different fatigue conditions ($F = 3.57$, against $F_{.05} = 3.05$). It was further observed through Post Hoc test that mental fatigue significantly slowed down the speed of movement of subjects (Mean Diff. = .018, against $I_{.05} = .016$) whereas physical fatigue did not significantly affect speed of movement (Mean Diff. = .005 against $I_{.05} = .016$) and significant differences were not observed in the effects of physical and mental fatigues on this variable (Mean Diff. = .013, against $I_{.05} = .016$).

The data on hand steadiness also exhibited that the high and the low fitness groups did not differ in their performance on this variable ($F = .63$, against $F_{.05} = 3.90$) before and after both types of fatigue, but the hand steadiness of subjects was significantly affected by different fatigue conditions ($F = 40.24$, against $F_{.05} = 3.05$), and both the physical and mental fatigues showed significant impairment on this variable when significance between paired means was observed (Mean Diffs. = 17.42 and 22.26 respectively, against $I_{.05} = 6.41$).

As regards to depth perception, the analysis of the data revealed that the subjects belonging to high
and low fitness groups showed significant differences on this variable at .05 level of confidence before and after physical and mental fatigues (F = 8.63, against F .05 = 3.90) and the depth perception performances of subjects were significantly affected by different fatigue conditions (F = 16.06, against F .05 = 3.05). The post hoc test of significance further revealed that both the physical as well as mental fatigues significantly impaired the depth perception of subjects (Mean Diffs. = 1.09 and 1.89 respectively against I .05 = .78), and also there were significant differences in the effects of physical and mental fatigues on depth perception (Mean Diff. = .80, against I .05 = .78).

Conclusions

Within the limitations identified and on the basis of the results of the study, the following conclusions were drawn:

Reaction Time

The high and the low fitness groups did not differ in their behaviour on reaction time performances before and after physical and mental fatigues, however, reaction time performances of subjects under different fatigue conditions were differently affected i.e. physical fatigue improved the reaction time, and the
mental fatigue prolonged the reaction time, but fitness level and reaction time were independent.

Speed of Movement

The fitness groups as employed in this study did not exhibit any real differences on the speed of movement performance before and after physical and mental fatigues, however, mental fatigue decreased the speed of movement whereas physical fatigue did not affect it. Further, fitness and speed of movement were not related.

Hand Steadiness

The two fitness groups did not differ on their hand steadiness performances before and after physical and mental fatigues, but physical fatigue and mental fatigue, both induced separately, considerably impaired the hand steadiness of subjects.

Depth Perception

The high and the low fitness groups showed significant differences in their depth perception ability before and after physical and mental fatigues, thus showing fitness as an underlying factor of visual perception, and also physical and mental fatigues induced differently impaired the depth perception of subjects, with mental fatigue affecting the depth
perception significantly more than the physical fatigue.

**Recommendations**

Based on the conclusions of this study, the following recommendations have been made:

1. **In performances where reaction time plays a decisive role, the pulse rate may be raised to between 150 and 170 bpm to achieve good results.**

2. **Mental relaxation techniques may be evolved as mental fatigue impairs the performances on the variables of reaction time, speed of movement, hand steadiness, and depth perception.**

3. **Physical fatigue of the level as employed in this study may be avoided in case of performances which demand steadiness and good visual perception as in shooting, archery etc.**

4. **Special fitness training may be advised for sportsmen participating in games like volleyball, basketball, tennis, squash, cricket etc. in which the ability to perceive depth correctly underlies the players' judgement to accurately receive or deliver the ball.**

5. **Studies may be undertaken on highly trained**
sportsmen who have participated at National and International levels, to investigate the psychophysiological performance variations, if any, as a result of induced physical and mental fatigues.

6. The study may be repeated with subjects of age and sex other than those employed in this study.