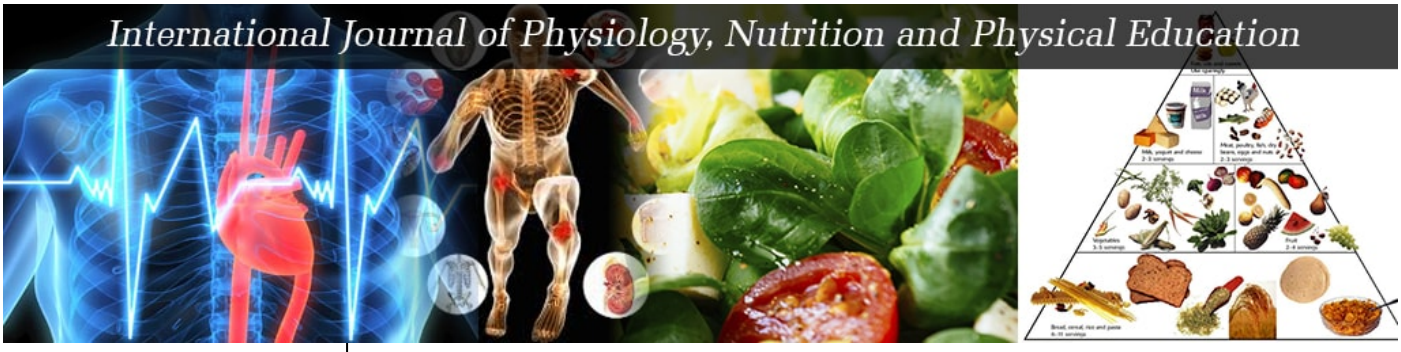

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A study on the effects of crossfit training on physical fitness variables in school basketball players

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Abstract
This study was designed to examine the effects of CrossFit training on selected physical fitness variables in school basketball players. For this purpose, 30 basketball players were recruited from Chavara Vidhya Bhavan Matriculation Higher Secondary School and Sri Ragavendra Matriculation Higher Secondary School, Coimbatore, Tamil Nadu. The subjects were randomly assigned to two equal groups, consisting of 15 players each (n = 15). Group I underwent CrossFit training (CFT), while Group II served as the control group (CG). The experimental group received CrossFit training four days per week (Monday, Tuesday, Thursday, and Friday) for a period of twelve weeks. The control group did not participate in any additional training beyond their regular routine activities. The selected physical fitness variables and their criterion measures were as follows: Speed - 50 m Dash Test, Agility - 4 × 10 m Shuttle Run Test, Reaction Time - Groningen Reaction Time Test, Hand-Eye Coordination - Alternate Hand Wall Toss Test, and Cardiovascular Endurance - Cooper 12-Minute Walk/Run Test. The data collected from the subjects were statistically analyzed using the t-test to determine significant differences at the 0.05 level of confidence ($p < 0.05$). The results revealed that speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance improved significantly in the experimental group as a result of CrossFit training, despite potential limitations such as variations in diet, climate, lifestyle, and previous training background. Furthermore, the experimental group showed highly significant improvements compared to the control group. These findings are consistent with previous investigations conducted by experts in the field of sports sciences, confirming that CrossFit training can effectively enhance multiple components of physical fitness in basketball players.

Keywords: Basketball, crossFit training, speed, agility, reaction time, hand-eye coordination, cardiovascular endurance

Introduction
Basketball is a dynamic and physically demanding sport that requires players to integrate technical skills with a wide range of physical fitness attributes (Smith *et. al.*, Johnson, 2013) [11]. Players must sprint, jump, pivot, and react rapidly to unpredictable game situations, all while maintaining stamina throughout the match (Williams *et al.*, 2016) [13]. These demands make components such as speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance essential determinants of success on the court (Anderson *et al.*, 2017) [2]. In recent years, CrossFit training has gained popularity as a functional conditioning method that emphasizes high-intensity, varied, and multi-joint movements (Glassman, 2007) [3]. Unlike traditional gym routines that isolate muscle groups, CrossFit integrates strength, endurance, flexibility, balance, and coordination into single sessions (Thompson *et al.*, 2020) [12]. Its principles align closely with the physical demands of basketball, making it a promising complement to regular practice. For instance, core-strengthening exercises improve balance and stability, upper-body and grip strength enhance ball control and shooting accuracy, and speed and agility drills sharpen reaction time and movement efficiency.
Adolescence is a critical period for physical development, and incorporating structured strength and conditioning programs during this stage may not only accelerate athletic performance but also instill long-term fitness habits (Martinez *et al.*, 2018) [4]. School basketball players, in particular, often focus primarily on technical and tactical skills while neglecting targeted physical training, which can limit their performance potential. CrossFit provides a holistic approach by addressing multiple fitness components simultaneously and

offering functional, sport-specific benefits. The role of CrossFit in developing mental toughness and resilience, through its high-intensity and goal-oriented workouts, is equally important, as psychological preparedness is crucial for competitive basketball performance. Combining CrossFit training with regular basketball practice, athletes may achieve more comprehensive development of their physical and cognitive skills. The present study, therefore, seeks to examine the effects of CrossFit training on physical fitness variables in school basketball players, focusing specifically on improvements in speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance. The findings are expected to contribute valuable insights into the integration of functional training methods within youth basketball programs, with implications for both performance enhancement and injury prevention.

Methods

To test the hypothesis of this study, 30 school basketball players were selected from Charavara Vidhya Bhavan Matriculation Higher Secondary School and Sri Ragavendra Matriculation Higher Secondary School, Coimbatore, Tamil Nadu. The subjects were randomly assigned to two equal groups: the CrossFit training group (n = 15) and the control group (n = 15). The experimental group underwent CrossFit training four days per week (Monday, Tuesday, Thursday, and Friday) for a period of twelve weeks. The control group did not receive any additional training apart from their regular routine.

Design

The physical fitness variables assessed in the study included speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance. Speed was measured using the 50 m Dash Test and recorded in seconds, while agility was evaluated through the 4 × 10 m Shuttle Run Test, also recorded in seconds. Reaction time was assessed using the Groningen Reaction Time Test, measured in seconds, and hand-eye coordination was evaluated using the Alternate Hand Wall Toss Test, recorded as the number of catches. Finally, cardiovascular endurance was measured using the Cooper 12-Minute Walk/Run Test, recorded in meters. All these variables were measured at baseline and reassessed after completing the twelve-week CrossFit training program.

Training Programme

The training program lasted 60 minutes per session, conducted 4 days a week for a total of 12 weeks. Each session consisted of a 10-minute warm-up, 40 minutes of CrossFit training, and a 10-minute cool-down. The training intensity was progressively increased by 5% every three weeks, ranging from 60% to 80% of the workload. The volume of CrossFit training was prescribed based on the number of sets and repetitions. Pre-tests and post-tests were administered to the subjects, and the results were recorded as scores.

Statistical Analysis

The collected data on above said variables due to the effects of the CrossFit training was statistically analyzed with 't' test to find out the significant improvement between pre-test and post-test. In all the tests, the criterion for statistical significance was set at a 0.05 level of confidence. ($P< 0.05$)

Table 1: Computation of the t ratio on selected physical fitness variables of school basketball players in the experimental group

Experimental group						
Variables		**N**	**Mean**	**Std. Deviation**	**Std Error Mean**	**'T' ratio**
Speed (in seconds)	Pre-test	15	8.65	0.02	0.00	12.43*
	Post-test	15	8.63	0.03		
Agility (in seconds)	Pre-test	15	26.74	0.02	0.01	14.30*
	Post-test	15	26.56	0.05		
Reaction time (in seconds)	Pre-test	15	0.53	0.06	0.00	23.70*
	Post-test	15	0.33	0.07		
Hand-Eye Coordination (in counts)	Pre-test	15	16.27	1.94	0.21	13.25*
	Post-test	15	19.00	2.23		
Cardiovascular Endurance (in meters)	Pre-test	15	1876.20	1.61	0.48	11.00*
	Post-test	15	1881.53	1.36		

*Significant level 0.05 level (degree of freedom 2.14,1 and 14)

Table I presents the computation of the mean, standard deviation, and 't' ratio for selected physical fitness variables, namely speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance of the experimental group. The obtained 't' ratios for speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance were 12.43, 14.30, 23.70, 13.25, and 11.00, respectively. The critical table value for 14 degrees of freedom at the 0.05 level of significance was 2.14. Since the obtained 't' values exceeded the table value, the results were considered statistically significant.

Table 2: Computation of the t ratio on selected physical fitness variables of school basketball players in the control group

Control group						
Variables		**N**	**Mean**	**Std. Deviation**	**Std Error Mean**	**'T' ratio**
Speed (in seconds)	Pre-test	15	8.65	0.03	0.00	1.66
	Post-test	15	8.65	0.02		
Agility (in seconds)	Pre-test	15	26.77	0.05	0.00	1.00
	Post-test	15	26.76	0.04		
Reaction time (in seconds)	Pre-test	15	0.54	0.06	0.01	1.38
	Post-test	15	0.51	0.09		
Hand-Eye Coordination (in counts)	Pre-test	15	16.13	2.33	0.13	1.00
	Post-test	15	16.27	2.37		
Cardiovascular Endurance (in meters)	Pre-test	15	1877.53	5.22	1.94	1.55
	Post-test	15	1880.53	8.60		

*Significant level 0.05 level (degree of freedom 2.14,1 and 14)

Table II presents the computation of the mean, standard deviation, and 't' ratio for selected physical fitness variables, namely speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance of the control group. The obtained 't' ratios for speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance were 1.66, 1.00, 1.38, 1.00, and 1.55, respectively. The critical table value for 14 degrees of freedom at the 0.05 level of significance was 2.14. Since the obtained 't' values were less than the table value, the results were not statistically significant.

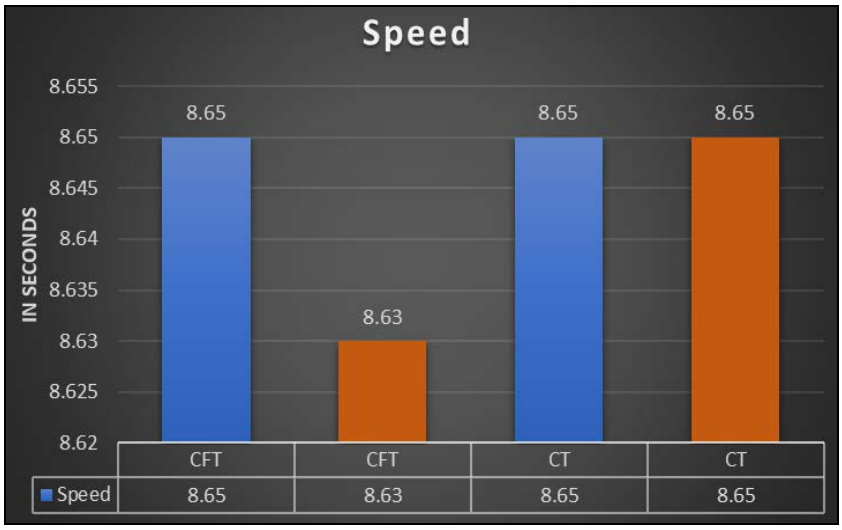

Fig 1: Bar diagram showing the mean value on selected physical fitness variables of Speed among school level basketball players in the experimental and control groups

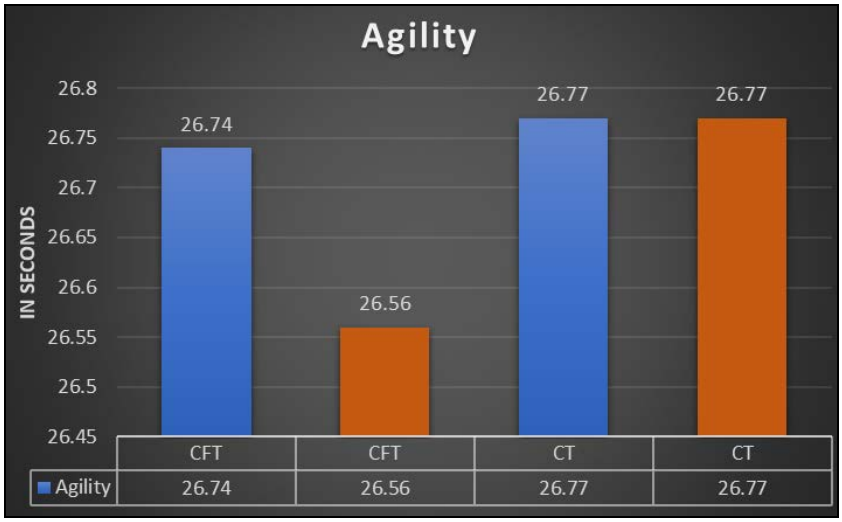

Fig 2: Bar diagram showing the mean value on selected physical fitness variables of Agility among school level basketball players in the experimental and control groups

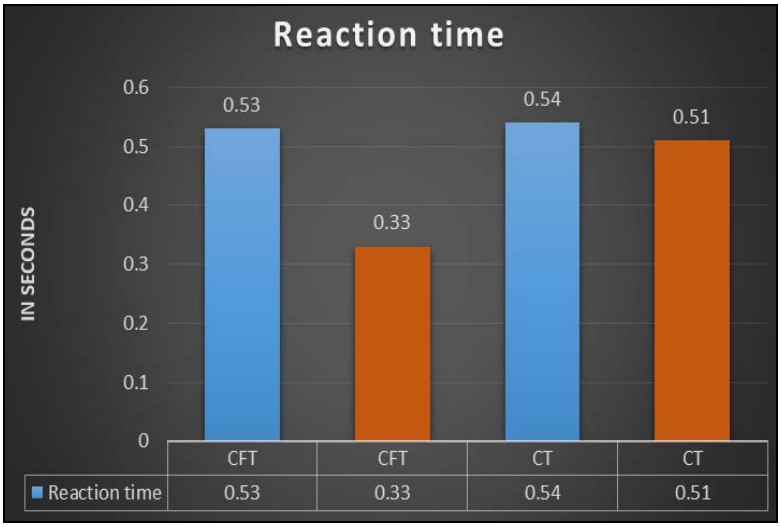

Fig 3: Bar diagram showing the mean value on selected physical fitness variables of Reaction Time among school level basketball players in the experimental and control groups

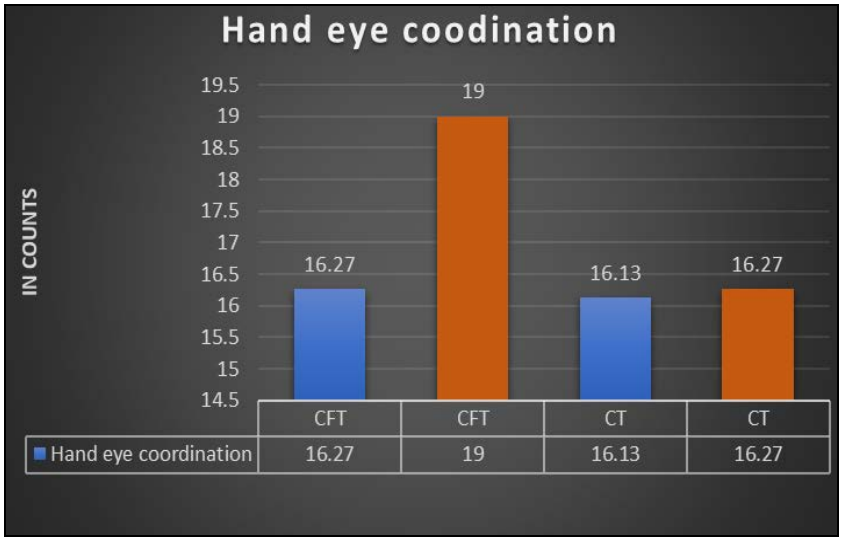

Fig 4: Bar diagram showing the mean value on selected physical fitness variables of Hand Eye Co-ordination among school level basketball players in the experimental and control groups

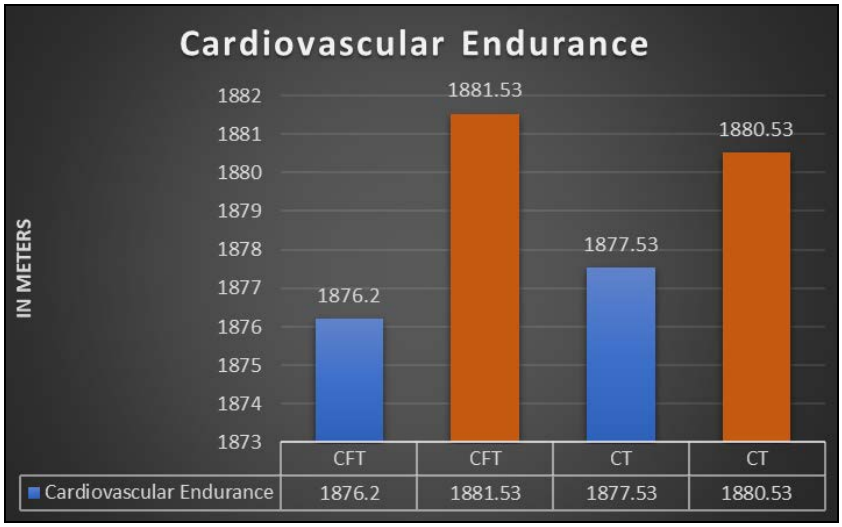

Fig 5: Bar diagram showing the mean value on selected physical fitness variables of cardiovascular Endurance among school level basketball players in the experimental and control groups

Findings

The findings observed a study on the effects of CrossFit Training on Physical Fitness Variables in School Basketball Players are as follows:

1. In the CrossFit training group, the mean differences observed between pre-test and post-test for speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance were statistically significant.
2. In the control group, the mean differences observed between pre-test and post-test for speed, agility, Reaction time, hand-eye coordination, and cardiovascular endurance were not statistically significant.

Discussion and Findings

The results of this study clearly demonstrated that a twelve-week CrossFit training program brought about meaningful improvements in speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance in school basketball players compared to those who did not undergo additional training. The enhancement in sprint speed can be linked to the explosive and functional nature of CrossFit exercises, which emphasize power, coordination, and rapid force production. Previous research has reported similar outcomes, noting that functional high-intensity training enhances sprinting capacity and muscular efficiency (Smith *et al.*, 2013, Hoffman, 2014) [11, 6]. Agility also showed marked improvement, which is vital for quick directional changes during games. (Trecroci *et al.*, 2016) [14] likewise observed that youth athletes engaging in functional drills exhibited significant progress in multidirectional movement. This type of training involves performing constantly changing functional movements at high intensity, with each method linked to a clear training goal (Wael Abdullah, 2024) [15]. Another important finding was the improvement in reaction time, which is crucial for responding rapidly to unpredictable game situations. The constant exposure to time-pressured and fatigue-based tasks within CrossFit sessions likely explains this outcome, aligning with Magill's (2011) [9] conclusion that cognitive-perceptual skills can be refined through functional and decision-making drills. Hand-eye coordination, which plays an essential role in dribbling, passing, and shooting, was also positively influenced by the training. This improvement may be attributed to exercises requiring object control and proprioceptive engagement. Finally, cardiovascular endurance increased significantly, likely due to the interval-style, high-intensity structure of CrossFit, which mirrors the intermittent demands of basketball competition. Studies by (Smith *et al.*, 2013) [11] similarly reported that such training leads to

improvements in aerobic capacity and overall endurance. Taken together, these findings suggest that CrossFit offers a comprehensive approach to physical development by simultaneously targeting multiple components of fitness essential for basketball players. It is an effective, multi-dimensional conditioning system for enhancing athletic performance while supporting long-term health and injury prevention.

Conclusion

It was concluded that twelve weeks of CrossFit training significantly improved the speed, agility, reaction time, hand-eye coordination, and cardiovascular endurance of the school basketball players. Based on these findings, it is postulated that CrossFit training is an effective method for inducing desirable improvements in the physical fitness variables of school basketball players.

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