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COMPARATIVE STUDY OF EXPLOSIVE STRENGTH AND MAXIMUM LEG STRENGTH BETWEEN 100 AND 400 METER SPRINTERS

TIWARI L.M.[1*], KULJINDER SINGH[2] AND VAIBHAV RAI[3]

[1]Department of Physical Education Punjabi University Patiala Punjab India
[2]Govt. Senior Secondary School Attari Amritsar Punjab India
[3]Department of Physical Education S.G.G.S. Khalsa College Mahilpur Punjab,India
*Corresponding Author: Email- drlalittiwary@gmail.com

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Abstract- Purpose: The Purpose of the study was to "compare the Explosive strength and Maximum leg strength between 100 meter and 400 meter sprinters." Forty (40) female Athletes from Punjab, India (20 from 100 meters and 20 from 400 meters) who have participated in All India Inter-University athletics Championship were selected as subjects. The age of the subjects were ranged from 18-24 years. It was hypothesized that there would not be a significant difference in explosive strength and maximum leg strength between 100 meter and 400 meter sprinters. Their maximum leg strength was measured by leg dynamometer in Kgs and explosive strength performance was recorded by standing broad jump in meters respectively. The data collected on explosive strength and maximum leg strength was analyzed by independent "t" test. The level of significance for testing the hypothesis was set at 0.05 level of confidence. Findings: The results have shown that the sprinters participated in 100mts and 400mts did not differ significantly in the explosive strength and maximum leg strength. The mean values of Explosive strength for 100 and 400 meter sprinters were 2.049 mt and 2.025 mt respectively and the mean values of Maximum leg strength for 100 and 400 meter sprinters were 133.2 kg and 133.05 kg respectively. The calculated t- value for explosive strength was 1.142 which showed no significant difference. (t_{cal}=1.142 <t_{tab}=2.021) and the calculated t- value for maximum leg strength was 0.037 which showed no significant difference. (t_{cal}=0.037 <t_{tab}=2.021). The sprinters participated in the events of 100mts and 400mts did not differ from each other in explosive strength and maximum leg strength .
Keywords- Explosive strength, Maximum leg strength, Dynamometer, Sprinters

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Introduction

Sprinting is one of the popular events in Track and Field.100m and 400m etc are some of the events which demands supreme efforts, excellent physical fitness, sufficient strength and speed. The sprinters of these events use blocks to start because of its mechanical advantages. Proper starting is one of the most important fundamentals of good sprinting and often races are decided by inches made or lost on at the start. Strength is a conditional ability i.e. it depends largely on the energy liberation processes in the muscles. Strength is also perhaps the most important motor ability in sports as it is a direct product of muscle contractions. It is the key element because it is more improved than other elements. It is infect the only element that can only be improved with one hundred percent success.

Bosworth (1965) selected 107 college women who were tested for leg strength and vertical jumping ability, anthropometric measures and ratios were obtained from photographs. Correlations were computed between the vertical jump and each of the anthropometric variables and leg strength. A multiple R of 0.612 was obtained with the criterion using leg lift/weight x shape index, bi-iliac width/leg length 2, lower trunk length 2, lower leg length 1/ upper leg length2, and foot width. Neither anthropometric measurements or strength variables, nor the cumulative effect of the selected variables were significantly related to the vertical jump performance adequately.

Boschs (1968) conducted a study on the subjects trained three times per week upper legs were parallel to the floor, followed by

the return to erect position. The experimental subjects (N=22) exercised with weights on their shoulders while the control subjects (N=24) exercised without weights. The vertical jumping height was measured, and a leg dynamometer measured isometric leg strength .A significant improvement in both sargent. Jumping & leg strength was shown for the experimental subjects. The control group did not improve in lither tests.

Smith (1961) conducted a study to find out the relationship between explosive strength and performance in the vertical jump. The leg strength of 70-college male was measured in a position designed to involve the power thrust of the muscle group used in the vertical jump. The subjects then performed a modified sargeant jump that used no arm swing. The result was interpreted to support the hypothesis that strength exerted against a dynamometer involves a different neurometer pattern that strength exerted by the muscle during a movement.

Quarles (1968) conducted a study in order to compare the increase and leg power of a rope jumping group of subjects with a stair running group of subjects and found that the stair running group showed a significant gain in leg power, while the rope jumping group did not show any significant gain.
Pearcy (1973) conducted a study in which measurements were obtained on 114 college men to determine the relationship between power and strength of the thigh and leg muscles to the extent to which this relationship was affected by limb length, pearsons product Moment and partial correlation's were positive but low (0.20 to0.30) between jump and reach scores and speed in extending the legs as measured by a 100sec. Chronoscope. There was no appreciable change in the correlations when thigh and lower limb measurements were held constant.

Gamer (1986) determined that, a plyometric exercise programme was better than a weight training exercise programme improving leg power as measured by vertical jump. Standing broad jump and forty-meter sprint ability. The training protocol consisted of plyometric drills two times a week or weight training exercise three times a week for eight weeks period, pre-test, mid-test and post test assessments were taken. Mean gains from the pre-test to post-test for the weight training, plyometric training on control group respectively were: standing broad jump 11.2 cms. 9.5cms and 15 cms, vertical jump 2.3 CMS, 1.78cms and 2.50cms and 40 m sprint, 2.22sec, 20sec and 30secs. The gain achieved by both treatment groups were significantly (p.05) greater than those experienced by control group, but no difference existed between the gains attained by the two-treatment group. It was concluded that there is no difference between the two programmes in improving leg power.

Dutko (1993) conducted a study, in order to compare two progressive strength training protocols, a plyometric exercise protocol and two flexibility protocols, for improving the strength and flexibility of the quadriceps and hamstrings muscular complex of high school weight training students. Sixty students 16-18 yr. of age volunteered for six weeks, 3 days a week, quadriceps and hamstrings muscular complex strength and flexibility study. All training protocols significantly increased left quadriceps and left hamstrings strength; however, the flexibility protocol static stretching was more effective in producing strength of the hamstrings.

Methods

Subjects- Forty (40) female sprinters (twenty 100 meter and twenty 400 meter) from Punjab state, India who have participated in 100mts and 400mts on various stages like quarter finals and finals in All India Inter-University athletics Championship were selected as subjects. The age of the subjects were ranged from 18-24 years.

Hypotheses- It was hypothesized that there may not be significant difference in explosive strength and maximum leg strength between 100 meter and 400 meter sprinters.

Criterion Measures

The following tests were selected and their scores were considered as criterion measures for this study: -

1. Maximum Leg strength was measured by Leg dynamometer the scores were recorded in kgs.
2. Explosive strength was measured by standing broad jump performance was recorded in meters.

Collection of Data

- **Explosive Strength (Standing Broad Jump)**

Test administration- The subject is asked to stand behind the starting line with the feet parallel to each other. He is instructed to jump as farthest as possible by bending knees and swinging arms to take off for the broad jump in the forward direction, the subject is given three trials.
Scoring- The distance between the starting line and the nearest point of landing provides the score of the test in meters.

- **Maximum Leg strength (Dynamometer Test)**

Test Administration

The subject stood on the dynamometer base, with feet parallel and about 6 inches apart. The malleoli of the ankle joint was nearly opposite to the attachment of the dynamometer to its base .The subject stood with head erect, back straight, and chalked fingers extending down the thighs. Belt was used around the subject's hips to stabilize the bar, as the lifting force of the legs is much too great to be held by the hands. The subject held the center of the bar, palms down, at the level of pubic bone. As the tester faces the subject, the belt loop was attached to the left end of the bar. The belt was brought around the lower portion of the sacrum to the right end of the handle. In order to make the attachment to the right side of the bar, subject proceeded as follows: formed a loop in the belt by folding it back. The loop was opposite the end of the handle. Held the loop in the left hand, reached down between the belt and subject grasped the end of the belt in the right hand. Slided the loop over the bar pulled the end of the belt up against the subjects hip. With the belt in that position, the pulling force of the bar was held the tail end of the belt against the subject's body, preventing the bar from sliding –similar to a timber hitch. The subject with head up and back straight, bend at the knees. The handle was hooked on to the chain so, that the subject's knees were flexed between 115 and 125 degrees. The bar was on the sub-

ject's thighs during the lift. The subject might have placed their hands either in the middle or at ends of the bar. The subject was asked to lift straight up. At the completion of the lift the subject's knee joint were almost completely extended to insure maximum effort.

Scoring
Three trials were given and the highest score of reading were recorded in kgs.

Statistical Procedure
In order to compare the scores of the subjects participated in the events of 100mts and 400mts, the scores obtained from the tests of maximum leg strength and explosive strength the data were subjected to Independent't' test. The level of Significance was set at 0.05 levels ($p < 0.05$).

Result
The Mean values of the variables of both groups are given in Table-1.

Table 1- Means of Scores of Subjects in Explosive Strenght and Maximum Leg Strenght

Group	N	Explosive Strength	Maximum Leg Strength
100 mt Sprinters	20	2.049	133.2
400 mt Sprinters	20	2.025	133.05

Mean value of Explosive Leg strength in Meters and the Mean value of Maximum Leg Strength in Kilograms
Findings pertaining to each of the selected variables of different groups which were subjected to the't' ratio has been given in Table 2.

Table 2- Significance of Difference of Means in Explosive Strength and Maximum Leg Strenght

Variable	Mean of 100 mt Sprinter	Mean of 400 mt Sprinter	D.M.	't' ratio
Explosive Strength	2.049	2.025	0.024	1.142
Maximum Leg Strength	133.2	133.05	0.15	0.037

**Significant at 0.05 level*
$t_{(0.05)}$ *(38) = 2.021*
Table 2 reveals that there were no significant differences in Explosive Strength and Maximum Leg Strength variables as the obtained't' value is less than the required 't' value.

Discussion of Findings
The analysis of data reveals that no significant difference in explosive strength and maximum leg strength of 100 and 400mts sprinters was found at the 0.05 level of significance, which establishes that various categories of sprinters possess more or less equivalent explosive and maximum leg strength. Both events comes under sprinting events and the athletes do approximately same training. Both type of sprinters required maximum amount of force for propelling their body from the starting block as a result they have white muscle fibers inside the muscles. These type of muscle fibers exert more force with maximum speed. This may be probably due to the similar nature of training and pre-requisite components for sprinters.

Testing of Hypothesis
As the results have shown that the subjects of 100 and 400mts sprinters did not show the significance difference in explosive strength and maximum leg strength therefore, the hypothesis as stated earlier that there may not be significant difference in explosive strength and maximum leg strength is accepted.

Conclusions
Within the limitations of the study the following conclusion is drawn:
The sprinters participated in the events of 100mts and 400mts did not differ from each other in explosive strength and maximum leg strength.

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