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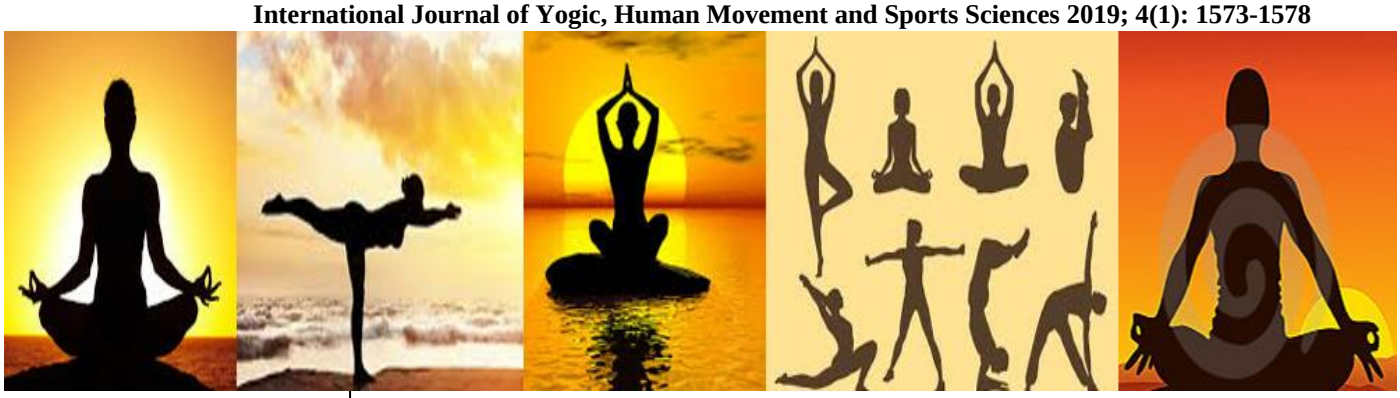

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Effect of complex training and contrast training on selected bio-motor components of male inter collegiate football players

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Abstract
The present investigation was designed to find out the effect of complex training and contrast training with skill practice on selected bio-motor components of male inter collegiate football players. To Carry out the study, thirty (N=30) male football players were selected as subjected from Government Engineering College Thrissur and Government Victoria College, Palakkad. Their ages ranged from 18 to 25 years. The selected subjects were divided into three equal groups, two experimental groups and control group (n=10 each). Pre-test data were collected two days before the training programme and post-test data were collected immediately after six weeks of training session. The data obtained from the experimental groups before and after the experimental period were statistically analyzed to check whenever the "F" ratio was found to be significant for pre and post-test means. Further the significance of mean difference of pairs was adjusted and final group mean was tested for significance by applying Scheffe's Post-hoc Test. The level of significance was fixed at 0.05 level of confidence.

Keywords: Complex training, contrast training, speed, agility and muscular strength and endurance

Introduction
Complex training and contrast training are two advanced methodologies utilized in athletic conditioning and sports performance enhancement. These training approaches are designed to optimize muscular power, strength and explosiveness through strategic combinations of exercises and intensity variations. Complex training involves performing a series of strength exercises followed by plyometric or explosive movements, thereby capitalizing on the potentiation effect to enhance subsequent explosive performance. On the other hand, contrast training alternates heavy resistance exercises with lighter, more explosive movements in rapid succession, exploiting the phenomenon of post-activation potentiation to improve power output and neuromuscular coordination. Both methods target the neuromuscular system in a synergistic manner, promoting adaptations that translate to enhanced athletic performance. Through meticulous programming and progressive overload, athletes can harness the benefits of complex and contrast training to achieve peak physical condition and excel in their respective sports endeavours. "Sports training is a scientifically based and pedagogically organised process which through planned and systematic, effect on performance ability and performance readiness aims at sports perfection and performance improvement as well as at the contest in sports competition" Thiess and Schnabel (1986) [11].

Complex Training
Complex training is basically a superset where the athlete performs a high-intensity strength exercise and follows it with a plyometric exercise with similar biomechanical demands of the strength exercise [Patrick, 2009] [12]. Complex training one of the most advanced forms of sports training, integrates strength training, plyometrics and sport-specific movement. It consists of an intense strength exercise followed by a plyometric exercise.

Contrast Training

Contrast Training is a workout comprising of one set of a resistance exercise followed by one set of a matched plyometric exercise. Contrast training refers to a type of resistance training that alternates the use of heavy and light load exercises in order to improve muscular power. To improve power through training program, are should focus on trying to produce more force or velocity with your exercises. Contrast training accomplishes both by requiring to perform two exercises back-to-back. The first exercise is a traditional strength exercise and the second exercise is an explosive exercise that challenges the same muscles and movement pattern. Because the resistance in the first exercise is heavy, this will create more activation of the muscles involved in the movement.

Methodology

The purpose of the study was to find out the effect of complex training and contrast training on selected bio-motor variables of intercollegiate male football players. To execute the investigation, altogether thirty (N=30) inter-collegiate football players were chosen from Government Engineering College Thrissur and Government Victoria College, Palakkad. Were selected as subjects. They were divided randomly into three groups of ten each (n=10) the experimental group-I underwent to complex training, experimental group-II underwent to contrast training and experimental group-III was act as control group, their age ranged from 18-25 years. The dependent variables selected for this study were bio motor variables are speed (50m dash), agility (Shuttle run 4x10mts) and muscular strength and Endurance (sit-ups). Pre-test data were collected two days before the training programmed and post-test data were collected immediately after six weeks of training session.

Criterion measures

The subjects of complex training group, contrast training group and control group were assessed on the selected variables by the standardized test items before and after the training period of six weeks.

Table 1: Shows the Variables, Tests and Unit of measurement

S.no.	Variables	Tests	Unit of measurement
Corporeal variables			
1.	Speed	50m dash	Seconds
2.	Agility	Shuttle run 4x10mts	Seconds
3.	Muscular strength and endurance	Sit ups for one minutes	Counts

Training programme

The total duration of complex training and contrast training for three alternative days. During the training period 60 minutes the subject were treated with complex training (Monday, Wednesday, Friday), contrast training (Tuesday, Thursday, Friday).

Experimental Group I complex training Group I (CTG), Experimental Group II Contrast training group (CTG) and Control Group III (CG) not engaged in any specific training program. Training Duration One Hours (60 minutes), Preparation / warm-up -10 minutes, Training for specific components -30 minutes, distributed rests -10 minutes, relaxation / cool-down -10 minutes. Training session per week three alternative days in a week only in the morning total length of training six weeks training load progression every two weeks.

Statistical Techniques

The data obtained from the experimental groups before and after the experimental period were statistically analyzed to check whenever the "F" ratio was found to be significant for adjusted post-test means. Further the significance of mean difference of pairs was adjusted and final group mean was tested for significance by applying Scheffe's Post-hoc test. The level of significance was fixed at 0.05 level of confidence.

Results

Table 2: Analysis of covariance of complex training group, contrast training group and control group of inter-collegiate football players on speed (In Seconds)

	Complex Training Group	Contrast Training Group	Control Group	Source of variance	Sum of Squares	Df	Mean square	F-ratio
Pre-test	7.32	7.42	7.27	BG	0.112	2	0.06	0.32
				WG	4.78	27	0.18	
Post-test	6.84	7.21	7.37	BG	1.49	2	0.75	5.76*
				WG	3.49	27	0.13	
Adjusted post mean	7.63	7.34	7.03	B/G	1.29	2	0.65	15.52*
				W/G	1.08	26	0.04	

*Level of significance at 0.05

Table-2 reveals that the obtained mean values of pre-test and post test scores of speed on complex Training Group 7.32and 6.84, contrast Training Group 7.42 and 7.21 control group 7.27 and 7.37 respectively; the obtained and the obtained F ratio is 5.76. Since the obtained F ratio of 5.76 for post-test means on speed is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 27 degrees of freedom.

The adjusted post-test means on speed of complex training Group (CTG), contrast training Group (CTG) and Control group (CG) are 7.63, 7.34, and 7.03 respectively and the obtained F ratio is 15.52. Since the obtained F ratio of 15.52 for adjusted post-test means on speed is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 26 degrees of freedom.

The results of the study indicate that there is a statistically significant difference among the adjusted post-test means complex training group, contrast training group and control group (CG) on speed. To determine which of the paired means had a significant difference, the Scheffe's test was used

as a post-hoc test and the results are presented in table-3.

Table 3: Scheffe's test for the difference between the adjusted post test mean on speed - (In seconds)

Complex Training Group	Contrast Training Group	Control Group	M.D	C.I
7.63	7.34	-	0.29	
7.63	-	7.03	0.60	0.41
-	7.34	7.03	0.31	

*Level of significance at 0.05

Table 3 shows that the adjusted post-test means differences of the means complex training group (CTG), contrast training group (CTG) and control group(CG) are 0.29, 0.60, and 0.31 respectively, which are lesser than the confidence interval value of 0.41 for insignificance at 0.05 level of confidence for 2 and 27 degrees of freedom. It also shows that the adjusted post-test mean differences on speed between complex training group (CTG), contrast training group (CTG) and Control group(CG) are 0.60 respectively and lesser than the confidence interval value of 0.41 for significance at 0.05 level of confidence for 2 and 27 degrees of freedom.

The study results show statistically significant differences between the adjusted post-test means of the complex training group (CTG), contrast training group (CTG) and control group (CG) had higher significant changes on speed to compared with control group and it was 0.60 respectively, and higher than the confidence interval value of 0.41 for significance at 0.05 level of confidence for 2 and 26 degrees of freedom.

The mean values of complex training group (CTG), contrast training group (CTG) and Control group (CG) on speed are graphically represented in figure-1.

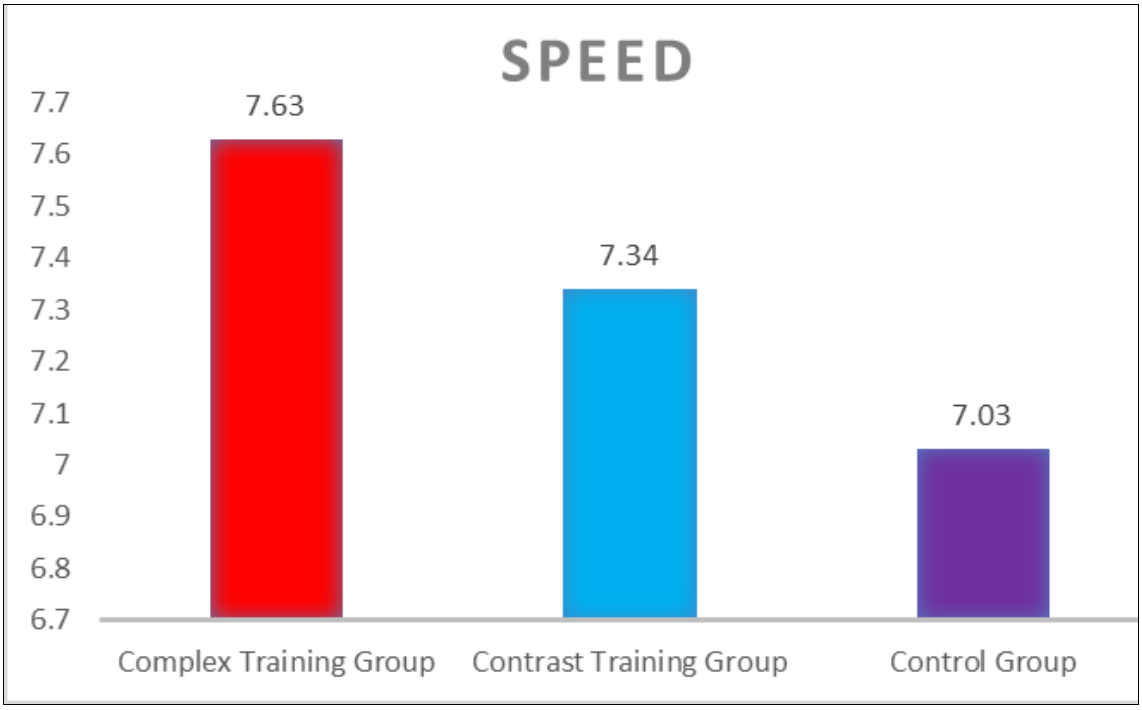

Fig 1: The adjusted post tests mean values of complex training group, contrast training group and control group on speed

Table 4: Analysis of covariance of complex training group, contrast training group and control group of intercollegiate football players on agility

	Complex Training Group	Contrast Training Group	Control Group	Source of variance	Sum of Squares	Df	Mean square	F-ratio
Pre-test	10.50	10.66	10.51	BG	0.15	2	0.08	0.54
				WG	3.76	27	0.14	
Post-test	10.13	10.51	10.64	BG	1.45	2	0.70	6.65*
				WG	2.86	27	0.11	
Adjusted post mean	10.82	10.56	10.29	B/G	0.99	2	0.49	28.34*
				W/G	0.45	26	0.02	

*Level of significance at 0.05

Table-4 reveals that the obtained mean values of pre-test and post test scores of agility on complex training Group 10.50 and 10.13, contrast training Group 10.66 and 10.51 control group 10.51 and 10.64 respectively; the obtained and the obtained F ratio is 6.65. Since the obtained F ratio of 6.65 for post-test means on agility is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 27 degrees of freedom.

The adjusted post-test means on agility of complex training Group (CTG), contrast training Group (CTG) and Control group (CG) are 10.82, 10.56, and 10.29 respectively and the obtained F ratio is 28.34. Since the obtained F ratio of 28.34 for adjusted post-test means on agility is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 26 degrees of freedom.

The results of the study indicate that there is a statistically significant difference among the adjusted post-test means complex training group, contrast training group and control group on agility. To determine which of the paired means had a significant difference, the Scheffe's test was used as a post-

hoc test and the results are presented in table-5.

Table 5: Scheffe's test for the difference between the adjusted post test mean on agility

Complex Training Group	Contrast Training Group	Control Group	M.D	C.I
10.82	10.56	-	0.26	0.26
10.82	-	10.29	0.53	
-	10.56	10.29	0.27	

*Level of significance at 0.05

Table 5 shows that the adjusted post-test means differences of the means complex training group (CTG), contrast training group (CTG) and Control group (CG) are 0.26, 0.53, and 0.27 respectively, which are lesser than the confidence interval value of 0.26 for insignificance at 0.05 level of confidence for 2 and 56 degrees of freedom. It also shows that the adjusted post-test mean differences on agility between complex training group(CTG), contrast training group (CTG) and Control group(CG) are 0.53 respectively, and lesser than the confidence interval value of 0.26 for significance at 0.05 level of confidence for 2 and 27 degrees of freedom.

The study results show statistically significant differences between the adjusted post-test means of the complex training group (CTG), contrast training group (CTG) and Control group (CG) had higher significant changes on agility to compared with control group and it was 0.53 respectively, and higher than the confidence interval value of 0.26 for significance at 0.05 level of confidence for 2 and 26 degrees of freedom.

The mean values of complex training group (CTG), contrast training group (CTG) and Control group (CG) on agility are graphically represented in figure-2.

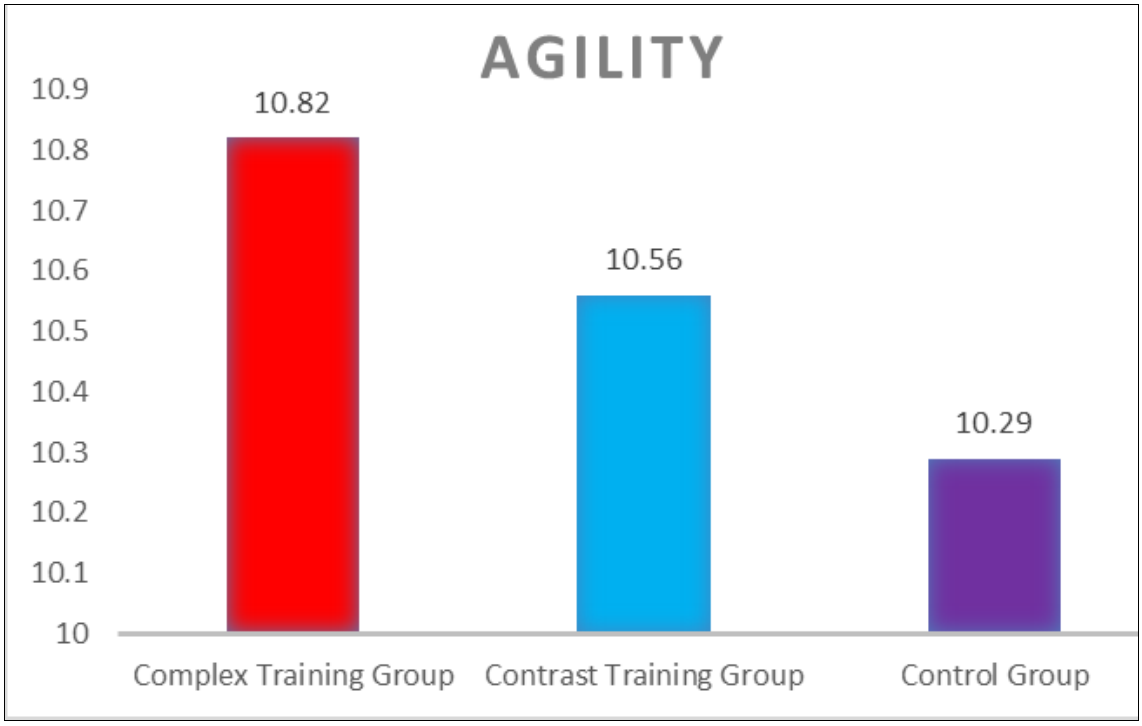

Fig 2: The adjusted post tests mean values of complex training group, contrast training group and control group on agility

Table 6: Analysis of covariance of complex training group, contrast training group and control group of intercollegiate football players on muscular strength and endurance

	Complex Training Group	Contrast Training Group	Control Group	Source of variance	Sum of Squares	Df	Mean square	F-ratio
Pre-test	45.60	48.40	48.40	BG	52.28	2	26.13	0.49
				WG	1433.20	27	53.08	
Post-test	52.90	52.40	46.80	BG	229.40	2	114.70	3.70*
				WG	836.90	27	30.99	
Adjusted post mean	42.97	46.37	53.07	B/G	422.45	2	211.22	23.47*
				W/G	234.01	26	9.00	

*Level of significance at 0.05

Table-6 reveals that the obtained mean values of pre-test and post test scores of muscular strength and endurance on complex training Group 45.60 and 52.90, contrast training Group 48.40 and 52.40 control group 48.40 and 46.80 respectively; the obtained and the obtained F ratio is 3.70. Since the obtained F ratio of 3.70 for post-test means on muscular strength and endurance is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 27 degrees of freedom.

The adjusted post-test means on muscular strength and endurance of complex Training Group (CTG), contrast Training Group (CTG) and Control group (CG) are 42.97, 46.37, and 53.07 respectively and the obtained F ratio is 23.47. Since the obtained F ratio of 23.47 for adjusted post-test means on muscular strength and endurance is higher than the required table value of 3.32, it is found to be significant at 0.05 level of confidence for 2 and 26 degrees of freedom.

The results of the study indicate that there is a statistically significant difference among the adjusted post-test means complex training group, contrast training group and control

group on muscular strength and endurance. To determine which of the paired means had a significant difference, the Scheffe's test was used as a post-hoc test and the results are presented in table-7.

Table 7: Scheffe's test for the difference between the adjusted post test mean on muscular strength and endurance

Complex Training Group	Contrast Training Group	Control Group	M.D	C.I
42.97	46.37	-	3.4	1.92
42.97	-	53.07	10.01	
-	46.37	53.07	6.7	

*Level of significance at 0.05

Table 7, shows that the adjusted post-test means differences of the means complex training group (CTG), contrast training group (CTG) and Control group (CG) are 3.4, 10.01, and 6.7 respectively, which are lesser than the confidence interval value of 1.92 for insignificance at 0.05 level of confidence for 2 and 56 degrees of freedom. It also shows that the adjusted post-test mean differences on muscular strength and endurance between complex training group (CTG), contrast training group (CTG) and Control group (CG) are 10.01 respectively, and lesser than the confidence interval value of 1.92 for significance at 0.05 level of confidence for 2 and 27 degrees of freedom.

The study results show statistically significant differences between the adjusted post-test means of the complex training group (CTG), contrast training group (CTG) and Control group (CG) had higher significant changes on muscular strength and endurance to compared with control group and it was 10.10 respectively, and higher than the confidence interval value of 1.92 for significance at 0.05 level of confidence for 2 and 26 degrees of freedom.

The mean values of complex training group (CTG), contrast training group (CTG) and Control group (CG) on muscular strength and endurance are graphically represented in figure 3.

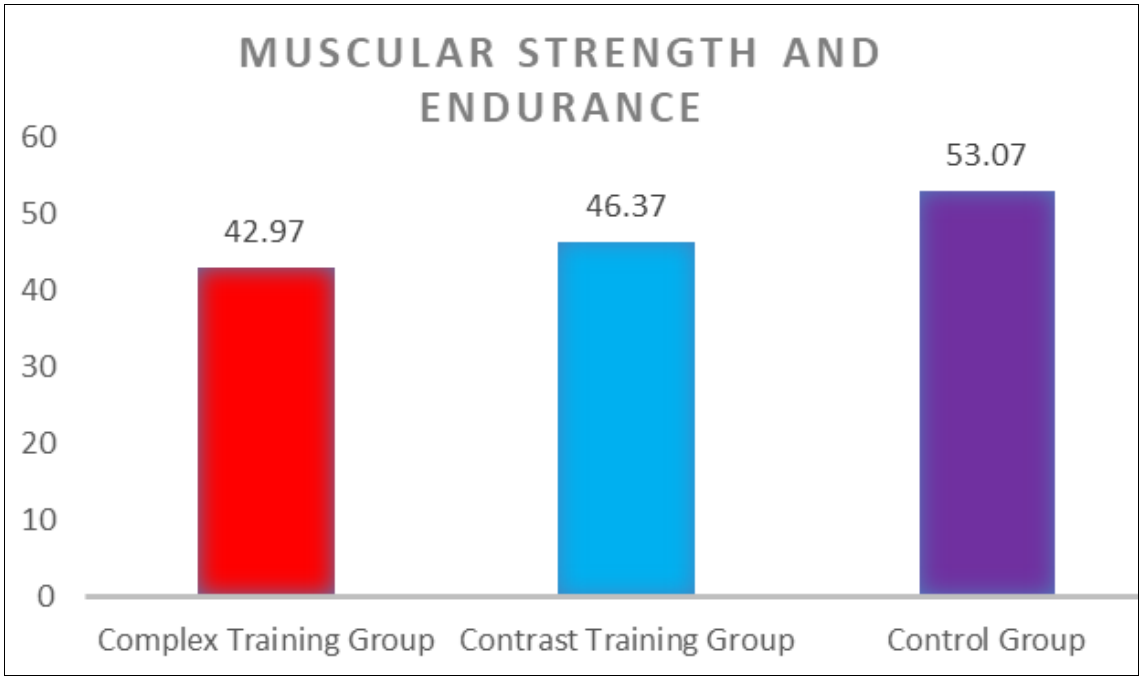

Fig 3: The adjusted post tests mean values of complex training group, contrast training group and control group on muscular strength and endurance

Findings

In this present study which indicates that both training programme named as complex training and contrast training are effective method to improve on selected bio motor components.

The observed improvements in bio-motor variable named as speed, agility and muscular strength and endurance are statistically significant after the post treatment of six weeks Complex and Contrast training. Thus the Complex training shows the better improvement than the Contrast training.

Conclusion

Based on the findings and within the limitation of the study it is noticed that practice of complex training and contrast training helped to improve speed, agility and muscular strength and endurance of intercollegiate male football players. It was also seen that there is progressive enhancement in the selected criterion variables of complex training and contrast training after six weeks of training programmed.

From the statistical analysis, it was found that there was a significant improvement on bio-motor components named as speed, agility and muscular strength and endurance due to the effect of six weeks complex training and contrast training of male inter collegiate football players.

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