

Simple Randomised Controlled Trial Comparison of Effect of Suspension Training and Plyometric Training on Dynamic Balance and Vertical Jump in Competitive Basketball Players

Devaki Suresh Kale¹, Namrata Sidhaye - Bhadbhade²

¹Intern (Deccan Education Society's Brijlal Jindal College of Physiotherapy), 527, Shivajinagar Gaothan, behind Rokdoba mandir, Pune. ²Assistant Professor (Deccan Education Society's Brijlal Jindal College of Physiotherapy) 7, Anand baug, Navi peth, Pune.

How to cite this article: Devaki Suresh Kale, Namrata Sidhaye - Bhadbhade. Simple Randomised Controlled Trial Comparison of Effect of Suspension Training and Plyometric Training on Dynamic Balance and Vertical Jump in Competitive Basketball Players. Indian Journal of Physiotherapy and Occupational Therapy/Volume 18 No. 2, April-June 2024.

Abstract

Objectives: To assess dynamic balance and vertical jump pre and post Suspension training and Plyometric training in competitive basketball players.

Methods: 24 basketball players aged 18-24 were selected and randomly assigned to three groups namely Suspension training, Plyometrics and the control group. Supervised sessions were held for 8 weeks, 2 times a week for 45 minutes. Pre and post assessment for dynamic balance and vertical jump was done.

Results: Suspension training and Plyometric training both have shown a positive effect on dynamic balance ($p < 0.007$) except for anterior direction and vertical jump ($p < 0.007$) in basketball players. The results of the control group have shown a lot of variability as no specific training was given for dynamic balance and vertical jump.

Conclusion: Suspension training and Plyometric training have positive effect on dynamic balance and vertical jump height. However, no training method is found to be more efficient than the other.

Key words: Basketball players, dynamic balance, plyometric training, suspension training, vertical jump height.

Introduction

Coordinative abilities rely on the movement control and regulation processes, which are fundamental in sports. One of the main components of coordinative abilities is balance. This ability is influenced by various factors that are sensory information (from somatosensory, visual and vestibular systems), joint range of motion, and strength⁽¹⁾

Basketball is a multidirectional sport that involves explosive activities such as sprinting, rapid changes of direction, jumping, abrupt and intense change of direction, frequent commencement and stopping, and contact among players during offence and defence largely dependent on dynamic balance and agility.⁽²⁾

Corresponding Author: Namrata Sidhaye Bhadbhade, Assistant Professor (Deccan Education Society's Brijlal Jindal College of Physiotherapy), 7, Anand baug, Navi peth, Pune.

E-mail: namratasidhaye.physio@gmail.com

Submission date: Jul 22, 2023

Revision date: Dec 22, 2023,

Published date: May 2, 2024

This is an Open Access journal, and articles are distributed under a Creative Commons license- CC BY-NC 4.0 DEED. This license permits the use, distribution, and reproduction of the work in any medium, provided that proper citation is given to the original work and its source. It allows for attribution, non-commercial use, and the creation of derivative work.

Vertical jump is a functional movement required to basket the ball in the ring. Thus, training an athlete to improve the vertical jump is important along with training an athlete for good balance.

In order to improve athletic performance traditional training methods are being done on different platforms such as Bosu ball, Pilates ball and Thera-band or simple traditional exercises along with core exercises like Yoga, planks, crunches, kegels etc. More recently, the suspension training system Pro Suspension Training System (TRX) has been added to this group of materials⁽³⁾

The Suspension training provides foundational movement based training and the instability created through a single anchor point produces a proprioceptive-rich environment which requires a higher level of core activation than stable surfaces. It enhances stability-endurance, hypertrophy, strength, power, balance, flexibility and coordination/ kinaesthetic awareness within each individual training session.⁽⁴⁾

Plyometrics is a high intensity training technique which uses stretch shortening cycle that utilises the energy stored during the eccentric loading phase and stimulation of the muscle spindles to facilitate maximum power production during the concentric phase of movement. Land based Plyometric programs can be used to achieve positive changes with regard to maximum jump velocity, maximum force, absolute and relative power as well as average power during counter movement jumps⁽⁵⁾. Incorporating unilateral and bilateral Plyometric training improves the balance in young athletes. It is stated that balance ability is affected by explosive power.⁽⁶⁾

Need of the study

Balance and vertical jump are critical components in Basketball players. Suspension training and Plyometric training have both found to be effective. Hence, the need of the study is to compare efficacy of suspension training and Plyometric training on dynamic balance and vertical jump.

Methodology

Study design and setting

The trial was a three-group, simple randomised controlled trial in which basketball players playing at different levels were selected from the community, playing at different courts like (tar and synthetic) in Pune.

Participants

Inclusion Criteria:

1. Male, Female healthy Basketball players
2. Age :18-24
3. Playing basketball for at least 4 days/ week under a coach for 2-3 hours.
4. BMI : Ideal for height and weight (18.5-24.9)
5. Strength- Grade 5 by MMT for dynamic strength of Quadriceps, Gluteus maximus, Hamstrings, Gastrocnemius.
6. Good strength by Microfet 3 for static strength of Quadriceps, Gluteus maximus, Hamstrings, Gastrocnemius.

Exclusion Criteria:

1. Spinal problems /pain
2. Congenital problems of lower limb
3. Vestibular involvement
4. Any injury in lower limb

Procedure:

Around 75-80 basketball players were screened for inclusion and exclusion criteria and 24 players aged 18-24 were randomly assigned by simple randomisation with the help of random number generator on Stat trek after taking an informed consent from the participants. The subjects were assigned to 3 training groups namely Suspension training, Plyometric training and the control group respectively on taking a verbal consent and were assessed for dynamic balance by mSEBT and vertical jump by My Jump 2 pre and post training. mSEBT reach distance values were normalized by the limb length of the player. The results were calculated considering anterior, posteromedial and posterolateral reach distances as these directions have found to be reliable and to obtain a concise data. The app was found to be reliable however, reliability of test retest of the app was checked on 10 samples and was found to be 0.96 ICC. Strength was assessed by MMT and objective comparable static strength by Microfet 3. Supervised sessions were conducted for 8 weeks by qualified suspension and athletic trainer, twice a week for 45 minutes excluding warm up and cool down. 10 minutes of warm up prior to the training consisted of 5 minutes jogging, 5 minutes general exercises and stretching. Following training, 10 minutes of cool down was done. Statistical analysis was done using SPSS software version 16.0

Suspension training

TRX-Overhead squats, front squat, squat and hop, squat jump, single leg squat, split squat, step back lunge, balance lunge, crossing balance lunge, step side lunge, power pull, oblique lunge. 3 sets each with 30 seconds exercise time and with 30 seconds rest time.

TRX Over head squats



TRX crossing balance lunge



TRX power pull



TRX single leg squat



TRX step back lunge



TRX step side lunge



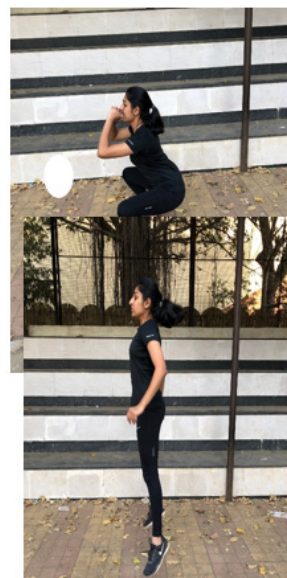
TRX front squat



Plyometric training

Squat jumps, Box jumps, Step lunge, Lunge and hop, German drill, Hop 45 degree and jump, Ice skater, Pogo hops, Tuck jumps, Paused jump squats, Lateral box over jumps, Box over jumps. 3 sets each with 30 seconds exercise time and 30 seconds rest time.

Squat jumps



Box jumps



Tuck jumps



German drill



Lunge and hop



Ice skater



Control group

Players in the control group underwent pre assessment and continued their usual exercise regime which consisted of weight training in the gym, regular fitness routine along with basketball training without being trained specifically for dynamic balance and vertical jump.

Outcome measures

In order to decrease the evaluation time,

dynamic balance is checked by mSEBT which is consistent and reliable. It involves one leg standing with a highest aim achieved of the other feet in 3 different directions namely anterior, posteromedial and posterolateral(7)

My Jump 2

The CMJ is recorded by the recorder laying prone on the ground with the iphone facing the participant at approximately 1.5 m from the force platform and zooming in on the feet of the participant.

Descriptive statistics:	AGE	BMI	GENDER
Suspension training	20.25 ±2.48	20.32±8.44	4 males, 4 females
Plyometric training	19.87±2.42	20.81±2.23	6 males, 2 females
Control group	19.62±2.34	20.95±1.91	5 males, 3 females

DIFFERENCE IN JUMP HEIGHT (cm)

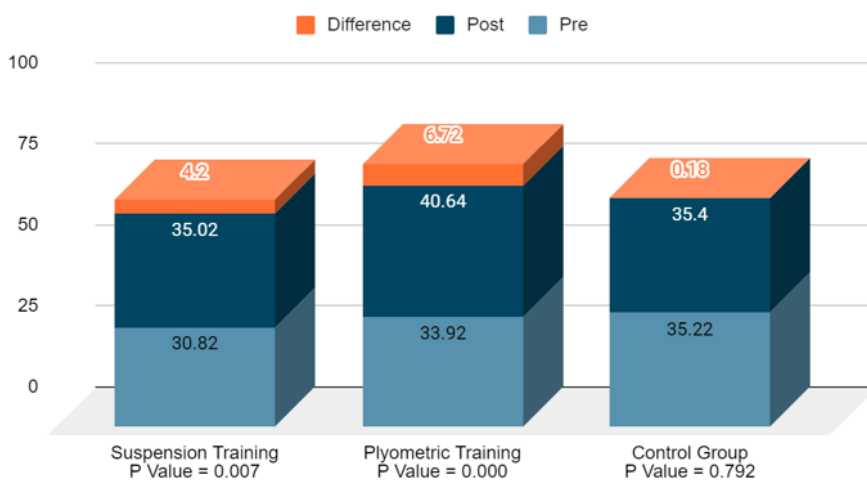


Figure no 1:

DIFFERENCE IN FLIGHT TIME (ms)

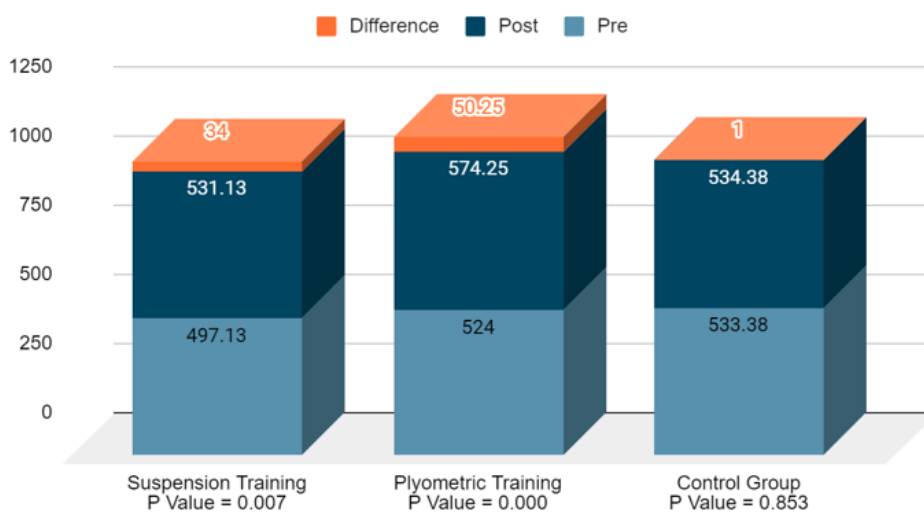


Figure no 2:

DIFFERENCE IN REACH DISTANCE BY SEBT(cm)

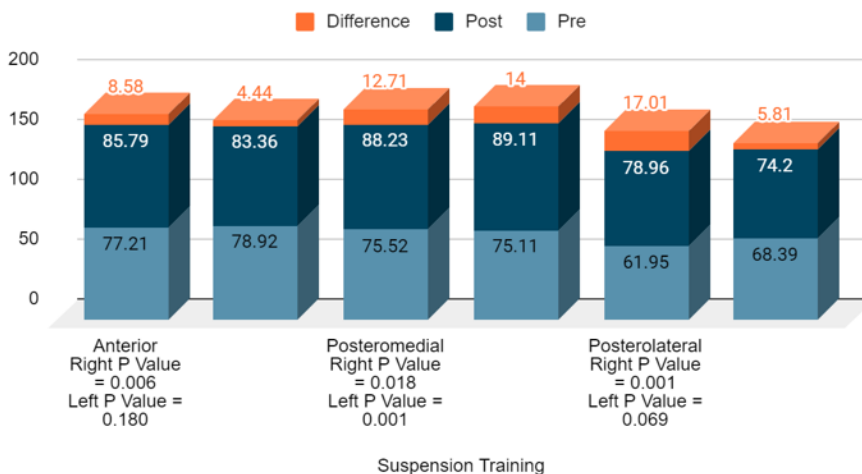


Figure no 3:

DIFFERENCE IN REACH DISTANCE BY SEBT(cm)

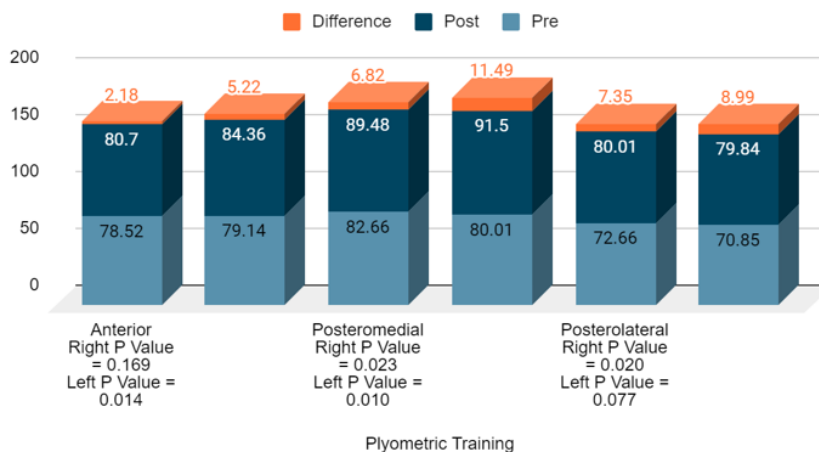


Figure no 4:

DIFFERENCE IN REACH DISTANCE BY SEBT(cm)

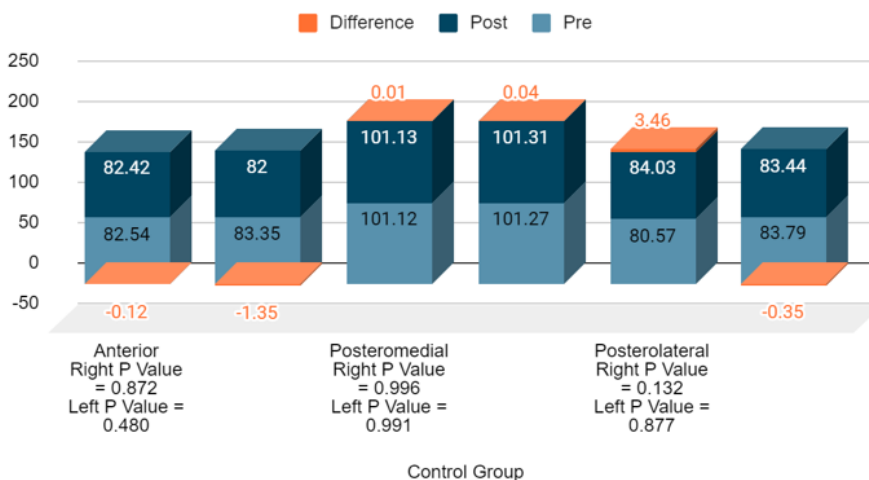


Figure no 5:

Discussion

The purpose of this study was to compare the effect of Suspension training and Plyometric training on dynamic balance and vertical jump in basketball players. 24 competitive basketball players aged 18-24 were included in the study as the pubertal age has passed by and growth changes have already taken place so there is no chance of further development which would affect the results.

The players falling in the normal range of BMI i.e 18.5-24.9 were included as obesity can affect balance and jump significantly.

Muscle strength of Quadriceps, Gluteus maximus, Hamstrings, Gastrocnemius was assessed bilaterally by MMT and MICROFET to have qualitative as well as the quantitative data.

The results of the study indicate that suspension training and Plyometric training both have been found to be effective compared to control group. However, the results of the anterior reach left side and posterolateral reach of left side of by Suspension training and anterior reach of right side and posterolateral of left side by Plyometric training showed difference but are not statistically significant. This result is likely as the study was done on competitive players playing at different levels and not on players playing at the same level so the level of training at each level differs from Elite players to recreational players. According to the study 'Balance ability and athletic performance' by CON HRYMALLIS (March, 2011) which was done to compare the balance ability of athletes from different sports; determine if there is a difference in balance ability of athletes at different levels of competition within the same sport; it was found out that balance ability was related to competition level for some sports with the more proficient athletes displaying greater balance ability.⁽⁸⁾

The Suspension trainer helps in providing foundational movement based training and the instability created by being partially suspended through a single anchor point produces a proprioceptive-rich environment which requires a higher level of core activation than stable surfaces. It forces the participant to engage the lumbopelvic musculature at all times to maintain proper body

alignment and biomechanics which can translate into enhanced core stability both dynamically and statically.

A study by Özgür Nalbant says, Suspension training is also used in the treatment of trunk muscles that hold the spine and hip stable like in core exercises. All these muscles thus work together to keep the body in balance during movement. TRX suspension training studies are among the training priorities in basketball because of the importance of balance (Savaş 2013).

Study by Myer et al. (2006) who stated that the incorporating unilateral and bilateral Plyometric training (PT), improve the balance in young athletes. Salahzadeh et al. (2011) also indicated that using a combination plan (plyometric, technical, balance, and strength) can improve anterior-posterior balance. It is stated that balance ability is affected by explosive power (Atilgan 2013). It was also stated that there is a significant relation between the given Plyometric training program, balance abilities and somatometric characteristics.

Another study by CON HRYMALLIS suggested that addition of balance training component to the activities of recreational active subjects increased vertical jump, agility and shuttle run. Balance training increased rectus femoris activation during jump landing. Greater muscle activation might optimize musculotendinous and joint stiffness reducing the amortization phase in the stretch shortening cycle and subsequently improve performance in eccentric-concentric action such as CMJ.

It has been suggested that peripheral and central neural adaptations and enhancement of neuromuscular factors were induced by Plyometric training, resulting in improved joint position sense and detection of joint motion. Peripheral adaptations that may have occurred because of Plyometric training likely resulted from the repetitive stimulation of the articular mechanoreceptors near the end range of motion (Grigg, 1994). Central adaptation resulting from Plyometric training may also improve proprioception. In conclusion of the study, 'Effects of In-season Plyometric training on sprint and balance performance in basketball players, by Abbas Asadi

,the results of this study highlights the potential of using plyometric training at in-season of competitive phase to improve sprint and dynamic balance.

Jump height and flight time have shown improvements with Plyometric training as well as Suspension training. Research done to compare effect of land and aquatic based plyometric training on jumping ability and agility of young basketball players suggests that this effect is a result of the stretch shortening cycle that utilises the energy stored during the eccentric loading phase and stimulation of the muscle spindles to facilitate maximum power production during the concentric phase of movement (Potach, 2004; Potach & Chu, 2008). Several research findings also show that land based plyometric programs can be used to significantly improve: explosive power (Fatouros et al., 2000; Luebbers et al., 2003); flight time (Fatouros et al.,2000). Thus, it is apparent that plyometric training is a useful training tool for athletes who participate in sport, which require dynamic, explosive types of movement such as basketball. This result was also supported by the study which suggested that a significant difference in standing long jump (SLJ) and vertical jump (VJ) after TRX training is parallel to the strength development of the core, back and leg muscles that contribute to jump performance. It is also an important factor in sports that require speed and explosive strength (Shaver, 1970; Muratlı, 2011).

The control group has shown a lot of variability in balance as well as the jump height and flight time. This variability could be because no training specific to balance and jump was given to the players in this group and were told to continue their regular exercise regime like weight training in the gym, regular fitness routine along with basketball training.

There is a positive effect of suspension training and plyometric training on dynamic balance and vertical jump in competitive basketball players. However, no training method is found to be more efficient than the other. The reason for this can be comparable activation of core muscles and leg as well as back muscles significantly improving explosive power and small sample size.

Clinical implication: To avoid injuries and to enhance athlete performance Suspension training and Plyometric training to improve dynamic balance and vertical jump have to be incorporated in the training.

Limitation: Small sample size.

Variation in training surfaces as the players train on different surfaces.

Future scope: The study can be carried out with larger sample size.

Minimal difference in heights of the samples and equal gender distribution per group would enhance the results in future.

There are a lot of multidirectional contact sports like football, handball, hockey, rugby, etc which involve dynamic balance and jumping so in future, studies can be done to check the effect of Suspension training and Plyometric training considering these sports.

The study can be carried out considering athletes playing at the same competitive level.

Conclusion

There is a positive effect of Suspension training and Plyometric training on dynamic balance and vertical jump in competitive basketball players. However, no training method is found to be more efficient than the other.

Ethical Clearance: Taken from departmental review board of Deccan Education Society's Brijlal Jindal College of Physiotherapy Taken from departmental review board of Deccan Education Society's Brijlal Jindal College of Physiotherapy dated 6th March 2020.

Source of funding: Self

Conflict of Interest: None

References

1. Leonardo Ricotti . Static and Dynamic balance in young athletes. Journal of Human Sport and Exercise. Vol 6. No 4. Biorobotics Institute- Scuola Superiore Sant'Anna, Pontedera (Pisa), Italy. December 2012.
2. Neeraj Panwar, MPT (Sports), Gaurav Kadyan, MPT (Sports), Aseem Gupta, MPT(Sports), Ravinder Narwal, MPT(Ortho/Cardiopulmonary).Effect of wobble board balance training program on static balance, dynamic balance & triple hop distance in male collegiate basketball athlete. International Journal of Physiotherapy and Research. Res 2014, Vol 2(4):657-62 ISSN 2321-1822.India. August 2014.

3. Assist, Prof. Dr. Özgür Nalbant. The effect of Suspension Workout on Agility and Forces Performances on Elite Basketball Players. v6 n6 p128-133. Jun 2018.
4. Suspension training overview (National council on Strength and Fitness)
5. Hamid Arazi, Ben Coetzee & Abbas Asadi. Comparative Effect of land and aquatic based plyometric training on jumping ability and agility of young basketball players. South African Journal for Research in Sports, Physical Education and Recreation. Vol 34(2):1-14 . 2012
6. Zeynep Inci Karadenizli. The Effects of Plyometric training on Balance, Anaerobic power and Physical fitness parameters in Handball. Anthropologist. 24(3) : 751-761. Duzce University, Turkey. 2016.
7. Garrett F Coughlan, Karl Fullam, Eamonn Delahun, Conor Gissane, Brian M. Caulfield, A Comparison between performance on selected directions of the star excursion balance test and the Y balance test. Journal of Athletic Training. 47(4) :366-371. August 2012.
8. CON HRY SOMALLIS. Balance ability and athletic performance; Sports Medicine. 2011 Mar.
9. Anna Brachman, Anna Kamieniarz, Justyna Michalska, Michal Pawlowski, Kajetan J Stomka , Grzegorz Juras; Balance training programs in athletes- A systemic review. Journal of Human Kinetics volume. 58/2017, 45-64 DOI:10.1515/hukin-2017-0088 Section 1- Kinesiology. 2017.
10. KOSTOPOULOS NIKOLAOS¹, BEKRIS EVANGELOS¹, APOSTOLIDIS NIKOLAOS¹, KAVROULAKIS EMMANOUIL², KOSTOPOULOS PANAGIOTIS; The effect of balance and proprioception training program on amateur basketball players' passing skills. Journal of physical education and sport. 2012.
11. Abbas Asadi Roudbar. Effects of In-season plyometric training on Sprint and Balance performance in Basketball players. Sports Science. 6(1) :24-27. Islamic Azad University, Roudbar, Iran. June 2013.