CHAPTER - III
METHODS AND PROCEDURES

In this chapter the selection of the subjects, selection of tests, administration of the tests and statistical methods for analysis of data have been discussed.

SAMPLES

The subjects for this study were track and field male athletes attending the national camps at Sports Authority of India, Netaji Subhas National Institute of sports, Patiala. The subject were devided in to four groups on the basis of their events like Throwers, Jumpers, Sprinters and Middle distance runners. Throwers group consists of Hammer throw, Discuss throw, Javline throw and Shot put events; Sprinters group was of 100 M, 200 M and 100 M Hurdle events : Jumpers group includes High jump, Long jump, Pole vault and Tripple jump and Middle distance group comprised of 800M and 1500 M, events. Total number of subjects for the study were eighty (80), twenty (20) subjects from each group.

TOOLS

In order to measure hamstring and quadriceps strength the cybex 340 model isokinetic machine was used. This machine facilitates testing at any given angle for eighteen groups of muscles except back and neck. The cybex 340 has positioning chairs which assure complete stability during testing and have independent adjustable seats abd backs.
for testing. It has a dynamometer with integral range limit device providing controlled testing from 0 - 300°/sec. The computer attached to the cybex has the testing procedure memory. It records the data during testing and simultaneously displays the data in the form of graphs numerics. After completion of the test, the data collected is transferred to the hard disc of the computer and when required print out can be taken.

ADMINISTRATION OF THE TEST

The subjects were tested at three speeds 60°/sec, 180°/sec and 240°/sec. The subjects were given proper warm up before testing. They were made familiar with the isokinetic machine and were given trails prior to testing so that during testing they did not hesitate to perform their best effort.

The dynamometer was rotated to the side to be tested and maintained at zero degree tilt. The subject was seated as close to back rest as possible so that his back remained completely straight along the back rest, with knee flexed at 90°, arms crossed over the chest. The knee to be tested was close to the dynamometer. The centre axis of the dynamometer passing through the centre of the knee to be tested. The back rest was adjusted to support the subject in a comfortable position with trunk at a desired angle of testing. The long input adapter was attached to the dynamometer. The adjustable arm was slid inside the long input adapter. The shin pad was attached to the adjustable arm handle. Adjustment of the shin pad was made on the leg so as the
bottom edge of the shin pad was kept just above the superior border of the medial malleous. To prevent slipage the shin pad was strapped to the subject along with velcro belt as tightly as tolerable. The subject was stabilised from pelvic and torso tightly securing the three point safety and tape belts. The subjects were instructed to begin testing in full flexion with heel touching the kick pad.

After the subject was stabilised, the shin pad was adjusted on the leg at proper position. For each subject new file was opened and biodata of the subject was entered. Following the standard instructions and procedures the subject was asked to start at 60°/sec. Four trails were given in order to get subject acquainted with the mode of performing the task and after adequate rest final test was conducted. After 20 sec. rest similar procedure was followed at 180°/sec. three trails were recorded. After rest four trails were given at 240°/sec. and final test was conducted in which 20 repetitions were recorded.

After completion of the test for one leg, the stabilising belts were removed and the subject was given adequate rest and then the same procedure was followed for the other leg. After completion of the test, the data collected was transferred to the hard disc of the computer and print out was taken.

Prior to each test session, the dynamometer was calibrated using the manufacturer's suggested protocol.

In addition to the strength test the age, body weight and height of the subject was taken and fed in to the computer. The weight of the
subjects taken by using electronic weighing machine and the height of the subject was measured with stadio meter with the help of an anthropometry expert.

**STATISTICAL ANALYSIS**

The data collected was statistically analysed. Mean and standard deviation values were calculated for the peak torque for the dominating and nondominating leg for all the four groups. 't' test was applied to calculate the significance level. In order to establish significance of differences among groups with respect to quadriceps and hamstring strength for dominating and non-dominating legs at three speeds separately, F test was applied. If F values were found significant post Hoc test was applied to find significance of difference between paired means.

Similarly the calculations were made for hamstring/quadriceps strength ratio, angle of peak torque and torque acceleration energy for the dominating and non-dominating leg for all the four groups.