IOSR Journal of Sports and Physical Education (IOSR-JSPE)
e-ISSN: 2347-6737, p-ISSN: 2347-6745, Volume 13, Issue 1, Series 1, (Jan. – Feb. 2026), PP 01-05
www.iosrjournals.org

"Effects Of Eccentric Strength Training On Speed And Change Of Direction In Basketball Players"

Dr. Sulaiman. I, Pooja. N. S, Dr. A. K. Vijay Krishna Kumar
Professor, Dr. B. R. Ambedkar College Of Physiotherapy, Bangalore, Karnataka, India
BPT Intern, Dr. B. R. Ambedkar College Of Physiotherapy, Bangalore, Karnataka, India
Principal, Dr. B. R. Ambedkar College Of Physiotherapy, Bangalore, Karnataka, India

Abstract
***Background**: Basketball is a fast paced, exciting, court-based team sport that require a combination of skill, athleticism and teamwork. Players are required to perform high eccentric load movements such as acceleration, deceleration, speed, jump, rapid change of direction. Eccentric strength training can be a beneficial intervention for enhancing speed and change of direction.*
***Objective:** To determine the effects of eccentric strength training on basketball player's speed and change of direction.*
***Method:** This study involves Thirty -four basketball players, who were randomly selected based on inclusion and exclusion criteria, assigned eccentric training for 6 weeks conducting 2 sessions per week. Pre and post intervention performance were measured through 30m sprint test and agility T test.*
***Results:** The results are reported as 30m Sprint Test showed a significant improvement, with scores decreasing from 8.18 ± 0.52 seconds at pre-test to 6.94 ± 0.51 seconds at post-test (mean difference 1.24, t = 35.303, p < 0.001). Similarly, the Agility T-Test demonstrated a marked improvement, with times reducing from 11.61 ± 0.50 seconds at pre-test to 10.32 ± 0.44 seconds at post-test (mean difference 1.29, t = 46.439, p < 0.001), indicating enhanced agility performance following the intervention.*
***Conclusion:** The study shows that there is a significant improvement on speed and change of direction with the help of eccentric strength training among basketball players.*
***Keywords:** Eccentric Training, Change of Direction, Speed, Basketball.*

Date of Submission: 27-12-2025 Date of Acceptance: 07-01-2026

I. Introduction

Basketball is a team sport characterized by intermittent play on a court, which demands recurring episodes of intense physical activity including sprinting, explosive jump, acceleration, deceleration, abrupt stop, lateral shuffle, fast change of direction, all of these actions require players to absorb eccentric loads. Players need strong lower body explosiveness and rapid force generation, agility with and without the ball, and short-distance speed. Strength, speed, power and agility are crucial for basketball success, enhancing these qualities directly improves game performance [1,2].

Eccentric training uses slow, controlled muscle extension against an external load, providing continuous resistance that effectively activates muscle fibers to enhance strength and endurance. Eccentric strength training has been considered as a potential method for improving speed and change of direction skill, a player's ability to perform technically and execute offensive or defensive strategies is directly correlated with their movement changes, team sport performance could be improved by this. It uses slow, controlled muscle lengthening against resistance. This method maximizes muscle fiber activation, leading to significant gains in strength and endurance, reduce injury risk [3].

Team sport athletes who need to generate rapid force during quick movements can gain advantages from eccentric training, this training is a powerful tool for enhancing physical performance [4]. Although eccentric strength training is a valuable therapeutic tool, populations at risk, including older adults, exhibit increased susceptibility to muscular injury and diminished recovery capacity when subjected to bouts of high-intensity muscle actions [5]. Eccentric training has been shown to increase range of motion by boosting the voluntary activation of the agonist muscle and reducing the co-activation of the antagonist muscle [6].

Overloading the eccentric phase builds more strength than using a constant weight. Eccentric contractions store kinetic energy as elastic potential energy in the muscle-tendon unit, it trains the body to store and use elastic energy more effectively, boosting speed and power. This is crucial for change of direction, as it helps athletes decelerate and stabilize quickly before re-accelerating [7,8]. Progressively increasing the intensity of eccentric exercises leads to substantial strength improvements [9]. Strong eccentric strength in the hips, quads, and calves is vital for the braking phase of directional changes. Enhancing this strength improves deceleration speed and performance [10]. While the benefits of eccentric resistance training for strength, speed, and injury prevention are well-documented in adults, there is limited evidence regarding its practical implementation for youth athletes [11].

Incorporating eccentric training boosts peak strength, explosive power, and muscle growth while serving as a vital tool for tendon rehabilitation. Although it typically outperforms traditional methods in building mass and strength, these gains can sometimes be specific to the training modality rather than general function [12,13]. Adding eccentric-based exercises to a standard training program is essential for maximizing an athlete's physical capabilities and lowering their susceptibility to injury [14]. Hence, Eccentric strength serves as a primary factor in an athlete's ability to change direction [15].

Previous studies have largely examined the broad impacts of eccentric training highlighting its benefits for acceleration, deceleration, stop, jump, speed and agility. However, this study specifically determines the effects of eccentric strength training on speed and change of direction ability in basketball players. This study hypothesizes that eccentric strength training will lead to marked improvements in speed and change of direction among basketball players.

II. Methodology

This experimental study was conducted at the Centre for Sports Science, Bangalore. A total of 34 participants were selected using a purposive sampling technique. The study included male and female basketball players below 18 years of age who had been actively involved in the sport for at least two years. Players with a recent history of lower limb or spinal injury, recent surgical intervention, or any major systemic illness were excluded from participation. After participants were selected using the inclusion and exclusion criteria, their speed and change of direction were measured as a pre-test.

Procedure:

The participants then underwent an Eccentric Strength Training program of 35 minutes duration, which comprised a 10-minute warm-up and a 5-minute cool-down involving jogging and dynamic stretching exercises. Following a six-weeks intervention period, post-test assessments were conducted to re-evaluate speed and change of direction.

The following exercises (Table 1) were given, 2 Sessions per week for a duration of 6 weeks.

Table 1: **Eccentric Exercises**

Weeks	Eccentric Exercises	Sets and Repetitions
1-2	Backward lunges Crossover cutting Lateral squat 90° lunge	1×6 1×6 1×6 1×6
3-4	Backward lunges Crossover cutting Lateral squat 90° lunge	1×8 1×8 1×8 1×8
5-6	Backward lunges Crossover cutting Lateral squat 90° lunge	1×10 1×10 1×10 1×10

Outcome measures:

30m SPRINT TEST

The test involves running a single maximum sprint over 30 meters, with the time recorded. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position was held for 2 seconds prior to starting, and no rocking movements were allowed. The tester advised participants on how to increase their speed, suggesting a low stance and strong arm and leg movements, also motivated them to keep pushing themselves until the end. Two trials were done, and the best time was recorded.

AGILITY T-TEST

The participant starts at cone A. On the command of the timer, the participant runs forward to cone B and touches the base of the cone with their right hand. Then they turned left and shuffle sideways to cone C, touch the base with their left hand. Then shuffle sideways to the right to cone D and touch the base with the right hand. They shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch was stopped as they pass cone A.

III. Data Analysis And Interpretation

The statistical analysis was done using SPSS 23.0. The categorical variables were represented in frequency and percentage. Numerical variables were presented using mean and standard deviation. Pre post comparison was done using Paired sample t test. A p value <0.05 was considered statistically significant.

Table 2: Distribution based on gender

	Frequency	Percent
Female	9	26.5
Male	25	73.5
Total	34	100.0

Of the 34 participants, 26.5% (n = 9) were female and 73.5% (n = 25) were male.

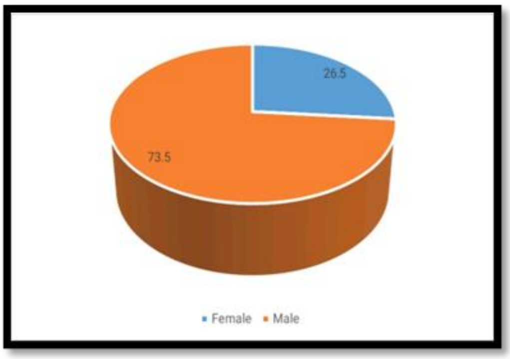


Figure 1: Representations based on gender

Table 3: Descriptive statistics of Height, Weight and BMI

	N	Minimum	Maximum	Mean	Std. Deviation
HEIGHT (cm)	34	40.00	110.00	58.656	15.638
WEIGHT (kg)	34	150.00	198.00	169.265	13.351
BMI (kg/m^2)	34	16.10	28.70	20.079	3.213

The participants had a mean height of 58.66 ± 15.64 cm (range: 40.00–110.00 cm) and a mean weight of 169.27 ± 13.35 kg (range: 150.00–198.00 kg). The mean BMI was 20.08 ± 3.21(kg/m^2) (range: 16.10–28.70).

Table 4: Pre post comparison in 30 METER SPRINT TEST (sec)

		Mean	N	Std. Deviation	Mean Difference	t value	P value
30 METER SPRINT TEST (sec)	Pre	8.1765	34	.52400	1.238	35.303	p<0.001
	Post	6.9382	34	.50513			

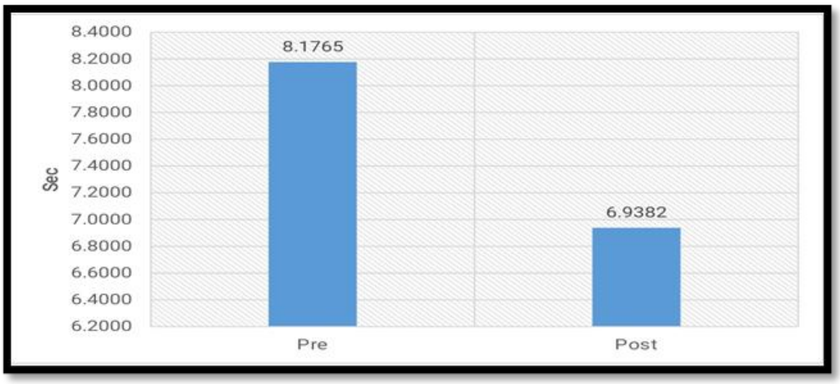


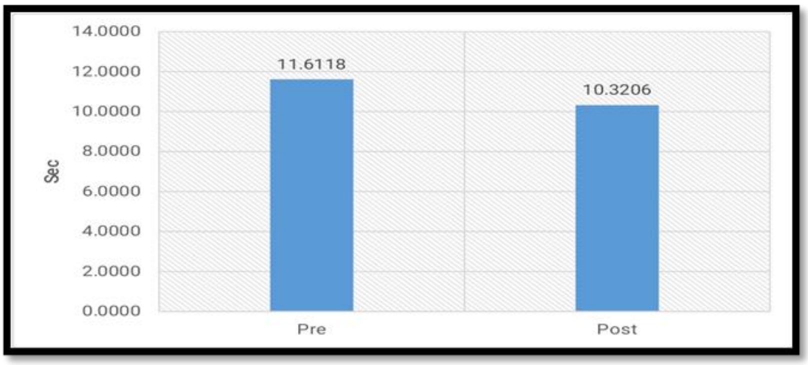
Figure 2: Representation of pre post 30 METER SPRINT TEST (sec)

The mean time for the 30-meter sprint test improved from 8.18 ± 0.52 seconds at pre-test to 6.94 ± 0.51 seconds at post-test, with a mean difference of 1.24 seconds. This improvement was statistically significant (t = 35.303, p < 0.001), indicating a substantial enhancement in sprint performance following the intervention.

Table 5: Pre post comparison in AGILITY T-TEST (sec)

		Mean	N	Std. Deviation	Mean Difference	t value	p value
AGILITY- T TEST (sec)	Pre	11.6118	34	.50016	1.291	46.439	p<0.001
	Post	10.3206	34	.44434			

Figure 3: Representation of pre post AGILITY T-TEST (sec)



The mean time for the agility t-test improved from 11.61 ±0.50 seconds at pre-test to 10.32 ±0.44 seconds at post-test, with a mean difference of 1.29 seconds. This improvement was statistically significant (t=46.439, p<0.001), indicating a substantial enhancement in agility t-test performance following the intervention.

IV. Discussion

The present study was conducted to evaluate the effects of eccentric strength training on speed and change of direction in basketball players. The results showed a statistically significant improvement in both speed and agility performance after 6 weeks of intervention.

In the current study, the mean sprint time improved from 8.18 ± 0.52 seconds to 6.94 ± 0.51 seconds, with a mean difference of 1.24 seconds (t = 35.303, p < 0.001), showing a statistically significant gain in speed. Similarly, agility performance improved from 11.61 ± 0.50 seconds to 10.32 ± 0.44 seconds, reflecting a mean difference of 1.29 seconds (t= 46.439, p<0.001), showing better change of direction ability. These improvements support the hypothesis that eccentric strength training contributes to enhanced basketball-specific skills by improving neuromuscular efficiency, eccentric force absorption, and movement control.

The positive adaptations observed in this study may be attributed to the nature of basketball, which involves frequent acceleration, deceleration, and change of direction movements. Eccentric training enhances an athlete's movement by improving muscle length, tension coordination, and joint stability. This leads to better posture, deceleration, and speed control, which are vital for rapid directional change and stop [1].

According to the results of a previous study by O'Brien et al. (2020), who reported that eccentric overload training, particularly flywheel inertial training, significantly improved strength, power, speed, and change of direction in basketball players [3]. Gonzalo-Skok et al. (2022) also highlighted that direction-specific eccentric overload training reduced inter-limb asymmetries while enhancing functional performance, further supporting the effectiveness of eccentric approaches in multidirectional sports like basketball [5]. Furthermore, di Cagno et al. (2020) emphasized that eccentric training yielded greater improvements in sport-specific actions compared to plyometric training. This aligns with our results, as participants not only gained sprinting speed but also agility, which are the main components in basketball performance [6].

Physiologically, eccentric training improves the muscle's ability to absorb and reuse elastic energy, enhances tendon stiffness, and improves neuromuscular control, resulting in more efficient transitions between braking and propulsion phases [7]. Similar benefits have been reported in other team sports, including soccer and badminton, where eccentric overload training significantly improved sprinting, deceleration, and agility performance [8,10]. Additionally, eccentric resistance training is considered safe and effective for youth athletes, supporting its application in adolescent basketball players [11]. Overall, the findings of the present study are consistent with existing literature, indicating that eccentric strength training is an effective and practical approach for improving speed and change of direction in basketball players while also supporting neuromuscular control and injury prevention [13,14].

Eccentric training improves the muscle's ability to absorb and produce force efficiently, thereby reducing energy leaks during explosive actions. This may explain the observed improvements in sprint and agility performance, it may also contribute to injury prevention by improving neuromuscular control and load absorption capacity.

Limitations Of The Study

The study was conducted on a relatively small sample size limiting the generalizability of the finding and gender imbalance in the sample (more males than females) may differ the results and reduces the scope for gender specific comparisons.

V. Recommendations

Future research should explore larger population, extended training duration, and multiple performance measures to further establish the role of eccentric training in basketball and other sports.

VI. Conclusion

This study concludes that eccentric strength training significantly enhances speed and change of direction ability in basketball players over a six-week period. The improvements in speed and agility performance suggest that eccentric exercises improve force absorption, and movement control, which are essential for basketball. Incorporating such training into regular programs can not only boost performance but also reduce injury risks. Overall, eccentric strength training is a safe and practical approach to improving basketball performance.

References

[1]. Zhang Y, Zhuang Y, Zhang L And Sun M (2024) The Impact Of Eccentric Training On Athlete Movement Speed: A Systematic Review. Front. Physiol. 15: 1492023.Doi: 10.3389/Fphys.2024.1492023.

[2]. Omar Younes-Egana [1,*], Juan Mielgo-Ayuso [2], Marko D. M. Stojanović [3], Stephen P. Bird [4], Julio Calleja-González [5]. Effectiveness Of Eccentric Overload Training In Basketball Players: A Systematic Review. Journal Of Human Kinetics Volume 88/2023, 243–257 DOI: 10.5114/Jhk/167469.

[3]. Joey O Brien *, Declan Browne And Des Earls. The Effects Of Different Types Of Eccentric Overload Training On Strength, Speed, Power And Change Of Direction In Female Basketball Players .J. Funct. Morphol. Kinesiol. 2020, 5, 50; Doi:10.3390/Jfmk5030050.

[4]. Javier Sanchez-Sanchez[1], Oliver Gonzalo-Skok[1,2], Manuel Carretero[1], Adrian Pineda[3], Rodrigo Ramirez-Campillo[1,4], And Fábio Yuzo Nakamura[1,5].EFFECTS OF CONCURRENT ECCENTRIC OVERLOAD AND HIGH-INTENSITY INTERVAL TRAINING ON TEAM SPORTS PLAYERS' PERFORMANCE. Original Scientific Paper Https://Doi.Org/10.26582/K.51.1.14.

[5]. Gonzalo-Skok, O.;Sánchez-Sabaté, J.; Tous-Fajardo, J.;Mendez-Villanueva, A.; Bishop, C.;Piedrafita, E. Effects Of Direction-Specific Training Interventions On Physical Performance And Inter-Limb Asymmetries. Int. J. Environ. Res. Public Health 2022, 19, 1029. Https://Doi.Org/10.3390/Ijerph19031029.

[6]. Alessandra Di Cagno [1], Enzo Iuliano [2], Andrea Buonsenso [3], Arrigo Giombini [1],Giulia Di Martino [1], Attilio Parisi [1], Giuseppe Calcagno [3] And Giovanni Fiorilli [3].Effects Of Accentuated Eccentric Training Vs Plyometric Training On Performance Of Young Elite Fencers.©Journal Of Sports Science And Medicine (2020) 19, 703-713. Http://Www.Jssm.Org.

[7]. Conor Mcneill [1,*], C. Martyn Beaven [1], Daniel T. Mcmaster [1,2] And Nicholas Gill [1,2].Eccentric Training Interventions And Team Sport Athletes. J. Funct. Morphol. Kinesiol. 2019, 4, 67; Doi:10.3390/Jfmk4040067.Www.Mdpi.Com/Journal/Jfmk.

[8]. Giovanni Fiorilli [1], Intrieri Mariano [1], Enzo Iuliano [3], Arrigo Giombini [2], Antonello Ciccarelli [2], Andrea Buonsenso [1], Giuseppe Calcagno [1] And Alessandra Di Cagno [2]. Isoinertial Eccentric-Overload Training In Young Soccer Players: Effects On Strength, Sprint, Change Of Direction, Agility And Soccer Shooting Precision. ©Journal Of Sports Science And Medicine (2020) 19, 213-223. Http://Www.Jssm.Org.

[9]. Harris-Love MO, Seamon BA, Gonzales TI, Hernandez HJ, Pennington D And Hoover BM (2017) Eccentric Exercise Program Design: A Periodization Model For Rehabilitation Applications. Front. Physiol. 8:112. Doi:10.3389/Fphys.2017.00112.

[10]. Yuan S, Lu Z, Tan S, Zhang Z, Jing S, Liu H, Zhou Z And Bao D (2025) Comparison Of Six-Week Flywheel And Traditional Resistance Training On Deceleration And Dynamic Balance In Elite Badminton Players. Front. Physiol. 16:1491661. Doi: 10.3389/Fphys.2025.1491.

[11]. Benjamin Drury [1,*], Sébastien Ratel [2], Cain C.T. Clark [3], John F.T. Fernandes [1], Jason Moran [4] And David G Behm [5]. Eccentric Resistance Training In Youth: Perspectives For Long-Term Athletic Development. J. Funct. Morphol. Kinesiol. 2019, 4, 70; Doi:10.3390/Jfmk4040070 Www.Mdpi.Com/Journal/Jfmk.

[12]. Burgos-Jara, C.;Cerda-Kohler, H.; Aedo-Muñoz, E.; Miarka, B. Eccentric Resistance Training: A Methodological Proposal Of Eccentric Muscle Exercise Classification Based On Exercise Complexity, Training Objectives, Methods, And Intensity. Appl. Sci 2023, 13, 7969. Https://Doi.Org/10.3390/App13137969.

[13]. Stojanovi´C, M.D.M.; Andri´C, N.; Miki´C, M.; Vukosav, N.; Vukosav,B.; Zolog-S, Chiopea, D.-N.; T ˇab ˇacar, M.; Melinte, R.M. Effects Of Eccentric-Oriented Strength Training On Return To Sport Criteria In Late-Stage Anterior Cruciate Ligament (ACL)-Reconstructed Professional Team Sport Players. Medicina 2023, 59, 1111. Https://Doi.Org/10.3390/Medicina59061111.

[14]. Eduardo Abade [1,2,3]. Bruno Gonçalves [3,4,5]. Bruno Figueira [4,5]. Sara Santos[1,2]. Diogo Coutinho [6] (2024). Impact Of Eccentric Exercises On Soccer Players' External Load, Muscle Soreness And Physical Performance: A Comparative Study Of Pre And Post- Training Routines. Journal Of Science In Sport And Exercise Https://Doi.Org/10.1007/S42978-024-00315-7.

[15]. Oliver Gonzalo-Skok[1]; Julio Tous-Fajardo[2,3]; Carlos Valero-Campo[1]; César Berzosa[1]; Ana Vanessa Bataller[1]; José Luisarjol-Serrano[1]; Gerard Moras[3] And Alberto Mendez-Villanueva[4].Eccentric-Overload Training In Team-Sport Functional Performance: Constant Bilateral Vertical Versus Variable Unilateral Multidirectional Movements. International Journal Of Sports Physiology And Performance DOI: Http://Dx.Doi.Org/10.1123/Ijspp.2016-0251.