

EFFECT OF 8-WEEK PLYOMETRIC TRAINING ON SPEED OF MALE BASKETBALL PLAYERS

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ABSTRACT:

The main objective of this experimental research study was to assess the 8-week plyometric training (PT) effect on the speed of male Basketball players aged 16 to 19. The researcher selected 24 male Basketball players from Govt Higher Secondary Schools, District Haripur, Khyber Pakhtunkhwa, Pakistan based on inclusion-exclusion criteria. Participants were divided into two groups: the Control Group (CG=12) and the Experimental Group (EG=12). The EG completed an 8-week plyometric training (PT) intervention that included plyometric exercises of different intensities and durations. The EG was engaged in 4 days per week plyometric training with 3 days of rest in addition to their usual Basketball practice. During this period, the CG was only engaged in their normal Basketball practice. Before and at the end of 8-week plyometric training, 20m sprint test was conducted and data was carefully collected. The data was analyzed through Statistical Product and Service Solutions. To assess differences in the speed of the same group, a paired sample t-test was applied. An Independent sample t-test was applied to compare the differences between the CG and EG. The statistical significance level was set at 0.05. Statistical results of 8-week plyometric training showed significant differences in the speed of Experimental group ($p=0.006$). In the end, it was concluded that 8-week plyometric training has a significant effect on the speed of male Basketball athletes aged 16 to 19. Finally, it is recommended that Basketball players, trainers, and coaches incorporate plyometric exercises in their training sessions to improve the speed of male Basketball players.

Keywords: Plyometric training, Basketball, Speed, Sprint,

INTRODUCTION:

Basketball is one of the most popular games in the world. It is among the most popular team sports played and viewed worldwide (Li & Xu, 2021). Complex movements like sprinting, jumping, throwing and as well as components of physical condition like strength, speed, flexibility, agility, and power are important

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elements of the game (Budiman, 2022). Quickness, coordination, balance, aerobic and anaerobic endurance are additional key success components for the game. Each player of the team needs to receive sufficient training to become skilled in all fundamental skills, tactics, and strategies (Candra, 2018). Basketball players require the ability to rapidly move, change direction quickly, and jump high for which agility, speed, and leg muscle power are essential elements (Poomsalood & Pakulanon, 2015).

Speed is the ability to cover a maximum distance in the shortest period (Purwanto et al., 2021). The ability to move speedily is essential for overall performance in sports. Studying the fundamentals of sprinting was an area that successful athletes were particularly interested in (Bin Shamshuddin et al., 2020). Plyometric Training (PT) uses the speed and force of different movements to enhance the power of muscles. These are rapid, powerful movements followed by a counter-movement or pre-stretch, involving a stretch-shortening cycle (SSC), and are based on exercises that involve rapid and repeated stretching and contracting of muscles (Poomsalood & Pakulanon, 2015). These types of exercises are popular among athletes who participate in dynamic activities, such as bounding, skipping, and jumping, to improve muscular abilities (Impellizzeri et al., 2008).

Lower-body Plyometrics is an efficient way to strengthen lower-body muscles and increase tendon flexibility, which increases speed. These exercises aim to improve dynamic efficiency and may be beneficial in fields that require the development of the lower extremities. (Chu & Meyer, 2013). Plyometric training enhances sprinting ability by increasing speed, explosive power, and lower-body muscle coordination. The stretch-shortening cycle increases the pace at which force is generated while enhancing the elasticity of the tendons and muscles related to speed. Resultantly, athletes have shorter ground contact times, faster momentum, powerful strides, and, ultimately, faster sprinting (Fabricius & D. L. 2011).

PT has been demonstrated to improve sprinting abilities in a variety of sports and may also be used to increase performance in the game of Basketball (Ramirez-Campillo et al., 2020). Plyometric training has a significant impact on speed-related muscles in many sports and may also be utilized to assess its effects on Basketball player's speed (Ozen et al., 2020). PT has received considerable attention in international literature, but lack of a scientific research studies on PT effects on Pakistani school-level Basketball players (Ashraf et al., 2019). So, the main objective of the current experimental research was to investigate the effects of eight-week PT on the speed of male Basketball players from higher secondary schools, aged 16 to 19.

MATERIAL AND METHODS:

To assess the effectiveness of 8-week PT on the speed of male Basketball players from higher secondary schools. The researcher selected 24 male Basketball players from government higher secondary schools, District Haripur, Khyber Pakhtunkhwa, Pakistan based on inclusion-exclusion criteria as mentioned in Table 1. The participants of the study were separated into two equal groups randomly: The experimental group EG=12 and the Control group CG=12. The EG completed an eight-week plyometric training intervention that included plyometric exercises with different intensities and durations along with their usual Basketball practice. During that period, the CG was only engaged in their normal Basketball practice. Pre-participation evaluation (PPE) was also used in the selection of participants to maintain safe sports participation and ensure the athlete's health and safety (Sportärztliche Vorsorgeuntersuchung, 2015). The Govt. Higher Secondary School Bagra was chosen as the site for the study and written approval was taken from the head of the school.

INCLUSION-EXCLUSION CRITERIA:

Table 1:
Showing Inclusion & Exclusion Criteria for Participants of the Study

S#	Inclusion	Exclusion
1	Age between 16-19 years	below 16 and above 19 years
2	Basketball experience of more than 01 year	Experience less than 01 year
3	Free from lower extremity injuries	having lower extremity injuries
4	BMI 18.5 to 24.9	BMI not between 18.5 to 24.9
5	No orthopedic injuries	Orthopedic injuries
6	Only engaged in current PT	Engaged in any other training besides current PT

Anthropometrics/Demographics/ of the participants:

Table 2:
Showing Anthropometrics/Demographics of the groups

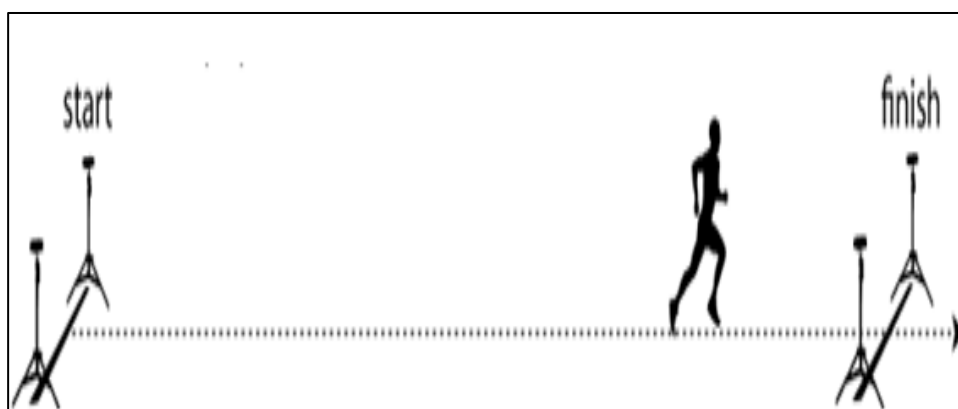
S#	Variable	EG Mean $\pm$ S.D	CG Mean $\pm$ S.D
1	Age (years)	17.33 $\pm$ 1.15	17.50 $\pm$ 1.21
2	Weight (Kg)	67.66 $\pm$ 3.89	66.50 $\pm$ 3.50
3	Height in (m)	1.75 $\pm$ 0.05	1.68 $\pm$ 0.03
4	BMI in (kg/m ²)	22.14 $\pm$ 0.88	22.47 $\pm$ 0.77
5	Basketball playing Experience (years)	1.83 $\pm$ 1.19	1.700 $\pm$ 1.10

Pre-post Testing Methodology and Measurement:

Before the commencement of the eight-week plyometric training, a pre-test was conducted for control and experimental groups by using a 20m sprint test. Similarly, the post-test was administered after eight weeks of plyometric training shown in Figure 1. The tests were conducted on an outdoor Basketball court. The time was recorded with a digital stopwatch. After the warm-

up, athletes started their sprint from the starting mark. On go command, they sprinted to the finish line as quickly as possible. The stopwatch was stopped as he crossed the finish mark. Between each trial, there was a two-minute rest time. The best of the three was selected as the final performance for assessment.

Figure-1
Layout of 20m Sprint test



Plyometric Training Intervention:

Eight-week Plyometric training intervention for experimental group is shown in Table 3. The EG practiced plyometric training four days a week with three-day rest for a total of eight weeks in addition to their usual Basketball practice. The plyometric intervention's intensity and volume of work were according to the standards of the American College of Sports Medicine (Poomsalood & Pakulanon, 2015). Before the PT session, there was a five-minute warm-up which included both general and specific warm-ups shown in The PT intervention consisted of twelve different types of plyometric exercises. The duration of each training session varied from 20 to 45 minutes depending upon the volume, intensity, and number of exercises performed in each session. The plyometric training intervention included 2 to 5 sets, 6 to 15 repetitions of 3 to 6 exercises, and 90 to 140 touches or foot contacts per session.

The foot contact with the ground is represented by touch or bounce (Ozbar et al., 2014). According to the intensities and volume of exercises, the rest interval between two attempts was 10 to 20 seconds, and the rest period between sets was 1 to 3 minutes. Three-minute cool down after each PT session.

Table-3:
8-week Plyometric Training Intervention for Experimental Group

Week	Foot Contacts (Volume)	Plyometric Exercises Monday to Thursday (10 am)	Duration of Each Training Session	Sets & Reps	Rest (Seconds/Min)		Intensity
					Between Reps	Between Sets	
01	90	Side-to-side ankle hopes Standing jump and reach Front cone hopes	20Minutes	2 × 15 2 × 15 5 × 6	10 sec 10 sec 10 sec	01min 01min 01 min	low low low
02	120	Side-to-side ankle hopes Standing long jump Lateral jump over a- barrier Double leg hopes	25Minutes	2 × 15 5 × 6 2 × 15 5 × 6	10 sec 10 sec 15 sec 15 sec	01 min 02 min 02 min 02 min	low low mod mod
03	120	Side-to-side ankle hopes Standing long jump Lateral jump over a- barrier Double leg hopes Lateral cone hopes	30Minutes	2 × 12 4 × 6 2 × 12 3 × 8 2 × 12	10 sec 10 sec 15 sec 15 sec 15 sec	01 min 01 min 02 min 02 min 02 min	low low mod mod mod
04	120	Side to side ankle hopes Standing long jump Lateral jump over a- barrier Double leg hopes Lateral cone hops.	30 Minutes	2 × 12 4 × 6 2 × 12 3 × 8 2 × 12	10 sec 10 sec 15 sec 15 sec 15 sec	01 min 01 min 02 min 02 min 02 min	low low mod mod mod
05	140	Diagonal cone hopes Standing long jump with-lateral sprint Lateral cone hopes Single leg bounding Lateral jump, single leg	40 Minutes	4 × 18 4 × 8 2 × 12 4 × 7 4 × 6	10 sec 15 sec 15 sec 20 sec 20 sec	01 min 02 min 02 min 03 min 03 min	low mod mod high high
06	140	Diagonal cone hopes Standing long jump with-lateral sprint Lateral cone hopes Cone hopes with 180-degree Turn Single leg bounding Lateral jump, single leg	45 Minutes	2 × 7 4 × 7 4 × 7 4 × 7 4 × 7 2 × 7	10 sec 15 sec 15 sec 15 sec 20 sec 20 sec	1 min 2 min 2 min 2 min 3 min 3 min	low mod mod mod high high

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07	140	Diagonal-cone hopes Hexagon-drill Cone hopes with a change of direction Sprint Double-leg hopes Lateral-jump, single-leg	35 Minutes	2 x 12 2 x 12 4 x 6 3 x 8 4 x 6	10 sec 10 sec 15 sec 15 sec 20 sec	01 min 01 min 01 min 02 min 02 min	low low mod mod high
08	120	Diagonal cone hopes Standing long jump with-lateral sprint Lateral cone hopes Cone hopes with 180-Degree Turn Single leg bounding Lateral jump, single leg	45 Minutes	2 x 7 4 x 7 4 x 7 4 x 7 4 x 7 2 x 7	10 sec 15 sec 15 sec 15 sec 20 sec 20 sec	01 min 02 min 02 min 02 min 03 min 03 min	low mod mod mod high high

DATA ANALYSES:

For analysis of the data, inferential and descriptive statistics were used. Statistical Product and Service Solutions (SPSS) software was used and significant value was 0.05. A paired sample t-test was utilized to assess significant differences in speed of the same group whereas an independent sample t-test was used to assess the significant variations between the CG and EG at pre-and post-training stages.

RESULTS OF THE STUDY:

Table-4
Paired sample t-test results of 20m sprint test for Experimental and Control groups

Variable	Groups	n.	Pre-test Mean±SD	Post-test Mean±SD	df	t	Sig.
Speed	EG	12	4.36 ± 0.46	4.13 ± 0.33	11	3.40	0.006
	CG	12	4.36 ± 0.47	4.61±0.34	11	-2.77	0.018

SD=Stander deviation) df (degree of freedom) t (significant value) n (No. of participants)

Table-4 shows that (Mean $\pm$ SD) of the pre-test of 20m sprint test is 4.36 $\pm$ 0.46 and post-test (Mean $\pm$ SD) is 4.13 $\pm$ 0.33, $t = 3.40$ and $p = 0.006$, showing a significant difference in post-test of EG. The pre-test (Mean $\pm$ SD) of the speed of CG is 4.36 $\pm$ 0.47 and post-test is 4.61 $\pm$.34, $t = -2.771$, and $p = 0.018$, showing a significant difference in the speed of CG.

Table-5
Results of Independent-sample t-test of 20m sprint test

Variable	Test	Groups	n	(Mean $\pm$ SD)	Lavene's Value	t	Sig. 2-tailed
Speed	Pre-	Experimental	12	4.36 $\pm$ 0.46	0.938	0.017	0.986
		Control	12	4.36 $\pm$ 0.47			
	Post	Experimental	12	4.13 $\pm$ 0.33	0.825	-3.50	0.002
		Control	12	4.61 $\pm$ 0.347			

SD=Stander deviation) t (significant value) n (No. of participants)

Table-5 shows that pre-test (Mean $\pm$ SD) of Speed of the EG is 4.36 $\pm$ 0.46 and CG is 4.36 $\pm$.47. The Lavene's Test for Equality of Variances is 0.938, $t = 0.01$, and $p = 0.986$, showing no significant difference in pre-test between experimental and CG. The post-test (Mean $\pm$ SD) of speed of EG is 4.13 $\pm$ 0.33 and CG is 4.61 $\pm$.34. The Lavene's Test for Equality of Variances is 0.825. So, $t = -3.502$ and $p = 0.002$, showing a significant variation in the speed of the post-test in EG.

DISCUSSION:

The main theme of the current experimental research was to assess the effects of eight-week PT on speed of male Basketball players. Based on the results, the researcher found that an eight-week PT has significant effects on the speed of male Basketball players. After eight weeks of Plyometric training, the speed of the Experimental group significantly improved. The current investigation's findings also confirmed previous studies on the effects of PT on speed. Androutsopoulos et al. (2021) examined the

efficacy of plyometric exercise in 20 young elite professional Basketball players who had been trained for up to eight years (EG=10, CN=10). The EG completed a four-week PT intervention in addition to their daily strength and conditioning sessions. The CG only engaged in their normal strength-training routines. Speed tests at 5, 10, and 20 meters were used in pre and post-training stages. The research findings demonstrated that speed in professional Basketball athletes was significantly increased when compared to CG. The PT group significantly improved in speed across all three distances 5m, 10m, & 20 m.

Bin Shamshuddin et al. (2020) investigated the efficacy of a 6-week PT on the speed ability of amateur Football players. Twenty-two amateur footballers aged 19-26 were selected for the research study and divided into CG=11 and EG=11. The intervention group engaged in PT for six weeks while the CG participants received no such exercises. Before and after six weeks of training, a 20m sprint test was administered to all participants. After comparing the PT group to the CG at the end of six weeks of training, it was noted that there had been a significant difference in EG sprint time $t = 3.76$, $p = 0.001$.

Androutsopoulos et al. (2021) investigated the effect of a four-week plyometric intervention on female Soccer speed. Seventeen female soccer athletes were participants in the study. The players were divided into CG and PT groups. The training plan for all players was the same, except members of the PT group additionally engaged in plyometric exercises. Before and after the training, tests were conducted to measure physical performance. PT group showed a noticeable improvement in their ability to sprint. Similarly, Govardhan and Gopinathan(2017) investigated how PT influenced adolescent's speed ability. For this study, 30 schoolboys between the ages of 15 and 17 were selected as samples. The participants were separated into two equal groups, experimental $n=15$ and control $n=15$. For a total of six weeks, EG received PT on three different days of the week for an hour.

Before and after eight weeks of PT, tests were conducted to measure the speed. According to the study's statistical results, EG performance in terms of speed was significantly improved by PT as compared to CG.

Asadi (2011) discovered that PT enhanced 20m sprint time after six weeks of sand-based PT. These results are consistent with those (Kotzamanidis, 2006) who discovered a significant improvement in a 30-meter sprint after 20 sessions (10 weeks, two sessions per week) of PT. Arazi et al. (2012) showed that the sprint performance of young male Basketball players was positively impacted by 6 weeks of high-intensity plyometric intervention. Based on the findings of previous research studies on PT regarding the various variables included in the current research study, it is found that the majority of the earlier research studies supported the findings of the current study on PT.

CONCLUSION:

The main goal of the current research investigation was to assess the effect of 8-week PT on the speed of male basketball players. The results showed significant effects of an eight-week PT on young male Basketball players from higher secondary schools aged 16-19. So it is concluded that an eight-week PT is an effective method of training to improve the sprinting abilities of male Basketball players of higher secondary schools aged 16 to 19.

LIMITATIONS OF THE STUDY:

Some major limitations of the current study could be addressed in further research studies on PT. While conducting this study, the researcher encountered the following limitations.

1. The diet of participants was one of the limitations of the current study.
2. The participant's interest and willingness to participate in each training session.
3. Small number of participants.

RECOMMENDATIONS:

1. Basketball players, coaches, and trainers may include PT in their training sessions to improve their speed and spring abilities.
2. Eight weeks PT can potentially improve the athlete's performance, hence trainers might follow the scientific principles of plyometric exercises to obtain effective results with the reduction of injuries.

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