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## Effectiveness of ballistic training and resistance training on anaerobic power in collegiate basketball players

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### Abstract

The study was to compare the effectiveness of ballistic training and resistance training on anaerobic power among collegiate basketball players.

**Introduction:** Basketball is a sport which is played throughout the world. It is a team sports in which two team compete against each other to score a goal. This sports mainly depends on the anaerobic power which includes jumping ability of the players. This study concentrates over the assistance of ballistic training in improving anaerobic power.

**Methodology:** It is an experimental study with comparative of Pre and Post test type. A total of 30 subjects were selected and divided into two groups, Group A and Group B based on simple random sampling method. Group A consist of 15subjectswho have performed Ballistic training and group B consist of 15 subjects who have performed Resistance training. The Vertical Jump Test (VJT) and Three Step Jump Test (TSJT) were measured before initiation of the training program. The training protocol was planned for 6 weeks. After the training session post test measurement was done.

**Outcome measure:** Vertical jump test and Three step jump test.

**Results:** On comparing Pre test and Post test within and between Group A & Group B on Vertical Jump Test Score& Three Step Jump Test Score shows significant difference in the mean values at  $P \leq 0.05$ .

**Conclusion:** Ballistic training has shown significant improvement in terms of Vertical Jump Test (VJT) and Three Step Jump Test (TSJT) which improves anaerobic power in collegiate Basketball players compared to Resistance training.

**Keywords:** Ballistic training, resistance training, anaerobic power, vertical jump test, three step jump test

### Introduction

Basketball players require high level of anaerobic power to be successful in the sport because it involves high-speed, high-intensity activities such as sprinting, jumping, and quick changes of direction<sup>[1]</sup>. Anaerobic power, defined as the ability to produce energy without oxygen, is an important component of basketball performance. Coaches and athletes are constantly looking for effective training methods to improve anaerobic power and overall athletic performance<sup>[2]</sup>. The development of anaerobic power is of paramount importance in collegiate basketball due to its direct influence on critical game actions such as vertical jumping, sprinting, and explosive movements. These actions play a significant role in scoring, defending, and overall team success. Therefore, collegiate basketball players strive to optimize their anaerobic power levels through various training methods<sup>[3]</sup>. Among the training regimens commonly employed to enhance anaerobic power, ballistic training and resistance training have gained significant attention. Ballistic training focuses on dynamic and explosive movements with lighter loads, emphasizing the development of power and speed. This form of training aims to improve the rate of force production and enhance neuromuscular coordination, leading to improved anaerobic power<sup>[4]</sup>. On the other hand, resistance training involves the use of heavier loads to induce muscular strength and hypertrophy adaptations, indirectly contributing to anaerobic power improvements. Ballistic resistance training is also a form of exercise which includes both plyometric training and weight lifting and it involves lifting of relatively light loads at high speed. Ballistic training exercise are useful in recruiting and strength. This training requires the central nervous system to coordinate and produce the greatest amount of force in the shortest time possible. This ballistic training includes various

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type of exercise which includes medicine ball throws, bench throws, jump squats, cleans, snatches, and push presses. These exercises are proven to improve the explosive power of an individual [9]. The effectiveness of ballistic training and resistance training in enhancing anaerobic power has been explored in various sports and athletic populations. However, a comprehensive comparative study specifically tailored to collegiate basketball players is warranted to determine the optimal training approach. Such a study would provide valuable insights into the most effective method for enhancing anaerobic power in this specific population, thus guiding coaches and athletes in their training program design and implementation.

Vertical jump testing is a popular way to assess an athlete's strength and explosiveness. The vertical jump test describes a broad group of jump tests in which athletes aim to jump as high as possible. This includes loose counter movement jumps and squat jumps performed with and without arm movement. The vertical jump test is commonly used to analyze strength and explosive power. Athletes who are stronger and can produce force faster are usually better. Since this test is simple and non-expensive, it is quite frequently used. Vertical jumps are also sometimes used as a measure of an athlete's training readiness. In this regard, coaches can ask athletes to perform a few vertical jumps at the beginning of each training session and adjust the amount, intensity and difficulty of the exercise according to how each athlete reaches their average vertical jump value. Three step jump test is also a tool which is used to measure the jumping ability and explosive power of athlete. This test is same like vertical jump test but in this test, before taking a jump the person three step to increase the efficacy of jumping.

### Materials and Methods

It is an experimental study design based on comparative (Pre and post test) type. The study setting was conducted at reputed university in Chennai. The sample size was 30 subjects collected based on simple randomly. The inclusion criteria consists of male subjects with age group between 18 - 25 years off season collegiate basketball players who were not under any specific ballistic training and resistance training in past 6 months. The exclusion criteria were any recent injury or surgery, acute inflammation and hyper mobility. The outcome measures are vertical jump test (VJT) and three step jump test (TSJT). The materials consumed were Inch tape, chalk, plyometric box, medicine ball.

### Procedure

The study was approved by Institutional Review Board. 30 subjects were selected and they were given a brief detail about this study and its purpose. Informed consent was obtained from the subjects. Ballistic training for Group A and Resistance training for Group B. Pre and post test measurement was taken by using vertical jump test and Triple step jump test. Group A subjects received ballistic training of three session a week for a total of 6 weeks. And Group B subjects received resistance training of three sessions a week for a total of 6 weeks.

### Group A: Ballistic Training

Group A consist of 15 subjects who were trained with Ballistic training for 6 weeks. Ballistic training includes various exercises which includes:

- Box jump
- Broad jump

- Depth jump

### Group B: resistance training

Resistance training exercise uses either mechanical weights or his own body weight. These type of training increases muscle strength and bulk by breaking down the muscle fibre. There are various types of exercise which includes

- Jumping Jacks
- Squats
- Lunges

### Outcome measures

- Vertical Jump Test
- Three step jump test

### Results

On comparing the Mean Values of Group A & Group B on Vertical Jump Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A - Ballistic Training) shows  $51.40 \pm 10.33$  which has the higher mean value is more effective than (Group B -Resistance Training)  $44.26 \pm 6.07$  at  $P \leq 0.05$ . Hence the null hypothesis is rejected. On comparing the Mean Values of Group A & Group B on Three Step Jump Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A - Ballistic Training) shows  $63.93 \pm 7.69$  which has the higher mean value is more effective than (Group B -Resistance Training)  $52.40 \pm 6.08$  at  $P \leq 0.05$ . Hence the null hypothesis is rejected. On comparing Pre test and Post test within Group A & Group B on Vertical Jump Test Score & Three Step Jump Test Score shows significant difference in the mean values at  $P \leq 0.05$ .

### Discussion

The present study investigated the comparative effect of ballistic training and resistance training on anaerobic power in collegiate basketball power. Vertical Jump Test and Three Step Jump Test was used as an outcome measure. Carlo Castagna *et al* (2007) concluded that the basketball players perform short sprints over a duration of match hits a Vo2 peak that requires anaerobic power by various training protocol. The short term physical effort by the maximal power (work per unit time) reflects the energy output capacity of intramuscular high energy phosphates or by anaerobic glycolysis. There is lack of studies regarding the recent advancement in training for anaerobic power in collegiate basketball players. This study aims at comparing the effect of ballistic training and resistance training in collegiate basketball power. Nikola *et al* (2021) stated when the Basketball players trained with explosive power such as Ballistic training and plyometric showed an increased efficiency in the training load, frequency in the phase of warm up. Ashok Kumar *et al* (2018) has also concluded that when combining plyometric ballistic training has shown an increased effectiveness in the performance of the Basketball players. Nikolaos *et al* (2013) concluded that short period of ballistic training showed overall performance such as power output, peak velocity has been increased the vertical jump for the volleyball players. Mohan *et al* (2020) concluded that when volleyball players trained with the ballistic training such as throwing weights, jumping with weights to extend the explosive power showed significant improvement on vertical jump and seated medicine ball throw. Brian *et al* (2008) concluded that resistance training using the one repetition maximum weight at low velocity has been found to improve

muscles ability to generate force that provided improvement in vertical jump among high school boys. Matt Brughelli *et al* (2008) reviewed that resistance training provides improvement in the change of direction performance in various sporting activities but also conclude that horizontal jump, lateral jump demand has been observed. Michael *et al* (2000) evaluated that resistance training has as direct relation to improve athletic performance which include muscular strength, power, endurance and agility in vertical jump, sprint times distance running times. Juan Manuel *et al* (2022) suggested that high speed resistance training combined with plyometric produces improvements in strength, jump and sprint that yielded high performance in young Basketball players. Sogand Poureghali *et al* (2019) concluded that resistance training for basketball players such as weight squat, lunges and lateral squat showed improvement in performance that compared with Traditional/conventional exercise program.

Sergej *et al* (2010) concluded that the anaerobic capacity is measured by the vertical jump test which is used to assess the athletic performance. It has also shown that superior jump performance showed improvement in the elite athletes than non- elite players. A Theodorou *et al* (2013) concluded that vertical jump height assessed the anaerobic power that has been performed for 30 secs in maximum effort distribution of short duration. Luis *et al* (2000) concluded that vertical jump test was used to access the performance in players with the analysis of single jump trial with body centre of mass displacement. Tucker *et al* (2013) investigated the effectiveness of vertical jump test that has effect on the maximal oxygen uptake in male basketball players who performed 10 vertical rebound jump. It also correlates with high level anaerobic movements. Apostolos *et al* (2022) assessed the jumping ability in basketball players using the standardized vertical jump test with additional on leg take off vertical jump and two leg take-off In this study, On comparing the Mean Values of Group A & Group B on Vertical Jump Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A - Ballistic Training) shows  $51.40 \pm 10.33$  which has the higher mean value is more effective than (Group B -Resistance Training)  $44.26 \pm 6.07$  at  $P \leq 0.05$ . Hence the null hypothesis is rejected. On comparing the Mean Values of Group A & Group B on Three Step Jump Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A - Ballistic Training) shows  $63.93 \pm 7.69$  which has the higher mean value is more effective than (Group B -Resistance Training)  $52.40 \pm 6.08$  at  $P \leq 0.05$ . Hence the null hypothesis is rejected. On comparing Pre test and Post test within Group A & Group B on Vertical Jump Test Score& Three Step Jump Test Score shows significant difference in the mean values at  $P \leq 0.05$ .

### Conclusion

This study concluded that there was a significant improvement in anaerobic power among collegiate Basketball players in Ballistic training and Resistance training. However, ballistic training program has shown greater improvement in terms of Vertical Jump Test (VJT) and Three Step Jump Test (TSJT) test which improves anaerobic power in collegiate basketball players compared to resistance training.

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