Influence of Weight Training and Combined Weight and Plyometric Training on Leg Strength Anaerobic Power Body Mass Index Among Male Kabaddi Players

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***Abstract*—The purpose of the study was to find out the effect of weight training and combined weight and plyometric training, on leg strength, anaerobic power and body mass index. Forty five male kabaddi players aged between 19 and 25 years were selected for the study. They were divided into three equal groups, each group consisting of fifteen subjects in which two experimental groups and one control group, in which the group I (n=15) underwent weight training, group II (n = 15) underwent combined weight and plyometric training for three days (alternative days) per week for twelve weeks and group III, acted as control, which did not participate in any training apart from their regular kabaddi game practice. The subjects were tested on selected criterion variable as leg strength, anaerobic power and body mass index at prior to and immediately after the training period. For testing the leg strength, the leg lift with dynamometer was used, for assessing the anerobic power, 300 meters run test was administered and body mass index was found out after applying the Quetelet index. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, between the experimental groups and control group on selected criterion variable separately. Since there were three groups involved in the present study, the Scheffé *S* test was used as post-hoc test. The selected criterion variables such as leg strength and anaerobic power were improved significantly for all the training groups when compared with the control group.**

Key Words— weight training, combined weight and plyometric training, leg strength, anaerobic power and body mass index.

I. INTRODUCTION

Exercise has a higher physical impact when combined with scientifically informed research or experience. Sports science is researching the sort of training that enhances players' skills. Studying a number of topics helps to strengthen coaching philosophy and techniques. Under the science of training, players work for their coach or sports scientists who have access to as much information as feasible.

Physical exercise causes physiological, anatomical, biochemical, and psychological changes. It improves an individual's performance by adjusting the length, intensity, pace, load, frequency, and repetition of exercises. Because functional and psychological attributes will be displayed during competition, dynamic training schedule should include guaranteed components. To achieve the aim, the amount of hours spent training in a session or period leading up to a competition should be limited to physiological, psychological, or physical aspects (Zatsiorsky, 1995).

Kalf and Arnheim (1963) define training as a systematic process of learning and acclimatisation that needs incremental labour that is repeated over time. The term "training means" refers to a number of physical exercises, as well as other objects, techniques, and processes used to develop, maintain, and restore preparedness and performance capacity.

Sports tutoring is based on a planned, organised, and scientifically structured educational strategy that influences performance ability and preparation, with the purpose of enhancing athletic performance and competing in various sports contests. A training program is intended to improve a player's potential and stamina while preparing them for a certain tournament. The intensity of sports training in any athletic event was originally determined by the athlete's ability to perform motor actions with varying levels of strength, speed, resistance, and skill in order to complete individual and group tasks—the divisions of sports training technique (Simon, Mihaila, and Stanculescu, 2011).

Strength training is most effective when performed at equal intervals, with a gradual increase in exercise intensity (overload), a nutritious diet, and enough recuperation. Weight training burns less calories than endurance activity. It has a limited potential to reduce body weight; nonetheless, it will stimulate muscle hypertrophy. This does not suggest that the athlete will become stiff or unable to move freely. Muscles not only move at a steady speed, but they also gain strength and explosive force (Fox, 1989).

Numerous studies have demonstrated that resistance training causes muscle fibres to increase their cross-sectional area and force-generating potential (Moore et al., 2004). Hypertrophic and neuro adaptations are commonly used to increase the pace of force generation and create structural changes in muscle morphology (Verkhoshansky, 2006). Furthermore, plyometric and power training are essential for improving muscular performance throughout the stretch shortening cycle (Komi, 2000). In conclusion, adaptations to strength training increase muscle power output, broaden the body's capacity for energy-producing systems, and improve motor power potential in competitive circumstances.

Plyometrics, which aim to boost power output, is derived from two Greek words: plio, which means more, and metric, which means to measure (Whyte, Spurway, and MacLaren, 2006). Furthermore, it increases the potential of early concentric forces and makes the athlete more resistant to stronger eccentric muscle pressures. Plyometric training maximises an athlete's benefits in high-speed and high-power activities (Knudson, 2007). It employs the stretch shortening cycle, which consists of an instantaneous concentric contraction after a rapid eccentric contraction (Porter, 2013). This workout routine is intended to improve power output, coordination, and rapid neuromuscular responses at maximum intensity and velocity.

It is an optional program aimed to enhance athletic performance and decrease musculoskeletal injuries (Kisner, Colby, & Borstad, 2017). Furthermore, it necessitates stepping up, side lunging, single-leg pushing, and jumping or hopping (Kraemer and Hakkinen, 2008).

Workouts that incorporate paired exercises that target the same muscle area, such as the heel raise and straight leg leap, lunge and split jump, bench press, and plyometric push-up. To target rapid twitch, speed, and power generating muscle fibres, the weight utilised in these exercises must be more than 70% of one repetition maximum (1RM). Athletes must mix weight training with plyometric training to improve muscular strength for optimal sports performance. Both high-load weight training and plyometric exercise induce physiological changes that promote the development of athletic power (Ebben and Blackard, 1997).

Kabaddi originated in ancient India. Various versions of the game were played around the country. It was known as HU-TU-TU in Western India, HA-DO-DO in Eastern India and Bangladesh, chedugudu in Southern India, and kanubada, among other names, in Northern India. Kabaddi is claimed to have originated from the term "Kanubada," which means "challenge to the opponent." The major game kinds are Amar, Gemini, and Sangeevini. The game was played according to the scenario, with varied regulations. The current version of kabaddi was established by merging all of these variations.

II. METHODS

The goal of this study was to determine how weight training and combination of wight and plyometric exercise, affected leg strength and anaerobic power. 45 male kabaddi players who were enrolled at various colleges, those who were represented in inter-collegiate tournaments, around Srisailam, Andhra Pradesh for the academic year 2024–2025 were chosen as subjects to fulfil the goal. They were divided into three equal groups of fifteen each and further divided as two experimental groups and one control group, in which the group I (n=15) underwent weight training, group II (n = 15) underwent combined weight and plyometric training for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control which did not participate in any special training apart from the regular kabaddi game practice.

There will be changes to the playing ability and systems with every training regimen. After consulting with the specialists, the researchers decided to use the following variables as criteria: 1. Leg strength, 2. Anaerobic power, 3. Body Mass Index.

III. ANALYSIS OF THE DATA

The differences, if any, between the corrected post test means on several criteria variables were examined independently using analysis of covariance. The Scheffé *S* test was used as a post-hoc test if the adjusted post test mean's "F" ratio was shown to be significant. To evaluate the "F" ratio discovered using analysis of covariance, the level of significance was set at 0.05 level of confidence.

Table – I: Analysis of Covariance and 'F' ratio for leg strength, anaerobic power and body mass index of weight training group, combined weight and plyometric training group, and control group

Variable Name	Group Name	Weight training Group	Combined weight and plyometric training Group	Control Group	'F' Ratio
Leg Strength (in Kg)	Pre-test Mean ± S.D.	68.00 ± 4.14	67.63 ± 3.68	67.07 ± 4.42	0.24
	Post-test Mean ± S.D.	70.13 ± 4.17	69.40 ± 3.68	66.93 ± 4.38	2.52
	Adj. Post-test Mean	69.806	69.138	67.522	33.65*
Anaerobic Power (in Seconds)	Pre-test Mean ± S.D.	55.67 ± 2.27	55.67 ± 1.40	56.00 ± 1.60	0.17
	Post-test Mean ± S.D.	54.69 ± 2.36	54.48 ± 1.60	56.33 ± 1.72	4.46*
	Adj. Post-test Mean	54.776	54.576	56.114	24.10*
Body Mass Index (in w/h^2)	Pre-test Mean ± S.D.	20.52 ± 0.50	20.57 ± 1.06	20.71 ± 1.36	0.13
	Post-test Mean ± S.D.	19.53 ± 0.62	19.87 ± 1.08	20.69 ± 1.39	4.66*
	Adj. Post-test Mean	19.599	19.902	20.588	12.67*

* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 2 and 42 and 2 and 41 were 3.21 and 3.23 respectively).

Table – I show that the leg strength pre- and post-test "F" ratio value of 0.24 and 2.52 was less than the necessary table value of 3.21 for significant with df 2 and 42 at 0.05 level of confidence. For the adjusted post-test mean 'F' ratio value of 33.65 for the adjusted post-test scores was greater than the necessary table value of 3.24 for significant. According to Table - I, the pre-test averages of anaerobic power test 'F' ratio value of 0.17 was less than the necessary table value of 3.21 for significant with df 2 and 42 at 0.05 level of confidence. For post-test and adjusted post-test mean 'F' ratio values of anaerobic power were 4.46 and 24.10 was greater than the necessary table value of 3.24 for significant. The body mass index pre-test values 'F' ratio of body mass index value was 0.13 which was insignificant. For post-test and adjusted post-test mean 'F' ratio values of body mass index were 4.66 and 12.67 was greater than the necessary table value of 3.24 for significant. Further, to find out which training group has significant improvement on selected criterion variables, Scheffe *S* post-hoc test was applied and presented in table – II.

Table – II: Scheffẽ S Test for the difference between the adjusted post-test mean of leg strength, anaerobic power and body mass index of training groups and control group

Weight training Group	Combined weight and plyometric training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
Adjusted Post-test Mean for Leg strength				
69.806	69.138		0.668	0.722
69.806		67.522	2.284*	0.722
	69.138	67.522	1.616*	0.722
Adjusted Post-test Mean for Anaerobic power				
57.776	54.576		0.200	0.61
57.776		56.114	1.338*	0.61
	54.576	56.114	1.538*	0.61

Adjusted Post-test Mean for Body mass index				
19.599	19.902		0.303	0.515
19.599		20.588	0.999*	0.515
	19.902	20.588	0.686*	0.515

* Significant at 0.05 level of confidence.

IV. RESULTS

The adjusted post-test mean difference in leg strength between weight training group and control group and combined weight and plyometric training group and control group was 2.284 and 1.616, respectively, and these differences were significant at the.05 level of confidence, according to Table II. The table II also indicate that there was no significant difference was occurred between the training groups (0.175). Based on the study's findings, it can be said that weight training group and combined weight and plyometric training group considerably boost the leg strength.

The adjusted post-test mean difference in anaerobic power between weight training group and control group, combined weight and plyometric training group and control group was 1.338 and 1.538, respectively, and these differences were significant at the.05 level of confidence, according to Table - II. The anaerobic power was not significantly differed between the training groups (0.200). Based on the study's findings, it can be said that weight training group and combined weight and plyometric training group considerably enhance anaerobic power.

The adjusted post-test mean difference in goal body mass index between weight training group and control group, combined weight and plyometric training group and control group was 0.999 and 0.686, respectively, and these differences were significant at the .05 level of confidence, according to Table - II. The anaerobic power ability was not significantly differed between the training groups (0.303). Based on the study's findings, it can be said that weight training group and combined weight and plyometric training group significantly improved the body mass index.

V. CONCLUSIONS

After completing weight training and combined weight and plyometric training, the study's results shown a notable increase in selected criterion variables such as, leg strength, anaerobic power, and body mass index. There was no statistically significant difference between the weight training group and the combined weight and plyometric training group. This conclusion is consistent with the findings of Shivanagol, (2024), Rawte and Vadav, (2020), and Mohammad, (2016), who discovered a considerable improvement in leg strength following weight training. Shafeeq et al. (2013) discovered a considerable improvement in leg strength following combined plyometric and strength training. The study indicated that both the weight training and combined weight and plyometric training groups saw substantial increases in anaerobic power after finishing their training programs. Biçer (2021) discovered that a strength training plan considerably boosted anaerobic power. Sporis et al. (2011) discovered that women football players' anaerobic power increased considerably following a strength training plan. Dewangga et al. (2024) discovered that weight training dramatically reduced the BMI of obese female college students. Carvalho, Mourão, and Abade (2014) saw a substantial reduction in body mass content following weight training.

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