International Journal of Health Sciences and Research
Volume 14; Issue: 10; October 2024
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effectiveness of 4-week Fartlek Training on Cardiovascular Endurance and Speed among Amateur Basketball Players

Anoushka Bhutada[1], Nidhi Ladha[2]

[1,2]Department of Cardiovascular & Respiratory Physiotherapy, P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Corresponding Author: Nidhi Ladha

DOI: https://doi.org/10.52403/ijhsr.20241002

ABSTRACT

Background: Basketball, a demanding team sport, engages both anaerobic and aerobic systems, causing fatigue during gameplay. Fartlek training, characterized by alternating fast and slow running periods, is particularly suited for sports requiring anaerobic sprints and aerobic recovery.
Hypothesis: 4 weeks of fartlek training significantly affects cardiovascular endurance and speed among amateur basketball players.
Study design: Experimental Study
Level of evidence: 3
Methods: Thirty young amateur basketball players aged 12 to 17 participated in this experimental study. Pre-assessment included the Multi Stage Fitness Test for endurance and a 3/4th court sprint test for speed. After explaining the protocol to participants, coaches, and parents, the 4-week Fartlek Training was administered, followed by post-tests. Descriptive statistics were performed and the quantitative data was assessed using GraphPad and the level of significance was set at p value<0.05.
Results: 30 young amateur basketball players participated in this study with a mean age of 12.26 ± 0.44 years. Analysis post-training showed an extremely significant improvement in the VO2 max ($p<0.0001$) with an increase in the average. A decrease in speed was found post training and the result was found highly significant ($p<0.05$).
Conclusion: The study revealed a substantial increase in both cardiovascular endurance and speed among participants following fartlek training. Notably, all participants demonstrated a significant rise in VO2 max, indicating improved aerobic capacity.

Keywords: *amateur basketball players, endurance, fartlek training, speed*

INTRODUCTION

Participation in Basketball, like any other athletic endeavor requires athletes to optimize all of the contributing physical qualities to ensure their best athletic efforts will occur repeatedly over time. Basketball is a team sport in which two teams are opposing one another on the court.

Basketball is considered as an intermittent high-intensity sport that requires mainly anaerobic metabolism which is important for tactical moves (i.e., Defensive/offensive transitions) and technical actions such as shooting, jumping, blocking, passing, lay-

ups, and other movements. Basketball is also a 40-minute game in which players experience fatigue as game time progresses [(4)]. Studies have even reported that only 15% of the actual movement pattern is classified as high intensity and is considered critical for a successful performance [(6)]. However, the duration of a basketball game (40-48 min) requires a high level of aerobic metabolism to enhance the resynthesize of creatine phosphate, lactate clearance from active muscle, and removal of accumulated intracellular inorganic phosphate [(5)]. Thus, considering the relationship between oxygen supply and skeletal muscle recovery, aerobic capacity may be more critical in the recovery processes during actual performance[(6)]. In this context, it seems clear that both aerobic and anaerobic systems can influence the physical fitness of a basketball player and the game performance and should be incorporated under training prescriptions.

Fartlek training is a Swedish term meaning "speed play" and has been used by distance runners for years. It is best described as periods of fast running intermixed with periods of slower running and during the training session, the runner uses different paces depending on the durations and intensity of each interval closest to its VO2 max. The intensity and continuous exercise nature of fartlek training places stress on both the aerobic and anaerobic energy systems [(7)].

When properly incorporated, fartlek training utilizes all three bioenergetics systems: ATP phosphocreatine, fast glycolytic, and slow oxidative. If the goal of training is anaerobic adaptations, the training is performed at a high intensity for a short duration by working on a fast glycolytic energy system to produce adenosine triphosphate thus increasing the athlete's ability to perform high intensity activity [(5)]. A typical method for aerobic adaptations involves moderate intensity for a longer duration (i.e., long, slow distance) but with brief bouts of intervals of high intensity and partial recovery. This has been reported to enhance aerobic capacity if activity sufficiently overloads the aerobic system [(1)]. Thus, through these interactions between anaerobic and aerobic systems the study aimed at understanding the effects of fartlek training on cardiovascular endurance and speed.

MATERIALS & METHODS

Study setting and participants

An experimental study was conducted among 30 amateur basketball players in a span of 6 months from basketball clubs. The study participants included athletes between the age group of 12-17 years with a training experience of less than 6 months. Study participants were recruited from a single academy (height, 1.63 ± 0.07 m; mass, 48.1 ± 7.6 kg; age, 12.26 ± 0.44 years) and underwent a 4-week training. Permissions were taken from all the respected coaches and court owners and the study was explained in detail to all the participants, the coaches and the parents. Informed consent was obtained from the parents of the participants, and assent was obtained from the participants themselves.

Data collection

Before starting with the training, the participants were assessed for their cardiovascular endurance and speed using the Multi stage fitness test and 3/4th Court sprint test respectively. For the endurance, maximum shuttles ran and the level reached by the participant were noted. These shuttles and levels were used to calculate the VO2 max of each participant and for speed, two trials were allowed and the best time was recorded to the nearest two decimal places.

Fartlek training

The training included a mix of fast and slow runs and was administered thrice a week for a period of 4-weeks. The training session commenced with a 15-minute warm-up, followed by a structured protocol consisting of alternating hard runs and easy runs: 1 minute hard, 2 minutes easy, 2 minutes hard, 2 minutes easy, 3 minutes hard, 2

minutes easy, 3 minutes hard, 2 minutes easy, 2 minutes hard, 2 minutes easy,1 minute hard, 2 minutes easy. The session ended with cool down and stretches. As the weeks progressed, difficulty was increased by adding 30 sec to the hard runs without any change in the easy runs. The Multi stage fitness test and 3/4th Court sprint test was performed once again Participants repeated by the end of 4 weeks of training.

Data analysis

Descriptive statistics were assessed using MS Excel and Graph Pad was used to statistically analyze the data. Paired t-test was used to analyze the pre-post change in the cardiovascular endurance and speed following fartlek training. Level of significance was set at p value <0.05.

RESULT

A total of 30 amateur basketball players participated in the study with a mean age of 12.26 ± 0.44 years. The result of the study was examined to find out whether 4 weeks of fartlek training had any effects on cardiovascular endurance (VO2 Max) and speed among players.

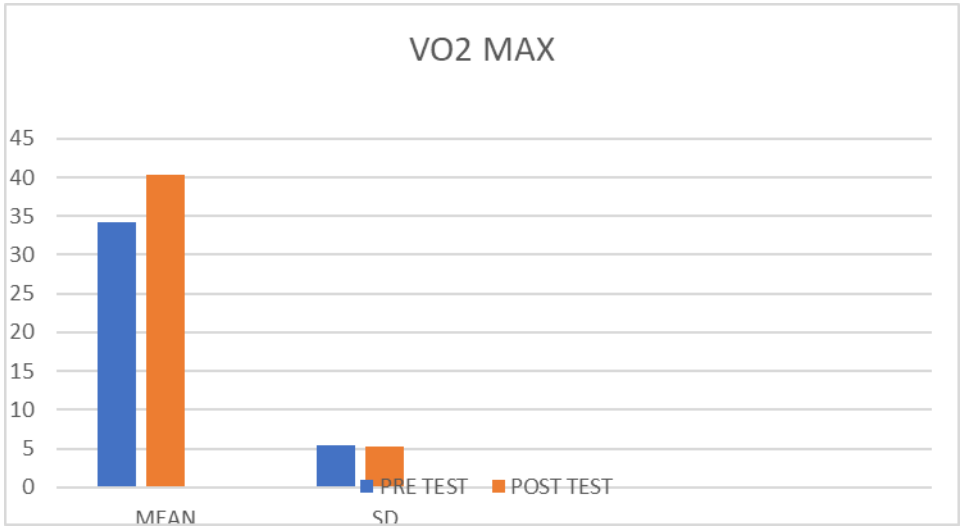
Fartlek training and Cardiovascular Endurance

Multi Stage Fitness Test was administered to assess the change in cardiovascular endurance following 4 weeks of fartlek training. Table 1 represents an extremely statistically significant difference between pre-test and post-test scores (p<0.0001). An increase in VO2 Max was found suggesting an improvement in aerobic capacity

All the participants had a highly significant increase in their Multi Stage Fitness Test scores and 3/4th court sprint test (table 2) i.e. the cardiovascular endurance and the speed. All participants had good significance in increase in the VO2 MAX i.e. the aerobic capacity.

PARAMETERS	PRE		POST		P VALUE	RESULT
AEROBIC CAPACITY (VO2 Max)	MEAN	SD	MEAN	SD		
	34.23667	5.494542	40.383	5.207891	0.0001	Extremely Significant

Table 1: Cardiovascular endurance (VO2 max) using Multi Stage Fitness test following fartlek training



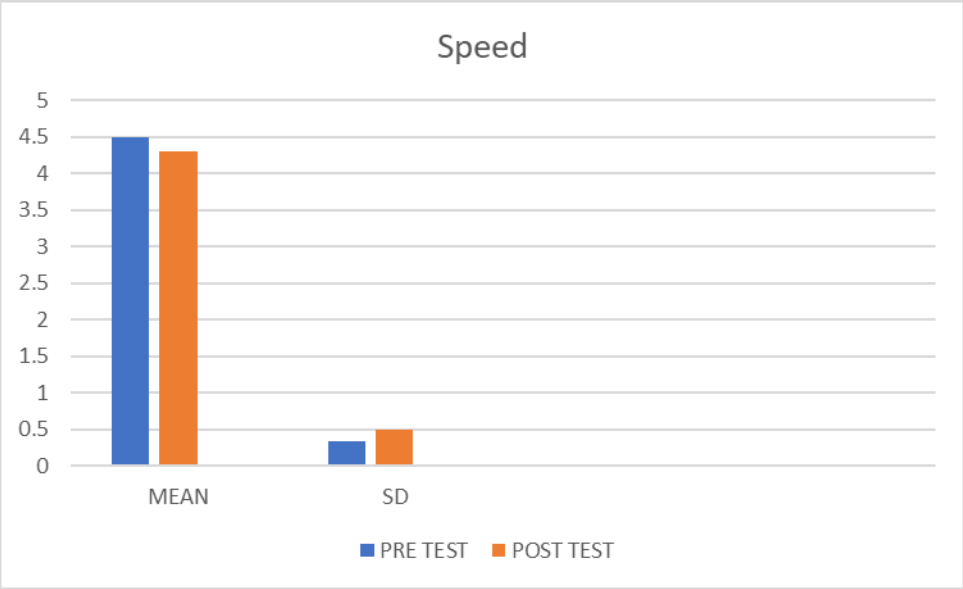
Graph 1: Comparison between pre and post VO2 Max following fartlek training

The graph compares mean and standard deviation (SD) of pre and post VO2 Max values following a period of 4-week fartlek training, sourced from Table 1. The x-axis denotes assessment VO2 Max values (ml/kg/min) with "Pre" indicating initial VO2 Max values before fartlek training in blue and "Post" representing values after completing the training regimen in orange. On the y-axis, mean and SD are depicted,

where higher values of mean and lower values of SD signify greater aerobic capacity. Each data point on the graph represents average VO2 Max scores obtained from participants. Statistical analysis, detailed in Table 1, was employed to assess the significance of changes in VO2 Max values post-training. The graph visually illustrates the impact of fartlek training on aerobic fitness levels, offering insights into any improvements observed in VO2 Max as a result of the training program

PARA METERS	PRE		POST		P VALUE	RESULT
	MEAN	SD	MEAN	SD		
3/4th Court Sprint Test (Speed)	4.564167	0.34395	4.3055	0.536421	0.0301	Highly Significant

Table 2: 3/4 Court sprint test scores following fartlek training



Graph 2: Comparison between pre and post 3/4th Court sprint test scores following fartlek training

The graph depicts the comparison between pre and post 3/4th Court sprint test scores following a period of 4-week fartlek training sourced from table 2. The x-axis represents the assessment time points, with "Pre" indicating scores before the training in blue and "Post" indicating scores after the training in orange. The y-axis measures mean and the standard deviation (SD) of the 3/4th Court sprint test, where lower values of mean and higher values of SD indicate improved performance (i.e., shorter sprint times). Each data point on the graph represents average scores obtained from the participants. Statistical analysis, detailed in table 2, was conducted to determine the significance of any differences observed between pre and post-training scores. The graph and its accompanying statistical findings aim to illustrate the impact of fartlek training on sprint performance.

DISCUSSION

An experimental study was done which included 30 amateur basketball players within the age group of 12-17 years. We found that all the participants had a significant increase in their Multi-Stage Fitness Test scores (cardiovascular endurance), 3/4th court sprint test (speed), and Aerobic capacity, a similar study was conducted by Bashir, S, and Hajam, B[3] which showed similar results.

All 30 participants significantly improved the Multi-Stage Fitness Test Scores, their 3/4th Court sprint test(speed), and their Aerobic Capacity.

Fartlek can increase training heart rate just like a high-intensity training session, although maintaining active recovery keeps heart rate at a higher rate than passive recovery. Cardiovascular effects of training

include a decrease in resting heart rate and heart rate response to submaximal exercise; an increase in resting and exercise stroke volume; an increase in maximal cardiac output; an increase in Vo_2max; and an increase in arteriovenous oxygen difference. All these factors help to improve Cardiovascular Endurance.

Metabolic adaptations include an increase in the oxidative capacity of skeletal muscle (greater number and size of mitochondria); an increase in skeletal muscle myoglobin concentration; a greater ability to oxidize fatty acids for energy; and an increase in stored glycogen. This adaptation accounts for the increase in Aerobic work capacity (VO2 Max) that occurs with regularly performed, prolonged exercise [(3)].

Anaerobic capacity may be defined as the maximal amount of ATP formed by the anaerobic processes during a single bout of maximal exercise. Anaerobic performance is mainly determined by fiber type proportion and glycolytic enzyme capacity of skeletal muscle which are very influenced by genetic factors, however, there is always a training potential to be considered. The anaerobic trainability increases with age (from childhood to adulthood with greater increases during puberty) and also with the increase in glycolytic enzyme activity (particularly phosphofructokinase) triggered by training.

Endurance training produced significant increases in anaerobic capacity during the competition period(2). When you engage in anaerobic training, such as HIIT or sprinting, your body relies on energy sources like ATP and glycogen without requiring oxygen. This type of training places stress on the anaerobic energy systems, particularly the phosphagen and glycolytic systems. As a result, your muscles adapt to become more efficient at producing and utilizing energy during short bursts of intense activity.

These adaptations include increased enzyme activity related to anaerobic metabolism, improved buffering capacity to handle lactic acid produced during high-intensity efforts, and enhanced muscle fiber recruitment. These changes collectively contribute to better anaerobic performance, which, in turn, can translate into improvements in speed.

We used Fartlek Running as a medium of training which works on the aerobic as well as anaerobic systems. This helped in improving the anaerobic capacity, hence an increase in Speed and Endurance.

CONCLUSION

The study found that all participants experienced a highly significant increase in their Multi Stage Fitness Test scores and 3/4th court sprint test results, indicating improvements in cardiovascular endurance and speed, while also noting a significant increase in VO_2 Max, reflecting enhanced aerobic capacity.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Ahmed, A, and Hashem, D. Effect of using fartlek exercises on some physical and physiological variables of football and volleyball players. World Journal of Sport Sciences 5(4): 225-231, 2011.
2. Balčiūnas M, Stonkus S, Abrantes C, Sampaio J. Long term effects of different training modalities on power, speed, skill and anaerobic capacity in young male basketball players. J Sports Sci Med. 2006;5(1):163-170. Published 2006 Mar 1.
3. Bashir, S, and Hajam, B. The effect of fartlek training on speed and endurance physical education students of Annamalai University. International Journal of Academic Research and Development 5(2): 142-145, 2017.
4. Ben Abdelkrim N, Castagna C, Jabri I, Battikh T, El Fazaa S, El Ati J. Activity profile and physiological requirements of junior elite basketball players in relation to aerobic-anaerobic fitness. J Strength Cond

Res. 2010;24(9):2330-2342. doi:10.1519/JSC.0b013e3181e381c1.
5. de Araujo GG, de Barros Manchado-Gobatto F, Papoti M, Camargo BH, Gobatto CA. Anaerobic and aerobic performances in elite basketball players. J Hum Kinet. 2014; 42:137-147. Published 2014 Oct 10. doi:10.2478/hukin-2014-0068.
6. Hoffman, J.R., Epstein, S., Einbinder, M., & Weinstein, Y. (1999). The Influence of Aerobic Capacity on Anaerobic Performance and Recovery Indices in Basketball Players. Journal of Strength and Conditioning Research, 13, 407-411.
7. Kumar, P. Effect of fartlek training for developing endurance ability among athletes. International Journal of Physical Education, Sports and Health 2(2): 291-293, 2015.

How to cite this article: Anoushka Bhutada, Nidhi Ladha. Effectiveness of 4-week fartlek training on cardiovascular endurance and speed among amateur basketball players. *Int J Health Sci Res.* 2024; 14(10):11-16. DOI: *https://doi.org/10.52403/ijhsr.20241002*

******