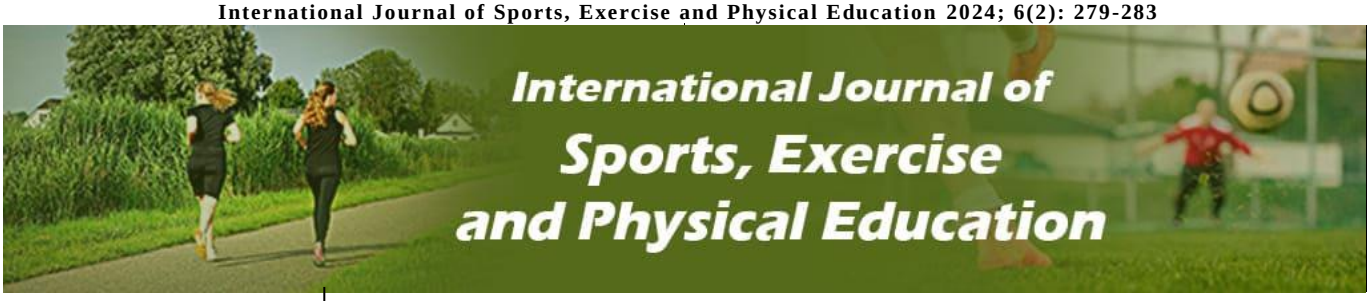

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The effect of circuit training with and without ladder training on selected motor fitness variables of high school

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Abstract
The purpose of the study was to find out the effect of circuit training with and without ladder training on selected motor fitness variables of high school handball players. To achieve the purpose of this study, sixty district level high school handball players were selected from, National Model Higher Secondary School, Peelamedu Trinity Metric Higher Secondary School Ramanathapuram, and S E S Metric Higher Secondary School Ganapati, Coimbatore District, Tamil Nadu. The subject's age ranged from 14 to 15 years and they were divided into three equal groups namely circuit training group, circuit with ladder training group and control group. The circuit training group, circuit with ladder training group underwent training programme for the period of twelve weeks, and control group has not under gone any type of training. The data were collected before and after the training programme. The selected data was statistically analyzed by using analysis of co-variance (ANCOVA). The result of the study reveals that circuit training group and circuit with ladder training group was better than the control group and also circuit with ladder training group is better than the circuit training group on speed and agility of motor fitness variables.

Keywords: Speed, agility, circuit

Introduction

- **Handball:** Handball is a dynamic, popular and exciting sport the players should have athleticism, strength and stamina, great fitness and alone all a good team work. The main movement of the game is to catch, to throw, to run and to jump using strategies and tactics in a combined team effort. It is a fast moving and dynamic game which utilizes movements of all the world sports. It is an ultimate sport and it is easy to learn and play.
- **Circuit Training:** Circuit training is a form of conditioning combining resistance training and high intensity aerobics. It is designed to be easy to follow and target strength building as well as muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the program. When one circuit is complete, one begins the first exercise again for another circuit. Circuit training is an arrangement of exercises that requires the athlete to spend some time completing each exercise before moving on. It is an excellent way to improve mobility and, at the same time, build strength and stamina. Depending on the equipment available, circuits can be developed to improve general fitness or can be highly specialized to meet the specific needs of certain athletes. Circuit training usually consists of 6–10 strength-type exercises that are completed one after the other. Body parts are also alternated so that consecutive exercises don't work the same muscle groups. The strength-type exercises can be interspersed with more aerobic-type activities, or with rest. A simple circuit can be performed up to three times in a training session, depending on time constraints. There are two types of circuits: fixed resistance circuits and individual resistance circuits.
- **Ladder Training:** Ladder Training is a kind of fun training to teach movement skill, it is used to improve the lower body strength, power and balance. The four basic skills include runs, skips, shuttles and jump or hopes. Though liner and lateral, ladder movements are simple, their combination can be complex and hard for training by teaching these steps, the chance for confusing and error is less. But, it needs to be show cased in a slow controlled Environment.

Ladder drills are also called speed ladder drills and these skills are necessary for the various sports. Where speed and agility are necessary. For all military forces, the physical fitness is the major part. It comprises of two concepts such as general fitness and specific fitness a task oriented definition based on the ability to perform specific aspects of sports.

Methodology

Selection of Subjects

The purpose of the study is to find out the effect of circuit training with and without ladder training on selected motor fitness variables of high school handball players. To achieve the purpose of the study, sixty high school handball players were selected from National Model Higher Secondary School, Peelamedu. Trinity Metric Higher Secondary School, Ramanathapuram and S E S Metric Higher Secondary School, Ganapati, Coimbatore District, Tamil Nadu. The age of the subjects was ranged between 14 to 15 years. Subjects were selected randomly and divided into three equal groups namely circuit training group, circuit with ladder training and Control group. The each group consisted of twenty subjects.

Table 1: Selection of the variables and test items

Variables	Name of the test	Unit of Measures
1.Speed	50 meters dash	Seconds
2.Agility	4x10Mtrs Shuttle run	Seconds

Training Programme

The selected subjects were divided into three equal groups' namely circuit training group, circuit with ladder training group and control group. The circuit training group and the circuit with ladder training group underwent the specific training programme.

Circuit training group - Three days per week (Monday, Wednesday and Friday)

Circuit with ladder training group - Three days per week (Tuesday, Thursday and Saturday).

Daily 60 minutes from 4.15pm to 5.15pm

Total duration of the training programme was twelve weeks.

The control group was not involved in the whole specific training.

Speed

The attained data on speed of experimental groups and control group have been evaluated and the results are presented in the following table.

Table 2: Significance of mean gains / losses between pretest and posttest of circuit training group circuit with ladder training group and control group on speed

Group	Pretest Mean (±SD)	Posttest Mean (±SD)	MD	SE	't' ratio
Circuit Training Group	7.93(0.38)	7.61(0.35)	0.32	0.03	10.66*
Circuit with Ladder Training Group	7.96(0.37)	7.29(0.30)	0.67	0.05	13.40*
Control Group	7.96(0.40)	8.03(0.40)	0.07	0.05	1.40

*Significance at 0.05 level ('t' value 2.09) with df 19

Table-II shows that the pretest and posttest mean values of circuit training group on speed is 7.93 and 7.61 respectively. The obtained 't' value of circuit training group on speed is 10.66. It is greater than the required table value of 2.09 with df19. Hence, it is proved that there is a significant difference between pretest and posttest of circuit training group.

The pretest and posttest mean values of circuit with ladder training group on speed is 7.96 and 7.29 respectively. The obtained 't' value of circuit with ladder training group on speed is 13.40. It is greater than the required table value of 2.09 with df 19. Hence, it is proved that there is a significant difference between the pretest and posttest of circuit with ladder training group.

The pretest and posttest mean values of control group on speed is 7.96 and 8.03 respectively. The obtained 't' value of the control group on speed is 1.40. It is lesser than the required table value of 2.09 with df 19. Hence, it is proved that there is no significant difference between pretest and posttest of control group.

The mean value of pretest and posttest on speed of circuit training group and circuit with ladder training group and control group are graphically represented in Figure- 1.

Table 3: Analysis of covariance of circuit training group circuit with ladder training group and control group on speed

Test	Circuit Training Group	Circuit with Ladder Training Group	Control Group	Source Of Variances	Sum Of Squares	df	Mean Squares	Obtained 'F' Ratio
Pretest Mean	7.93	7.96	7.96	Between	0.11	2	0.006	0.03
SD	0.37	0.37	0.40	Within	8.45	57	0.15	
Posttest Mean	7.61	7.29	8.03	Between	5.52	2	2.76	21.65*
SD	0.35	0.30	0.40	Within	7.29	57	0.12	
Adjusted Post test Mean	7.63	7.28	8.02	Between	5.47	2	2.73	82.57*
				Within	1.85	56	0.03	

* Significant at 0.05 level. Table value at 0.05 level of confidence for 2 & 56 and 2 & 57 degree of freedom = 3.19

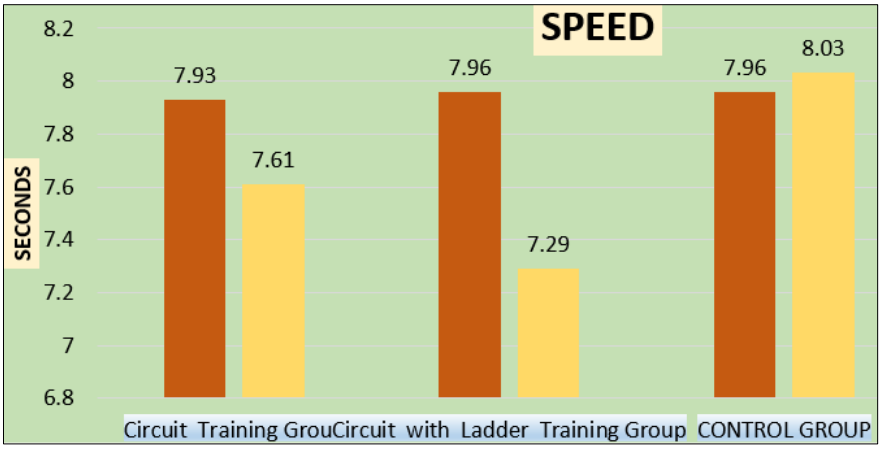

Fig 1: Bar diagram showing the pretest and posttest mean value of circuit training group circuit with ladder training group and control group on speed

Table-III shows that the pretest mean values of circuit training group, circuit with ladder training group and control group on speed are **7**.93, 7.96, and 7.96 respectively. The obtained 'F' ratio value for pretest mean of circuit training group, circuit with ladder training group and control group on speed is 0.03 which is lesser than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence. It is proved that all the three groups were randomly equal.

The post test mean value of circuit training group, circuit with ladder training group and control group on speed are 7.61, 7.29 and 8.03 respectively. The obtained 'F' ratio value for posttest mean of circuit training group, circuit with ladder training group and control group on speed is 21.65 which is greater than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence.

The adjusted posttest mean value of circuit training group, circuit with ladder training group and control group on speed are 7.63, 7.28 and 8.02 respectively. The obtained 'F' ratio value for adjusted posttest mean of circuit training group, circuit with ladder training group and control group on speed is 82.57 which is greater than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence.

The above statistical analysis proved that there is a significant difference among the groups on speed due to the training programme. Further to determine which of the paired means has a significant difference, the Sheffe's post hoc test was applied. The result of the follow-up test has been presented in table-IV

Table 4: Scheffe's post hoc test for paired mean differences among the three groups on speed

Adjusted Post-Test Means			Mean Difference	Confidence Interval
Circuit Training Group	Circuit With Ladder Training Group	Control Group		
7.63	7.28	-	0.35*	0.12
7.63	-	8.02	0.39*	
	7.28	8.02	0.74*	

*Significant at 0.05 level of confidence

Table-IV shows that the adjusted posttest mean difference on speed between circuit training group and circuit with ladder training group, circuit training and control group, circuit with circuit training group and control group are 0.35, 0.39 and 0.74 respectively, which are greater than the confidence interval value of 0.12 at 0.05 level of confidence. The result of the above table indicates that the circuit training group and circuit with ladder training group have significantly improved on speed when compared with the control group. circuit with ladder training group is better than the circuit training group on speed.

Agility

The attained data on agility of experimental groups and control group have been evaluated and the results are presented in the following table.

Table 5: Significance of mean gains / losses between pre test and post test mean value of circuit training group circuit with ladder training group and control group on agility

Group	Pretest Mean (±SD)	Posttest Mean (±SD)	MD	SE	't' ratio
Circuit Training Group	11.21(0.44)	10.41(0.55)	0.80	0.06	13.33*
Circuit with Ladder Training Group	11.10(0.61)	9.94(0.71)	1.16	0.10	11.60*
Control Group	11.18(0.56)	11.30(0.50)	0.12	0.07	1.71

*Significance at 0.05 level ('t' value 2.09) with d. f. 19

Table-V shows that the pretest and posttest mean values of circuit training group on Agility is 11.21 and 10.41 respectively. The obtained 't' value of circuit training group on agility is 13.33. It is greater than the required table value of 2.09 with df 19. Hence, it is proved that there is a significant difference between pretest and posttest of circuit training group on agility.

The pretest and posttest mean values of circuit with ladder training group on agility is 11.10 and 9.94 respectively. The obtained 't' value of circuit with ladder training group on

agility is 11.60. It is greater than the required table value of 2.09 with df 19. Hence, it is proved that there is a significant difference between the pretest and posttest of circuit with ladder training group on agility.

The pretest and posttest mean values of control group on agility is 11.18 and 11.30 respectively. The obtained 't' value of the control group on agility is 1.71. It is lesser than the required table value of 2.09 with df 19. Hence, it is proved that there is no significant difference between pretest and posttest of control group on agility.

The mean value of pretest and posttest on agility of circuit training group and circuit with ladder training group and control group are graphically represented in Figure- 3.

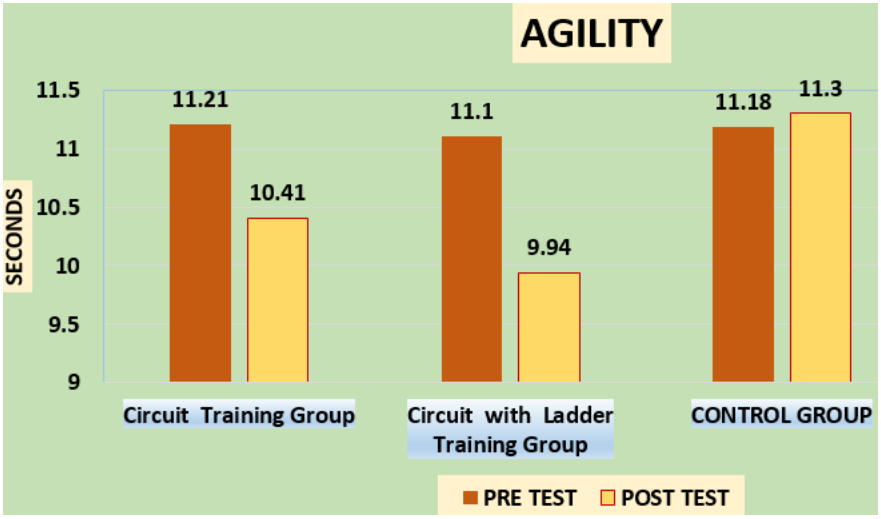

Fig 2: Bar diagram showing the pre test and post test mean value of circuit training group circuitwith ladder training group and control group on agility

Table 6: Analysis of covariance of circuit training group circuit with ladder training group and control group on agility

Test	Circuit Training Group	Circuit With Ladder Training Group	Control Group	Source of Variances	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
Pretest Mean	11.21	11.10	11.18	Between	0.15	2	0.07	0.24
SD	0.44	0.61	0.56	Within	16.96	57	0.29	
Posttest Mean	10.41	9.94	11.30	Between	19.24	2	9.62	24.68*
SD	0.55	0.77	0.50	Within	22.22	57	0.39	
Adjusted Posttest Mean	10.36	10.00	11.29	Between	17.53	2	8.76	62.57*
				Within	7.83	56	0.14	

* Significant at 0.05 level value at 0.05 level of confidence for 2 & 56 and 2 & 57 degree of freedom = 3.19

Table VI, shows that the pretest means values of circuit training group, circuit with ladder training group and control group on agility are 11.21, 11.10, and 11.18 respectively. The obtained value 'F' ratio for pre-test mean of circuit training group, circuit with ladder training group and control group on agility is 0.24 which is lesser than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence. It is proved that all the three group were randomly equal.

The posttest mean value of circuit training group, circuit with ladder training group and control group on agility are 10.41, 9.94 and 11.30 respectively. The obtained 'F' ratio value for posttest mean of circuit training group, circuit with ladder training group and control group on agility is 24.68 which are greater than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence.

The adjusted posttest mean value of circuit training group, circuit with ladder training group and control group on agility are 10.36, 10.00 and 11.29 respectively. The obtained 'F' ratio value for adjusted posttest mean of circuit training group, circuit with ladder training group and control group on agility is 62.57 which are greater than the required table value of 3.19 for significance with df 2 and 57 at 0.05 level of confidence.

The above statistical analysis proved that there is a significant difference among the groups on agility due to the training programme. Further to determine which of the paired means has a significant difference, the Sheffe's post hoc test was applied. The result of the follow-up test has been presented in table –VII.

Table – VII shows that the adjusted posttest mean difference on agility between circuit training group and circuit with ladder training group, circuit training and control group, circuit with ladder training group and control group are 0.36, 0.93 and 1.29 respectively, which are greater than the confidence interval value of 0.27 at 0.05 level of confidence. The result of the above table indicates that the circuit training group and circuit with ladder training group have significantly improved on agility when compared with the control group circuit with ladder training group is better than the circuit training group on agility.

The mean value of pretest, posttest and adjusted posttest on agility of circuit training and circuit with ladder training group and control group have been graphically represented in Figure-4.

Table 7: Scheffe's post hoc test for the difference between adjusted post-test mean of agility

Adjusted Post-Test Means			Mean Difference	Confidence Interval
Circuit Training Group	Circuit With Ladder Training Group	Control Group		
10.36	10.00		0.36*	0.27
10.36		11.29	0.93*	
	10.00	11.29	1.29*	

*Significant at 0.05 level of confidence

Discussion on Findings

The purpose of the study was to find out the effect of circuit training with and without ladder training on selected motor fitness variables of high school handball players.

- It was concluded that the circuit training group had significant improvement on selected dependent variables such as motor fitness components speed and agility of high school handball players.
- It was concluded that the circuit with ladder training group had significant improvement on selected dependent variables such as motor fitness components speed and agility of high school handball players.

Conclusions

- It was concluded that the circuit training group and circuit with ladder training group are better than the control group on speed because of the respective training programme. Further, the circuit with ladder training group is better than the circuit training group on speed.
- It was concluded that the circuit training group and circuit with ladder training group are better than the control group on agility because of the respective training programme. Further, the circuit with ladder training group is better than the circuit training group on agility.

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