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INFLUENCE OF HIGH INTENSITY INTERVAL TRAINING ON LEG STRENGTH AND BACK STRENGTH AMONG COLLEGE WOMEN ATHLETES

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Abstract:

The purpose of the study was designed to examine the effect of high intensity interval training on leg strength and back strength of college women athletes. For the purpose of the study, thirty college women athletes studying bachelor's degree in Telangana Social Welfare Residential Educational Institutions Society, Telangana, India were selected as subjects. They were divided into two equal groups. Each group consisted of the fifteen subjects. Group I underwent high intensity interval training for three days per week for twelve weeks. Group II acted as control who did not undergo any special training programme apart from their regular physical education programme. The following variables namely leg strength and back strength were selected as criterion variables. All the subjects of two groups were tested on selected dependent variables by using leg lift with dynamometer and back lift with dynamometer respectively at prior to and immediately after the training programme. The analysis of covariance was used to analyze the significant difference, if any among the groups. The .05 level of confidence was fixed as the level of significance to test the 'F' ratio obtained by the analysis of covariance, which was considered appropriate. The results of the study showed that there was a significant difference between high intensity interval training group and control group on leg strength and back strength. And also it was found that there was a significant improvement on leg strength and back strength due to twelve weeks of high intensity interval training.

Key Words: High Intensity Interval Training, Leg Strength, Back Strength, College Women Athletes

Introduction:

High-Intensity Interval Training (HIIT) is a training method characterized by repeated bouts of high-intensity exercise interspersed with recovery periods of low-intensity activity or complete rest. HIIT typically involves exercise intensities at or above 80-90% of maximum heart rate or near maximal oxygen uptake (VO_2max). It has gained significant attention due to its time efficiency and effectiveness in improving both aerobic and anaerobic fitness.

The concept of interval training was scientifically advanced by Per-Olof Åstrand, who demonstrated that alternating high-intensity work with recovery periods allows athletes to perform greater total work compared to continuous exercise (Åstrand & Rodahl, 1986). Modern HIIT research shows substantial improvements in cardiovascular endurance, metabolic function, muscular strength, and power (Gibala et al., 2012).

One of the most recognized forms of HIIT is the Tabata protocol, which consists of 20 seconds of maximal effort exercise followed by 10 seconds of rest, repeated for 4 minutes. Studies have shown that this format significantly improves both aerobic and anaerobic energy systems (Tabata et al., 1996).

HIIT also stimulates neuromuscular adaptations that enhance leg and back strength. The repeated explosive efforts promote motor unit recruitment, muscle fiber activation (particularly Type II fibers), and hormonal responses conducive to strength development (Buchheit & Laursen, 2013). Therefore, HIIT is widely applied in sports training programs to simultaneously develop cardiovascular fitness and muscular strength

Leg strength refers to the maximal force-generating capacity of the lower extremity muscles, particularly the quadriceps, hamstrings, gluteals, gastrocnemius, and soleus muscles. It plays a fundamental role in locomotion, posture maintenance, balance, and athletic performance. Strong leg musculature enhances sprinting speed, stride length, jumping ability, agility, and overall functional performance (Bompa & Haff, 2009). In competitive sports, leg strength is directly associated with explosive movements such as acceleration, deceleration, and rapid change of direction.

From a physiological standpoint, leg strength is influenced by muscle cross-sectional area, neural activation, motor unit recruitment, and muscle fiber type composition. Enhanced neuromuscular coordination improves force production and rate of force development, which are critical for sprinting and jumping activities

(Zatsiorsky & Kraemer, 2006). Moreover, adequate leg strength contributes to injury prevention by improving joint stability, particularly at the knee and ankle joints.

Back strength refers to the force-generating capacity of the muscles of the posterior trunk, including the erector spinae, latissimus dorsi, trapezius, and other stabilizing musculature of the spine. It is essential for maintaining upright posture, spinal stability, and efficient force transfer between the upper and lower body. In athletic contexts, back strength supports movements such as lifting, throwing, running, and rotational actions.

Strong back musculature enhances core stability, which is crucial for balance and coordination. According to McGill (2010), spinal stability depends significantly on muscular endurance and strength of trunk extensors and stabilizers. Weakness in back muscles can compromise biomechanical efficiency and increase susceptibility to lower back injuries. In sports performance, optimal back strength facilitates effective transmission of force generated by the lower limbs to the upper extremities, thereby improving overall power output.

HIIT exercises such as sprinting, jump squats, lunges, and resisted running require rapid and forceful contractions of the lower limb muscles (quadriceps, hamstrings, gluteus maximus, gastrocnemius). High-intensity efforts increase recruitment of fast-twitch (Type II) muscle fibers, which are primarily responsible for strength and power production. According to Buchheit and Laursen (2013), HIIT stimulates neuromuscular adaptations similar to traditional resistance training when intensity is sufficiently high.

Repeated high-load or explosive intervals promote hypertrophic adaptations in lower limb musculature. Studies by Gibala et al. (2006) demonstrate that high-intensity intervals activate signaling pathways (e.g., AMPK and mTOR) involved in muscle remodeling and strength enhancement.

HIIT improves inter- and intramuscular coordination by requiring synchronized activation of multiple muscle groups during high-speed movements such as sprinting and plyometrics. Paavolainen et al. (1999) found that explosive-type training improved neuromuscular characteristics and running performance through enhanced leg power and strength.

Methodology:

The purpose of the study was designed to examine the effect of high intensity interval training on leg strength and back strength of college women athletes. For the purpose of the study, thirty college women athletes studying bachelor's degree in Telangana Social Welfare Residential Educational Institutions Society, Telangana, India were selected as subjects. They were divided into two equal groups. Each group consisted of the fifteen subjects. Group I underwent high intensity interval training for three days per week for twelve weeks. Group II acted as control who did not undergo any special training programme apart from their regular physical education programme. The following variables namely leg strength and back strength were selected as criterion variables. All the subjects of two groups were tested on selected dependent variables by using leg lift with dynamometer and back lift with dynamometer respectively at prior to and immediately after the training programme. The analysis of covariance was used to analyze the significant difference, if any among the groups. The .05 level of confidence was fixed as the level of significance to test the 'F' ratio obtained by the analysis of covariance, which was considered appropriate.

Analysis of the Data:

Leg Strength:

The analysis of covariance on leg strength of the pre and post test scores of high intensity interval training group and control group have been analyzed and presented in table 1.

Table 1: Analysis of Covariance of the Data on Leg Strength of Pre and Post Tests Scores of High Intensity Interval Training and Control Groups

Test	High Intensity Interval Training Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
Pre Test							
Mean	92.33	91.93	Between	1.20	1	1.20	0.88
S.D.	1.19	1.28	Within	38.27	28	1.37	
Post Test							
Mean	95.20	92.00	Between	76.80	1	76.80	18.04*
S.D.	1.06	1.10	Within	119.20	28	4.26	
Adjusted Post Test							
Mean	95.06	92.14	Between	61.91	1	61.91	71.59*
			Within	23.35	27	0.86	

* Significant at .05 level of confidence.

(The table values required for significance at .05 level of confidence for 2 and 28 and 2 and 27 are 3.34 and 3.35 respectively).

The table 1 shows that the adjusted post-test means of high intensity interval training group and control group are 95.06 and 92.14 respectively on leg strength. The obtained "F" ratio of 71.59 for adjusted post-test

means is more than the table value of 3.35 for df 1 and 27 required for significance at .05 level of confidence on leg strength.

The results of the study indicated that there was a significant difference between the adjusted post-test means of high intensity interval training group and control group on leg strength.

Back Strength:

The analysis of covariance on back strength of the pre and post test scores of high intensity interval training group and control group have been analyzed and presented in table 2.

Table 2: Analysis of Covariance of the Data on Back Strength of Pre and Post Tests Scores of High Intensity Interval Training and Control Groups

Test	High Intensity Interval Training Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
Pre Test							
Mean	91.73	91.20	Between	2.13	1	2.13	2.56
S.D.	0.57	1.01	Within	23.33	28	0.83	
Post Test							
Mean	94.67	91.47	Between	76.80	1	76.80	20.70*
S.D.	1.11	0.88	Within	103.87	28	3.71	
Adjusted Post Test							
Mean	94.49	91.64	Between	55.86	1	55.86	88.31*
			Within	17.08	27	0.63	

* Significant at .05 level of confidence.

(The table values required for significance at .05 level of confidence for 2 and 28 and 2 and 27 are 3.34 and 3.35 respectively).

The table 2 shows that the adjusted post-test means of high intensity interval training group and control group are 94.49 and 91.64 respectively on back strength. The obtained "F" ratio of 88.31 for adjusted post-test means is more than the table value of 3.35 for df 1 and 27 required for significance at .05 level of confidence on back strength.

The results of the study indicated that there was a significant difference between the adjusted post-test means of high intensity interval training group and control group on back strength.

Conclusions:

- There was a significant difference between high intensity interval training group and control group on leg strength and back strength.
- And also it was found that there was a significant improvement on selected criterion variables such as leg strength and back strength due to high intensity interval training.

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