Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The world of training methodology has crossed many milestones as a result of different types of research in general and their application to the sports development in particular. In the modern scientific age athletes are being trained by highly sophisticated means for better achievements in their concerned sports, and greater stress has been laid on the quality rather than the quantity of training.

The purpose of the present study was to compare the effects of plyometrics, circuit training and circuit breaker programmes on related physiological variables and motor components of school level Tennis players. The subjects were 80 male Tennis players from the Lawrence School, Lovedale, Laidlaw Ketti and Hebron School, Ooty. The subjects were selected randomly and were randomly assigned to the three experimental groups and one control group with 20 subjects in each. All of the subjects were boarders in their respective schools and their ages ranged between 13-18 years.

The pre-test and post-test scores on the selected motor components and physiological variables namely Power: (Leg, Shoulder and Arm Power), Muscular Endurance Speed, Agility, Cardio Respiratory Endurance, Flexibility (Shoulder, Spine, Hip and Back) Static and Dynamic Balance, Resting Heart rate, Exercise Heart Rate, Resting
Respiratory Rate; Vo$_2$ max, and Cardiopulmonary Index were taken before and after the experimental training period of twelve weeks.

Leg power was assessed by the Standing Broad Jump performance and Shoulder and Arm Power were tested by Medicine Ball Put. Muscular Endurance involved use of Burpee Test, Speed was tested by 50 yard Dash, Agility by Right Boomerang Run and Cardio Respiratory Endurance was assessed by 1.5 Mile Run. Shoulder Flexibility was tested by Shoulder Rotation Test, Spine Flexibility by Bridge up Test Hip and Back by Sit and Reach Test, Static Balance by Stork Stand Test and Dynamic Balance was tested by Modified Bass Test.

The Resting Heart Rate and Exercise Heart Rate were assessed by palpation at the carotid artery and Resting Respiratory Rate was examined by the number of inhalation or exhalations in a minute. Vo$_2$ max was measured by using Astrand-Astrand-Nomogram and the Cardiopulmonary Index was assessed using the formula given by Hyman.

The training programmes for the experimental groups were administered thrice a week on alternate days. The plyometric training programme consisted of single leg hopping, bounding, plyometric pushups, medicine ball throw, depth jumps, box drill and sit ups on Mondays, Wednesdays and Fridays. The circuit training programme involved step ups, push ups, sit ups, double knee jumps, squat thrust,
skipping and interval running on Tuesdays, Thursdays and Saturdays. The circuit breaker programme consisted of jump rope, step ups, shuttle run, push ups, jump ups, side jumps and sit-ups on Mondays, Wednesdays and Fridays. To find out the significance of differences between pre-test and post-test means and among the experimental groups and the control group in selected motor components and physiological variables analysis of covariance was applied. The differences in the paired adjusted final means among the groups were tested following the post hoc analysis. The level of significance chosen to test the hypothesis was 0.05.

The findings pertaining to difference in standing broad jump, analysis of covariance indicated a significant F-ratio of 117.5 for the adjusted post test means, and the mean difference revealed significant differences for plyometric, circuit training and circuit breaker programme as compared with the control group.

The Analysis of data on shoulder and arm power measured by medicine ball put, revealed significant F-ratio's of 7.22 and 63.75. The mean differences revealed that plyometric and circuit breaker programmes are superior to circuit training and control group in the above variable.

In the case of muscular endurance significant F-ratio's of 2.98 and 20.50 for post and adjusted means were obtained. However the analysis
of covariance revealed significant difference for three experimental groups as compared with the control group.

In the case of 50 yard dash performance, significant F-ratio of 5.0 for adjusted means was obtained and the analysis further revealed significant difference for three experimental groups as compared with the control group.

Significant F-ratio's of 8.84, 7.32 and 16.75 were obtained for pre means, post means and adjusted means in the case of Agility. All the three experimental groups differed significantly from the control group.

In the case of cardio respiratory endurance significant F-ratio of 29.10 was obtained for adjusted means. The plyometric group differed significantly from all the other three groups except circuit breaker programme. Circuit training and circuit breaker programme groups differed significantly from the control group.

Significant F-ratio of 29.67 was obtained for adjusted means in the case of hip and back flexibility. The three experimental groups differed significantly from the control group.

With regard to spine flexibility significant F-ratio of 23.39 was obtained for adjusted means which revealed that all the three experimental groups differed significantly from the control group.
In shoulder flexibility test the F-ratio's 2.10 for the adjusted post mean was insignificant showing no significant differences between the three experimental and the control group.

Significant F-ratio of 17.52 was obtained for adjusted means in case of static balance which revealed that all the three experimental groups differed significantly from the control group.

Analysis of covariance with regard to dynamic balance showed significant F-ratio's of 4.77 and 36.91 for post and adjusted means which revealed that all the three experimental groups differed significantly from the control group.

In the case of resting heart rate significant F-ratio of 4.57 for adjusted means was found which revealed significant difference for three experimental groups as compared to the control group.

Significant F-ratio of 31.75 was obtained for adjusted means in case of exercise heart rate. This revealed that all three experimental groups differed significantly from the control group.

Analysis of covariance indicated significant F-ratio of 9.39 for adjusted means in respect of resting respiratory rate showing that all the three experimental groups differed significantly from the control group.

In the case of cardio-pulmonary index, all the three F-ratio's were insignificant (2.00, 1.00, 1.00) revealing no significant differences among the groups.
In maximal oxygen consumption (Vo₂ max) significant F-ratio of 7.87 was obtained for adjusted means which showed that all the three experimental groups differed significantly from the control group.

The overall analysis revealed that all the three experimental programmes of 12 weeks duration are effective in positively improving most of the physiological variables and motor components of the subjects. In speed and strength variables the plyometric and circuit breaker programme were comparatively better than the circuit training group. All three training programmes had an almost equal effect on the experimental groups with respect to other variables. In all the variables experimental groups exhibited better performance as compared to the control group.

**Conclusions**

On the basis of the findings of the study, the following conclusions may be drawn.

1. Twelve weeks of planned and systematic training programme is beneficial in improving the motor components and physiological aspects of school level male Tennis players.

2. Twelve weeks of plyometric training and circuit breaker programme is effective in improving the upper body power and leg power of school level male Tennis players.
3. Both the plyometric and circuit breaker training programmes are equally effective in developing body power.

4. Plyometric, circuit training and circuit breaker programmes are equally effective in developing agility, speed, muscular endurance, cardio-respiratory endurance, flexibility (back and hip, spine), balance (static, dynamic), resting heart rate, exercise heart rate, resting respiratory rate and maximal oxygen consumption (Vo2 max).

5. Shoulder flexibility and cardio pulmonary index are not improved by the kind of implemented Plyometric, circuit training and circuit breaker programmes.

**Recommendations**

On the basis of the findings of the study and the conclusions drawn, the following recommendations are made:

1. In sports and games where power is a dominating factor it could be developed and improved to a great extent through plyometric and circuit breaker training programmes.

2. Twelve weeks of plyometric, circuit training and circuit breaker programme may be effectively employed for improving the body power, agility, speed, muscular endurance, cardio-respiratory endurance, flexibility, balance, resting heart rate, exercise heart
rate, resting respiratory rate and maximal oxygen consumption (\(V_{O_2} \text{ max}\)).

3. Further studies may be undertaken with a larger sample in various Track and Field events, games and sports like, Weight Lifting, Boxing, Volley Ball, Squash, Badminton and Foot Ball where most of the motor abilities seem to affect performance.

4. Coaches and athletes may make use of plyometric training circuit training and circuit breaker programmes in their day-to-day workouts by the athletes for the improvement of physiological and motor components.

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