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Effects of different training protocols on reaction time among sprinters

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Abstract
The purpose of the study was to find out the effects of plyometric training, circuit training and repetition training on resting heart rate among male sprinters. To achieve the purpose of the present study, eighty (N=80) male sprinters of age group between 15 and 19 years, who at least participated school level athletics competition were randomly recruited from various Higher Secondary Schools of Bengaluru and SAI centre, Bengaluru, Karnataka. The sprinters (N=80) were randomly assigned to four equal groups of twenty sprinters each. The groups were treated as Experimental Group I - plyometic training sprinters group (PTS), Experimental Group II - circuit training sprinters group (CTS) and Experimental Group III - repetition training sprinters group (RTS) and Control group sprinters (CGS) in an equivalent manner. The pre test and post test scores were analyzed through analysis using Analysis of Covariance (ANCOVA). The results proved that The reaction time of the sprinter was significantly enhanced due to twelve weeks of plyometric training, circuit training and repetition training in the three experimental groups when compared to the non-training group sprinters, i.e. control group. The repetition training group sprinters showed better excels in reaction time performance than circuit training group sprinters and plyometric training group sprinters. Further, circuit training group sprinters are better than plyometric training group sprinters in enhancing reaction time.

Keywords: Plyometic, circuit, resistance, reaction time

Introduction
Sport is all forms of physical activity which, through casual or organized participation, aim to use, maintain or improve physical fitness and provide entertainment to participants. Performance in sports and games depends on both physical and mental abilities. Body and mind have an equal contribution in human success. Sport may be competitive, where a winner or winners can be identified by objective means, and may require a degree of skill, especially at higher levels.
Sports performance is indeed an aspect of complex human performance which has several aspects or dimensions. Hence several disciplines of sports science are required to work in a coordinate manner to explore the nature of sports performance and the process of improving sports performance (Belair Gagnon, 2015) [8].

Athletics
Athletics is the mother of all sports, so it has grown in importance over the last few years. Athletics is a collective name for physical exercise and game requiring skill and activity. Athletic events are classified into two namely track and field events. The track events includes short distance run (sprint) long distance run, middle distance run, relays, hurdling, walking and steeple chase. The field events include jumping events (such as long jump, triple jump, pole vault and high jump) and throwing events (such as discus throw, hammer throw and putting the shot). Athletics is very important as a means of all round development of an individual. Athletic exercises and training have positive effects on the development of the human body.
Through the practice of track and field, the basic form of a man's motor activities is strengthened and valuable skills are developed. They improve the coordination of organism, body activities of man and efficient solutions of physical task in everyday life. Athletic exercise and training further contribute to a man's mental growth. Finally, the practice of athletics is in the course of training and competition, ways to strengthen the will and shape the character of young boys and girls.

Plyometric Training

Plyometric training is a popular form of training used to improve athletic performance. It involves a stretch of the muscle tendon unit immediately followed by a shortening of the muscle unit. This process of muscle lengthening followed by rapid shortening during the stretch shortening cycle (SSC) is integral to plyometric exercise. The stretch shortening cycle process significantly enhances the ability of the muscle tendon unit to produce maximal force in the shortest amount of time. These benefits have prompted the use of plyometric exercise as a bridge between pure strength and sport related power and speed.

Circuit Training

Circuit training is very special form of training which concentrates on different parts of the body and general endurance. Circuit training is a fitness method that uses a combination of resistance and callisthenic training exercises. The system was firstly introduced by Morgan and Adamson in the late 1950s at the University of Leads, England. The intensity and vigor of circuit training are indeed pleasurable to the pantomime. This system produces positive changes in future in motor performance. General fitness, muscular power, abidance and speed have shown decided enhancement as well.

Repetition Training Method

Repetition training involves breaking down training distances into smaller parts that are easier to manage and repeat. This is, for example, when you sprint over a set distance several times. It improves your speed-endurance. A critical component of repetition training is recovery time between repetitions. In repeat training, when you include more recovery intervals, your speed gets improved.

Statement of the Problem

The research plan was to discover how 12 weeks progressive plyometric training, circuit training and repetition training will have impact on reaction time among sprinters.

Hypotheses: Study of experimental literatures created idea and information of gap left in studies, thus it assists the researcher, and subsequently hypotheses had been formulated:

It was hypothesized that all the three empirical training groups' sprinters performance on reaction time would be seen enhancement when compared with non-training (control) group male sprinters.

Selection of Sprinters

The purpose of the study was to find out the effects of plyometric training, circuit training and repetition training on selected motor fitness, physiological variables and sprinting abilities among sprinters. To achieve the purpose of the present study, eighty (N=80) male sprinters of age group between 15 and 19 years who at least participated school level athletics competition were randomly recruited from various Higher Secondary Schools, Bengaluru and SAI centre, Bengaluru, Karnataka, India.

Training Programme

The experimental groups, i.e. Experimental Group-I (Plyometric Training Sprinter Group) underwent twelve weeks of plyometric training exercises, Experimental Group-II (Circuit Training Sprinters Group) underwent twelve weeks of circuit training, and Experimental Group-III (Repetition Training Sprinters Group) underwent twelve weeks of repetition training on three alternative days a week. Each of the training programmes extended from 90 to 120 minutes with a schedule in the morning time between 6.00 a.m. and 8.00 a.m. No special training was given to the Control Group sprinters, but they have participated in their regular physical activities daily. Prior to and during each session, the sprinters underwent strict supervision. In addition to jogging, stretching, striding, and push-ups, they performed a 20 minute warm-up and cool-down. A regular self-analysis of the stature of the sprinter was done during the whole training session and none reported of injuries, whereas muscle soreness that occurred in the earlier weeks lowered down in the later period.

Data Collection

The intervention of plyometric training, circuit training and repetition training was given to the three experimental groups for 12 weeks. Prior to administration of training (pre data) and after completion of twelve weeks of training period (post data) collected from all four groups through standardized procedure selected variable tests.

Statistical Techniques

The procured data was statistically examined for significant difference using the method of Analysis of Covariance i.e., ANCOVA. Due to the involvement of the four various groups and at the significance of the F ratio for the adjusted post mean, the Scheffe's post hoc test was utilized to measure the difference of the paired means.

Analysis of the Data and Results of the Study

The influence of the independent variables (plyometric training, circuit training and repetition training) on the selected dependent variables (motor fitness variables, physiological variables and sprinting abilities) was determined by the subjecting the collected data by using appropriate statistical techniques and are presented below.

Resting Heart Rate

The analysis of covariance on the data obtained for resting heart rate of pre test, post test and adjusted post test scores of plyometric training sprinters, circuit training sprinters, repetition training sprinters and control groups have been analyzed and presented in the following Table 1.

Table 1: Computation of Analysis of Covariance of The Pre Test, Post Test and Adjusted Post Test Data On Resting Heart Rate Of Plyometric Training Sprinters, Circuit Training Sprinters, Repetition Training Sprinters And Control Groups

Tests / Groups		PTS	CTS	RTS	CGS	SOV	Sum of Squares	DF	Mean Squares	F ratio
Pre Test	$\bar{X}$	71.2	7.18	71.54	71.32	B	0.15	3	0.05	2.23
						W	1.7	76	0.022	
Post Test	$\bar{X}$	68.56	68.47	67.58	71.2	B	0.18	3	0.06	4.956*
						W	0.92	76	0.0121	
Adjusted Post Test	$\bar{X}$	67.86	68.92	67.52	71.24	B	0.17	3	0.0566	4.722*
						W	0.9	75	0.012	

*Significant at 0.05 level of confidence.
SOV: Source of Variance; df: Degrees of Freedom; B: Between, W: within
(The Table value for significance at 0.05 level with df 3 and 76, and 3 and 75 = 2.77)
(PTS - plyometric training sprinters group, CTS - circuit training sprinters group, RTS - repetition training sprinters group and CGS - control group sprinters)

Results of Resting Heart Rate: An examination of Table 1 indicates that the pre test, post test and adjusted post test means of plyometric training sprinters, circuit training sprinters, repetition training sprinters and control groups on resting heart rate performance.

The initial test mean of plyometric training sprinters group (PTS), circuit training sprinters group (CTS), repetition training sprinters group (RTS) and control group sprinters (CGS) on resting heart rate were 71.2, 71.28, 71.54 and 71.32 respectively. Calculated pre test F-ratio on resting heart rate is 2.23. Hence, the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 3 and 76, and 3 and 75 is 2.77 as the calculated F-ratio value is lower than the table value. This proved that there were no significant differences between the experimental groups indicating that the process of randomization of the groups was perfect while assigning the subjects to groups.

The post test mean values of plyometric training sprinters group (PTS), circuit training sprinters group (CTS), repetition training sprinters group (RTS) and control group sprinters (CGS) on resting heart rate were 68.56, 68.47, 67.58 and 71.2 respectively. Calculated final test F-ratio on resting heart rate is 4.956. Hence, the post test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 76, and 3 and 75 is 2.77 as the calculated F-ratio value is higher than the table value. The post test proved that the differences between the post test means of the subjects were significant.

The adjusted post test mean values of plyometric training sprinters group (PTS), circuit training sprinters group (CTS), repetition training sprinters group (RTS) and control group sprinters (CGS) on resting heart rate were 67.86, 68.92, 67.52 and 71.24 respectively. Calculated final test F-ratio on resting heart is 4.722. Hence, the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 3 and 76, and 3 and 75 is 2.77 as the calculated adjusted post test mean F-ratio value is higher than table value. The adjusted post test proved that the differences between the adjusted post test mean of the subjects were significant.

Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's post hoc test. The results were presented in Table 2.

Table 2: The Scheffe's Post Hoc Test for Differences between the Adjusted Post Test Paired Means of Balance

Adjusted Post Test Means				Mean Differences	Required CI
PTS	CTS	RTS	CGS		
68.56	68.47	-	-	0.09*	0.055
68.56	-	67.58	-	0.98*	
68.56	-	-	71.2	2.64*	
-	68.47	67.58	-	0.89*	
-	68.47	-	71.2	2.73*	
-	-	67.58	71.2	3.62*	

*Significant at 0.05 level of confidence.
(PTS - Plyometric training group, CTS - Circuit training group, RTS - Repetition training group, CGS - Control group)

Table 3 shows that adjusted post test mean difference of plyometric training sprinters group (PTS) and circuit training sprinters group (CTS) is 0.09; plyometric training sprinters group (PTS) and repetition training sprinters group (RTS) is 0.98; plyometric training sprinters group (PTS) and control group sprinters (CGS) is 2.64; circuit training sprinters group (CTS) and control group sprinters is 2.73; circuit training sprinters group (CTS) and repetition training sprinters group (RTS) is 0.89, and repetition training sprinters group (RTS) and control group sprinters (CGS) is 3.62. These values were greater than the confidence interval value 0.055 of 0.05 level which indicates that there was significant difference between the PTS and CTS; PTS and RTS; PTS and CGS; CTS and RTS; CTS and CGS, and RTS and CGS.

The pre test, post test and adjusted post test mean values of plyometric training sprinters group (PTS), circuit training sprinters group (CTS), repetition training sprinters group (RTS) and control group sprinters (CGS) on resting heart rate were presented through line graph for better understanding of the results in Figure 6:

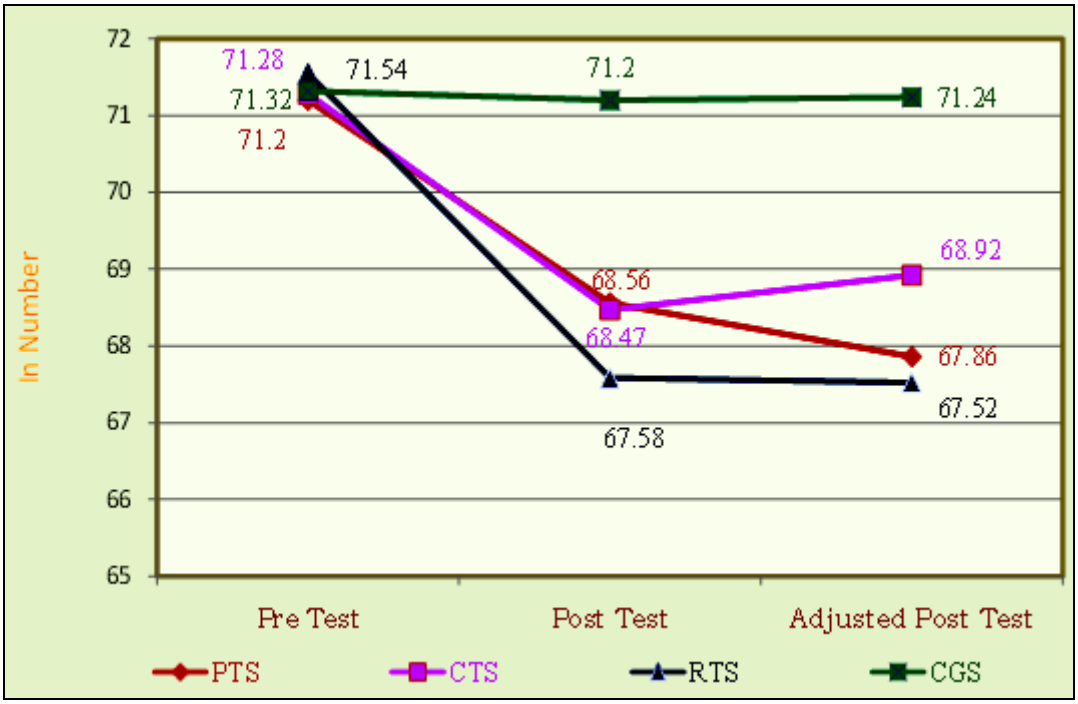

Fig 1: Line Graph Showing Pre Test, Post Test And Adjusted Post Test Means Of Plyometric Training Sprinters Group, Circuit Training Sprinters Group, Repitition Training Sprinters Group And Control Group Sprinters On Resting Heart Rate

Discussion on Findings

Resting Pulse Rate

This study found that resting pulse rate of the athletes decreased with the impact of 12 weeks plyometric training, circuit training and repetition training among the athletes. The results of experimental studies on resting pulse rate were Neha, *et al*., (2020) [9] suggested that regular practice of yoga bring improvement in cardiovascular function which can be helpful to reduce the resting pulse rate of individual and reduce the chances of cardiovascular diseases. Adamos, *et al*., (2016) [10] inclusion of circuit training decreased the risk for development of CVD by reducing resting heart rate in healthy untrained adults. Biju and Simmy revealed that fartlek, circuit and par course exercises are effective for decreasing resting heart rate number. Jaya and Johnson (2021) [11] discovered that resting pulse rate numbers significantly reduce with the influence of 12 weeks fartlek training and circuit training among men kho-kho players. Saranya (2014) [12] revealed that the 12 weeks of circuit training and interval training program significantly decreased resting pulse rate level among women cricket players

Conclusions

In the preset study, as a result of three training programmes, namely, plyometric training, circuit training and repetition training, the following improvements occurred on resting heart rate among male sprinters.

Resting Heart Rate

The resting heart rate of the sprinter was significantly decreased due to twelve weeks of plyometric training, circuit training and repetition training in the three experimental groups when compared to the non-training group sprinters, i.e. control group. The repetition training group sprinters showed decreased count in resting heart rate than circuit training group sprinters and plyometric training group sprinters. Further, circuit training sprinters are better than plyometric training group sprinters in decreasing resting heart rate level count.

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