CHAPTER - V
SUMMARY, CONCLUSION AND RECOMMENDATIONS

The purpose of the study was to compare the peak torque strength ratio of hamstring and quadriceps of dominating leg with hamstring and quadriceps of non-dominating leg and strength of hamstring and quadriceps of dominating and non-dominating leg at three selected speeds that is 60°, 180° and 240°/sec for the selected track and field event groups that is throwers, jumpers, sprinters and middle distance runners.

Twenty players each from four throwers, jumpers, sprinters and middle distance runners attending the national camps for the preparation of 1998 Asian games acted as subjects for the study.

The subjects were tested on cybex 340 iso-kinetic machine. Movement of knee joint was tested at three speeds to determine the peak torque. The cybex 340 machine has the facility of attached computer which facilitate date recording during the test.

't' test was used to find out significance of difference between dominating and non-dominating leg for each group separately. 't' test was also used to compare the hamstring/quadriceps strength ratio (H/Q ratio) at selected speeds for all the groups. 'F' test was applied to determine significance of differences among four track and field groups with respect to quadriceps, hamstring of dominating and non-dominating leg and hamstring/quadriceps strength ratio for dominating and non-dominating side at selected speeds separately. If 'F' ratio was found
significant then the post-hoc test was applied.

In the throwers group peak torque means values were higher than the other three groups and the middle distance runners were found to be poorer than other groups at all speeds. When peak torque of quadriceps and hamstring were compared for both dominating and non-dominating side the result revealed significance difference in all groups. When quadriceps of dominating leg were compared with quadriceps of non-dominating leg the result were found insignificant. A comparison between dominating & non-dominating hamstring was found to be insignificant.

When comparison among four groups was carried out it was found that all groups differ significantly from each other in quadriceps peak torque of dominating side at all speeds.

A comparison of quadriceps of non-dominating side indicated difference among all four groups. A comparison between throwers and middle distance runners, and between middle distance runners and jumpers was also found to be significant. The "F" values obtained while comparing the dominating hamstring were found to be significant at all speeds. The paired mean values between throwers and middle distance runners and between throwers and sprinters and jumpers and middle distance runners were found significant. The analysis of variance for hamstring peak torque non-dominating leg at 60°/sec and 180°/sec showed a significant difference among four groups.

No significant difference in hamstring and quadriceps strength ratio
between dominating and non-dominating side was found in throwers at all speeds. In sprinters at all speeds, in jumpers at 180 and 240°/sec and in middle distance runners at 240°/sec.

No significant difference existed among four groups with respect to hamstring quadriceps of strength ratio values of dominating side. But a significance difference was found on non-dominating side among four groups. Middle distance runners when compared with throwers, jumpers and sprinter at 180°/sec speed revealed significant difference and with throwers at 240°/sec speed the value found was significant.

Norms were prepared for hamstring and quadriceps of dominating and non-dominating side at all speeds for all the groups separately.

In addition to strength peak torque, the angle of peak torque (AOPT) and torque acceleration energy (TAE) was studied. There is a significant difference in AOPT between quadriceps and hamstring of dominating and non-dominating side at all speeds in all the selected groups. Though no significant difference in angle of peak torque was found when a comparison between quadriceps of dominating and non-dominating side and hamstring of dominating and non-dominating side was made. There was no significant difference found in angle of peak torque at all speeds among all the four groups when comparing quadriceps of dominating and non-dominating side and hamstring of dominating and non-dominating side.

The torque acceleration energy (TAE) values showed an increase in mean values with the increase in the speed/sec. but no difference
between dominating and non-dominating quadriceps hamstring was found at all speeds in all groups. All the four groups differed from one another in TAE values of dominating and non-dominating quadriceps at all speeds. No difference was found among four groups when hamstring of dominating side was compared whereas a significant difference was found for hamstring of non-dominating side among all the groups.

CONCLUSIONS

1. Throwers are found to be the strongest group and middle distance runners are poorest group in strength peak torque at all speeds.

2. Quadriceps is stronger than hamstring in dominating and non-dominating side at all speeds in all groups.

3. There is a no significant difference in quadriceps of dominating and non-dominating side at all speeds.

4. There is no significant difference in hamstring of dominating and non-dominating side at all speeds.

5. All groups differ from each other in quadriceps peak torque of dominating and non-dominating sides.

6. A significant difference in quadriceps peak torque exists between throwers and middle distance runners and between jumpers and middle distance runners.

7. A significant difference in dominating hamstring exists among all groups at all speeds.

8. A significant difference with respect to dominating hamstring
exists between throwers and middle distance runners, throwers and sprinters and jumpers and middle distance runners.

9. A significant difference in non-dominating hamstring exists among four groups at 60°/sec and 180°/sec speeds.

10. There is no significance difference in hamstring and quadriceps strength ratio between dominating and non-dominating side in throwers at all speeds in sprinters at all speeds; in jumpers at 180°/sec and 240°/sec and in middle distance runners at 240°/sec speed.

11. No significant difference was found among four groups with respect to hamstring/quadriceps strength ratio values of dominating leg.

12. A significant difference was found among four groups with respect to hamstring/quadriceps strength ratio. Middle distance runners when compared with throwers, jumpers and sprinters at 180°/sec speed and with throwers at 240°/sec revealed significant difference.

13. Significant difference exists in AOPT between quadriceps and hamstring of dominating and non-dominating side at all speeds in all the groups.

14. There is an increase in TAE values with the increase in test speed.
RECOMMENDATIONS

In the light of these conclusions the following recommendation are made:-

1. Coaches should ensure a balanced development of muscles working on both side of the knee joint.

2. It is necessary to conduct thorough investigation of muscles acting on knee joint.

3. Before conducting tests a training programme of minimum 6 week iso-kinetic machines may be carried out to get accustomed to the movements.

4. When using free weights, exercises may be executed at different angles. Specially at angles which are required for competition activity.

5. Flexibility exercises may be included in strength training programmes to avoid shortening of the concerned muscle group.

6. More stress should be laid on high velocity exercises.

7. A similar study may be undertaken with respect to sports women.

8. A similar study may be conducted on sports persons at a younger age.

9. A similar study may be carried out using subjects from different games or events.

10. Different angles should be used for assessing and training for strength development.