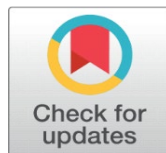


BALANCE, SPEED, AND EXPLOSIVE STRENGTH OF LEGS OF BASKETBALL PLAYERS AS A FUNCTION OF HIGH INTENSITY PLYOMETRIC EXERCISES AND PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION EXERCISES

Saket D. Kanetkar ¹, Dr. Surendra Tiwari ²¹ Department of Physical Education, Ramdeobaba University, Nagpur 440013, India² Jyotiba College of Physical Education, Digdoh, Hingna Road, Nagpur- 440019, India

DOI

[10.29121/shodhkosh.v5.i7.2024.5790](https://doi.org/10.29121/shodhkosh.v5.i7.2024.5790)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Copyright: © 2024 The Author(s). This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.

ABSTRACT

Basketball players require a unique combination of physical attributes, including explosive power, speed, balance, and coordination, to excel in the sport. High-intensity plyometric exercises and proprioceptive neuromuscular facilitation (PNF) exercises are two highly effective training modalities that can help players develop these critical qualities. Hence, the study of balance, speed, and explosive leg strength in basketball players is essential for optimizing performance, preventing injuries, and fostering long-term athletic development. These attributes are fundamental to the physical demands of basketball and directly influence a player's ability to succeed on the court. By focusing on these areas, coaches, trainers, and athletes can gain a competitive edge, improve overall fitness, and ensure sustained success in the sport. In view of the above this study was conducted to assess the impact of High-intensity plyometric exercises and proprioceptive neuromuscular facilitation (PNF) exercises on select physical fitness variables of basketball players of Nagpur District. All the necessary data was collected through experimental procedures and was critically analysed using SPSS 18.0 statistical software. The study results showed that that better balance and speed can be achieved through HI Plyometric exercise.

Keywords: Basketball, Speed, Balance, Plyometric Exercises and Proprioceptive Neuromuscular Facilitation Exercises



1. INTRODUCTION

Basketball is a dynamic and physically demanding sport that requires a unique combination of skills, including balance, speed, and explosive strength, particularly in the lower body (Kooroshfard and Rahimi, 2022). These attributes are critical for performing essential movements such as sprinting, jumping, cutting, and landing, all of which are integral to success on the court. Balance ensures stability during rapid changes in direction and while contesting for rebounds, speed allows players to outmaneuver opponents, and explosive leg strength is vital for powerful jumps and quick accelerations (Gaur, 2018). Given the importance of these physical qualities, optimizing training methods to enhance them is a key focus for coaches, trainers, and athletes.

In recent years, high-intensity plyometric exercises and proprioceptive neuromuscular facilitation (PNF) exercises have gained significant attention as effective training modalities for improving athletic performance (Naderifar et al., 2018). Plyometric exercises, which involve rapid stretching and contracting of muscles, are designed to increase explosive power and speed by enhancing the stretch-shortening cycle of muscle fibers (Sangari and Annadurai, 2017). These exercises, such as box jumps, depth jumps, and bounding, are particularly beneficial for basketball players, as they

mimic the explosive movements required during the game. On the other hand, PNF exercises focus on improving flexibility, balance, and neuromuscular coordination through a combination of stretching and contracting targeted muscle groups (Wang et al., 2024). PNF techniques, such as the contract-relax method, are widely used in rehabilitation and sports training to enhance proprioception and functional strength. While both plyometric and PNF exercises have been individually studied for their benefits, there is limited research on their combined effects on the balance, speed, and explosive leg strength of basketball players. Understanding how these training methods interact and complement each other can provide valuable insights into designing more effective and comprehensive training programs (Harry-Leite et al., 2022). For instance, plyometric exercises may enhance explosive power, while PNF exercises could improve the stability and control necessary to utilize that power efficiently during gameplay.

In view of the above, this study aimed to investigate the impact of high-intensity plyometric exercises and PNF exercises on the balance, speed, and explosive leg strength of basketball players (Zacharakis et al., 2020). By comparing the effects of these training modalities individually and in combination, the research seeks to identify the most effective approach for enhancing these critical physical attributes (Yanti et al., 2024). The findings of this study will not only contribute to the scientific understanding of training methodologies but also provide practical recommendations for coaches and athletes to optimize performance on the basketball court. In a sport where marginal gains can determine the outcome of a game, improving balance, speed, and explosive leg strength through targeted training can give players a competitive edge. This research is particularly relevant in the context of modern basketball, which is characterized by faster gameplay, higher jumps, and more intense physical demands. By exploring the synergistic effects of plyometric and PNF exercises, this study aims to advance training practices and support the development of basketball players at all levels. In view of the above this study is conducted to assess and compare the balance ability, speed and explosive power of legs of basketball players of Nagpur District as a function of strength training and high intensity plyometric training.

2. RESEARCH METHODOLOGY

The present investigation was delimited to the Basketball players of Nagpur District of Maharashtra. The study utilizes a combination of descriptive and exploratory research designs. In this investigation the primary data was collected from the basketball players of study area i.e. Nagpur District by incorporating the experimental procedures. The selection of basketball players was done using non probability purposive sampling technique, where a total of 90 Basketball players were selected. The age group of the players ranged between 13 to 18 years. These players were divided into 3 groups i.e A – PNF Exercises group , B – High intensity plyometric exercise group, C - Controlled group. The basketball players belonging to groups A and B received respective trainngs for a period of 6 weeks. The data pertaining to selected motor fitness variables like balance, speed and explosive strength of legs was collected using standard standard procedures. Specifically, the balance was determined using crosswise bass stick, test, while speed was determined using 50meter dash test, and the explosive strength of legs was assessed using vertical jump test. The collected data analyzed using various statistical tests and with the help of SPSS 18.0 statistical software. Specifically, the data characteristics (descriptive statistics) such as mean, standard deviation, minimum, maximum, skewness, kurtosis, etc. were determined and a One Way ANOVA procedure was used to compare the mean values for different parameters exhibited by basketball players undergoing different type of physical training. The significance level was chosen to be 0.05 (or equivalently, 5%).

3. STATISTICAL ANALYSIS AND INTERPRETATION

3.1. BALANCE

Table 1 Descriptive Statistics for Balance test results of Basketball Players

Attributes	Groups		
	Control	PNF Exercises	HI Plyometric Exercises
Mean (sec)	35	48	52
SD	4.6	5.7	6.1
Minimum	29	38	45

Maximum	44	56	58
Skewness	0.964	1.416	1.846
Kurtosis	1.611	2.007	-0.719

Above Table 1 presents descriptive statistics pertaining to the assessment of balance of Basketball players. The skewness value for control group basketball players was 0.964, whereas, for the experimental group (PNF Exercise) players, it was 1.416 and HI Plyometric Exercises players it was 1.846. Furthermore, the kurtosis values for control group basketball players was 1.611, whereas, for the experimental group (PNF Exercise) players it was 2.007 and HI Plyometric Exercises players it was -0.719.

3.2. BALANCE

Table 2 Comparison of balance test results of Basketball Players

Groups	Mean	±SD	Min	Max	F ratio	P
Control	35	±4.6	29	44	78.252	<0.05
PNF Exercises	48	±5.7	38	56		
HI Plyometric Exercises	52	±6.1	45	58		

SD: Standard Deviation; Min: Minimum; Max: Maximum; MD: Mean Difference; p: Probability

Above Table 2 presents results of comparative assessment of balance of Basketball players. The mean test score of crosswise bass stick test of control group basketball players was 35±4.6sec while that of experimental group (PNF exercise) players it was 48±5.7sec and of experimental group (HI Plyometric Exercise) players it was 52±6.1sec.

3.3. SPEED

Table 3 Descriptive Statistics for Speed test results of Basketball Players

Attributes	Groups		
	Control	PNF Exercises	HI Plyometric Exercises
Mean (milli sec.)	5.2	4.7	4.6
SD	0.8	0.7	0.6
Minimum	4.7	4.4	4.2
Maximum	5.8	5.3	5.4
Skewness	0.986	1.346	1.431
Kurtosis	1.308	0.864	0.963

Above Table 3 presents descriptive statistics pertaining to the assessment of speed of Basketball players. The skewness value for control group basketball players was 0.986, whereas, for the experimental group (PNF Exercise) players, it was 1.346 and HI Plyometric Exercises players it was 1.431. Furthermore, the kurtosis values for control group basketball players was 1.308, whereas, for the experimental group (PNF Exercise) players it was 0.864 and HI Plyometric Exercises players it was 0.963.

3.4. SPEED

Table 4 Comparison of speed test results of Basketball Players

Groups	Mean	±SD	Min	Max	F ratio	P
--------	------	-----	-----	-----	---------	---

Control	5.2	±0.8	4.7	5.8	6.242	<0.05
PNF Exercises	4.7	±0.7	4.4	5.3		
HI Plyometric Exercises	4.6	±0.6	4.2	5.4		

SD: Standard Deviation; Min: Minimum; Max: Maximum; MD: Mean Difference; p: Probability

Above Table 4 presents results of comparative assessment of speed of Basketball players. The mean test score of 50 meter dash test of control group basketball players was 5.2 ± 0.8 milisec while that of experimental group (PNF exercise) players it was 4.7 ± 0.7 milisec and of experimental group (HI Plyometric Exercise) players it was 4.6 ± 0.6 milisec.

3.5. EXPLOSIVE STRENGTH OF LEGS

Table 5 Descriptive Statistics for Explosive strength test results of Basketball Players

Attributes	Groups		
	Control	PNF Exercises	HI Plyometric Exercises
Mean (cm)	42.5	59	56
SD	6.4	8.9	7.1
Minimum	30	45	46
Maximum	68	70	68
Skewness	1.237	-1.648	1.103
Kurtosis	0.954	0.719	0.846

Above Table 5 presents descriptive statistics pertaining to the assessment of explosive strength of legs of Basketball players. The skewness value for control group basketball players was 1.237, whereas, for the experimental group (PNF Exercise) players, it was -1.648 and HI Plyometric Exercises players it was 1.103. Furthermore, the kurtosis values for control group basketball players was 0.954, whereas, for the experimental group (PNF Exercise) players it was 0.719 and HI Plyometric Exercises players it was 0.846.

3.6. EXPLOSIVE STRENGTH OF LEGS

Table 6 Comparison of explosive strength of legs test results of Basketball Players

Groups	Mean	±SD	Min	Max	F ratio	P
Control	42.5	±6.4	30	68	40.758	NS
PNF Exercises	59	±8.9	45	70		
HI Plyometric Exercises	56	±7.1	46	68		

SD: Standard Deviation; Min: Minimum; Max: Maximum; MD: Mean Difference; p: Probability

Above Table 6 presents results of comparative assessment of explosive strength of legs of Basketball players. The mean test score of vertical jump test of control group basketball players was 42.5 ± 6.4 cm while that of experimental group (PNF exercise) players it was 59 ± 8.9 cm and of experimental group (HI Plyometric Exercise) players it was 56 ± 7.1 cm.

4. CONCLUSIONS

4.1. BALANCE

The comparative analysis showed that there is ($p < 0.05$) significant difference in the balance of Basketball players undergoing different type of training. Specifically, the balance of experimental group (HI Plyometric exercise) basketball players appeared to be remarkably high than that of other basketball players.

4.2. SPEED

The comparative analysis showed that there is ($p < 0.05$) significant difference in the speed of Basketball players. Specifically, the speed of experimental group (HI Plyometric exercise) basketball players appeared to be remarkably high than that of other players.

4.3. EXPLOSIVE STRENGTH OF LEGS

The comparative analysis showed that there is no difference in the explosive strength of legs of Basketball players.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

REFERENCES

- Sangari V. S. and Annadurai R. (2017). Effect of plyometric circuit training on development of speed and agility on Basketball players, *Int. J. Phy. Edu. Spo*, 2(8), pp.38-41.
- Gaur M. P. (2018). Impact of Plyometric Training On Speed, Strength And Ball Control Ability of Male Basketball Players, *International journal of economic perspectives*, 12(1), pp.17-20.
- Naderifar H., Minoonejad H., Barati A. H. and Lashay A. (2018). Effect of a neck proprioceptive neuromuscular facilitation training program on body postural stability in elite female basketball players, *Journal of Rehabilitation Sciences & Research*, 5(2), pp.41-45.
- Harry-Leite, P., Paquete, M., Teixeira, J., Santos, M., Sousa, J., Fraiz-Brea, J. A and Ribeiro, F. (2022). Acute Impact of Proprioceptive Exercise on Proprioception and Balance in Athletes, *Applied Sciences*, 12(2), 830.
- Kooroshfard N. and Rahimi Z. (2022). The effect of the neuromuscular, strength, and combined training on balance and performance in female basketball players, *Physical Treatments-Specific Physical Therapy Journal*, 12(1), pp.41-50.
- Wang P., Liu Y. and Chen C. (2024). Effects of neuromuscular training on dynamic balance ability in athletes: A systematic review and meta-analysis, *Heliyon*.
- Yanti, N., Selviani, I., Supriatna, E., Nofrizal, D., Purba, P. H., Lubis, H. Y., Nurbait, S., Putro, D. E., Ismoko, A. P., Wahyuni, D., Suryadi, D., & Suganda, M. A. (2024). Effectiveness of plyometric training in handball: impact on throwing power and speed, *Retos*, 58, pp. 643–649.
- Zacharakis E. D., Bourdas D. I., Kotsifa M. I., Bekris E. M., Velentza E. T. and Kostopoulos N. I. (2020). Effect of balance and proprioceptive training on balancing and technical skills in 13-14-year-old youth basketball players, *Journal of Physical Education and Sport*, 20(5), pp.2487-2500.