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Effects of Plyometric and Circuit Trainings on selected Performance Variables among School Kho-Kho players

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Abstract: The aim of this study was to find out the effects of plyometric training and circuit training onselected performance variables of school kho kho players. For this purpose randomly selected 75 schoollevel kho kho players from Andhra Pradesh was selected and the performance variables selected weresingle chain run and double chain run. The study was formulated as a true random group designconsisting of a pre-test and post test. The subjects (N=75) were randomly assigned to three equal groupsof twenty five school boys. The groups were designed as experimental group I – plyometric trainninggroup, experimental group II Circuit training group and control group respectively. Pre test wasconducted for all the 75 subjects on selected performance variables. The experimental groups(plyometric and circuit training) participated in respective training for a period of six weeks. The controlgroup did not participated in any of the training programme. The post test was conducted on the abovesaid dependent variables after a period of six weeks for all the three groups. The obtained data weresubjected to statistical analysis using ANCOVA. When significant F values obtained the results werefurther subjected to post hoc analysis using Scheffee's confidence interval test. RESULTS adjusted posttest means were determined and analysis of covariance was done and the obtained F value 66.95 onsingle chain run and 101.10 on double chain run were greater than the required value of 3.13 and hence itwas accepted that the plyometric training and circuit training, significantly improved the performancevariables of kho kho playersd. The post hoc analysis on single chain run and double chain run on theobtained ordered adjusted means proved that there was significant differences existed between controlgroup and plyometric training group and control group and circuit training group. This proved that dueto six weeks plyometric training single chain run of the School Kho Kho players improvedsignificantly.While comparing between the two experimental groups, it was found that plyometric trainninggroup was significantly better than circuit training group in improving single chain run and double chainrun of school kho kho players. CONCLUSIN Based on the results of this study, it was found plyometrictraining was better than circuit training in improving performance variables of school kho kho players.

Keywords: plyometric training, circuit training, performance variables, kho kho players, pre-test, post-test, experimental group, control group, statistical analysis, post hoc analysis

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INTRODUCTION

Kho Kho is one of the most popular traditional sports in the country. Some of the interesting facts about the game. The position of the players sitting is random; one will never find the same set of players sitting in the same order as when the game starts. The game requires immense stamina and speed. It is a tag game of our country. Its roots are as old as the epic Mahabharata, with plans and strategies likely derived from the epic itself. As the tale narrates, on the 13th day of the war, the Kaurava Guru Dronacharya planned the sole tactics 'Chakravyuh', a special military defensive plan broke by Abhimanyu. Unfortunately, he died as he had to fight alone against 7 warriors and he was badly injured. His style of fighting reflected the concept of ring play – a defensive tactic in the game. The game during age-old times involved 'raths' and chariots and was named Rathera.

The Asian Kho Kho Federation first came into existence in 1987 at the time of the third SAF Games in India. The Kho Kho game gained international credit with the first Asian Championship which was held in Kolkata in 1996. The second championship was held in 2000 which added further shine to the game.The modern-day game was invented in the Indian state of Maharashtra. The Deccan Gymkhana of Pune tried to lend a sense of reliability and recognition to the game by introducing certain rules and regulations to make it more formal. As a result, countries such as Pakistan, Bangladesh, Nepal, Sri Lanka, and the Maldives also participated in the game. Sitting in squares, diving, chain formation, making circles, pole dive, giving Chou, turning round the pole, running, dodging, sudden change of direction are basic skills of the game. (https://www.kreedon.com/kho-kho-game/)

Athletic performance has dramatically progressed over the past few years. Performance levels unimaginable before are now common place, and the number of athletes capable of outstanding results is increasing. One factor is that athletics is a challenging field, and intense motivation has encouraged long, hard hours of work. Also, coaching has become more sophisticated, partially from the assistance of sport specialists and scientists. A broader base of knowledge about athletes now exists, which is reflected in training methodology (Bompa, 1999) .

Plyometric training is one of the best methods of developing explosive power in sports. Basically plyometrics provide a method of training for the optimum relationship between strength and speed which will ultimately manifest in self as explosive power. Today plyometric movement are performed in almost all sports. Basic strength level must be attained before starting plyometric training programme. The choice of exercise must correspond to age, sex and biological development of sports person. These should be gradually increase stress during a complete training cycle. Body weight should be the determining factor in assigning the value of jumps in ork out. Generally the number of sessions to devote the plyometric training is 2 or 3 times per week (Will and Freeman (1980) ,

Circuit training employs a series of exercises stations that consists of weight training, flexibility, calisthenics, and brief aerobic exercises. In circuit training the subjects can move rapidly from one station to the next and perform whatever exercise is to be done at that station within a specified time period. A circuit would consist of 8 to 12 stations and the entire would be repeated within three of four times, concentrating on the legs, abdomen, back, arms, shoulders and trunk. These exercises should be organized so that the subject moves from one muscle group to another. This method allows working hard on a muscle group and then resting it, while the other groups have their own work out (Tancred, 1987) .

Raju. S./S (2019) determined the effect of plyometric training on agility. Sixty Kho-Kho (N=60 were randomly selected as subjects and their age ranged between 16 and 18 years. The selected subjects were randomly assigned into two equal groups with thirty subjects each (N=30). Group I experimental, Group II Control group the experimental groups underwent their respective experimental treatment for twelve weeks 3 days per week and a session on each day. Control group was not exposed to any specific training apart from their curriculum. Agility was taken as variable for this investigation. The pre and posttest were conducted one day before and after the experimental treatment. Analysis of covariance (ANCOVA) was used to analysis the collected data. Scheffe's test was used as a post hoc test to determine which of the

paired mean differed significantly. The results revealed that there was a significant difference between experimental groups on speed ($P \leq 0.05$) Further it related that the plyometric training and plyometric training produced significant improvement($P \leq 0.05$) on agility as compared to control group.

Shahram Alam et.al. (2012) fond out the effect of plyometric circuit exercises on the physical preparation indices of elite handball player in the city of Behbahan. The participants' records were registered in 4 pre- and post-tests and compared. The results of the study revealed that 6 weeks plyometric circuit exercises have meaningful effect on the participants' records in four tests (vertical jump- shuttle briskness- medicine ball throw- 30 meters speed run) and have caused improvements in the results of these four tests. Therefore, it seems that plyometric circuit exercises have been effective on the physical preparation indices of handball players and can improve the athletes' performance of this field.

Clutch et al. (2001) examined the effect of depth jumps and weight training on leg strength and vertical jump in two studies. It was found that weight plus jumping produced no added beneficial performance improvement than the jumping alone group. The weight training programme did not provide added benefit.

Fletcher and Hertwell (2002) examined the effect of an 8 week combined weights and plyometrics training program on golf drive performance. Eleven golfers were randomly assigned to control and experimental group. The control group continued their current training programmes. The experimental group performed combined weight and plyometric training twice in a week. The treatment group showed significant changes in head speed and driving distance.

Hortobagyi, et al., (1991) examined the effects of simultaneous training for strength and endurance on upper and lower body strength and running performance. High Resistance (HR), Low Resistance (LR) and Control groups of college men were used as subjects without the difference in body compositions in fitness. It was concluded that gains in strength were compromised by simultaneous endurance training. High resistance or low resistance training did not affect the gains in strength and endurance. It would appear to be unproductive to mix strength and endurance training because an athlete would gain maximum benefits in the mixed training.

Padder, M.W.J and Ramesh, G. (2021) determined the impact of ladder training and plyometric training on speed and agility among school level Kho-Kho players in Kashmir. Forty-five male Kho-Kho players from higher secondary school Vessu Anantnag, higher secondary school Wanpoh Anantnag and higher secondary school Kelam kulgam in Kashmir, who had participated in interschool competition, were selected as subjects at randomly and their age ranged from 14 to 17 years. The subjects (N=45) were randomly assigned in to three equal groups of fifteen Kho-Kho players each as experimental group-I, experimental group-II and control group. The experimental groups and control group underwent normal routine KhoKho practices and in addition the experimental group-I underwent ladder training and experimental group-II underwent plyometric training for one hour in the morning session. The control group was not given any special training apart from their normal daily exercises. The period of training was twelve weeks in a schedule of weekly three days for alternative days. The data was collected on selected dependent variable before and after the training period. The collected data were statistically analysed by using analysis of covariance (ANCOVA) was used to find the significant difference among the groups. The

scheffe's post hoc test was used to find the paired mean difference if any. The level of confidence was fixed at 0.05. Based on the study it was conclude that ladder training and plyometric training were significantly improved the speed and agility among school level Kho-Kho players

Most scientific knowledge, whether from experience or research, aims to understand and improve the effects of exercise on the body. Exercise is now the focus of sport science. Research from several sciences enriches the theory and methodology of training, which has become a branch of science. Thus, this study was intended to fi9nd out the effect of plyometric training and circuit training on selected performance variables of school level kho kho players.

METHEDOLOGY

Subjects

To facilitate the study, 75 school kho kho players from different schools from Andhra Pradesh were randomly selected as subjects and their age ranged between 16 to 18 years. They were further divided into three groups namely Plyometric training group, circuit training group, and control group (CG), on random basis.

Selection Of Variables

Taking into consideration the feasibility and availability of instruments kho kho game performance variables, single chain run and double chain run were selected.

Training Programme

Table 1: Training Schedule for Plyometric Training

Name of Exercise	Repetitions			Rest
	I & II	III & IV	V & VI	
Squat Jumps	10	12	14	2 minute
Jump to Box	10	12	14	2 minute
Box Jumping Both Legs	10	12	14	2 minute
Lateral Jump to Box	10	12	14	2 minute
Medicine Ball Chest Push with Partner	10	12	14	2 minute

Training Schedule for Circuit Training

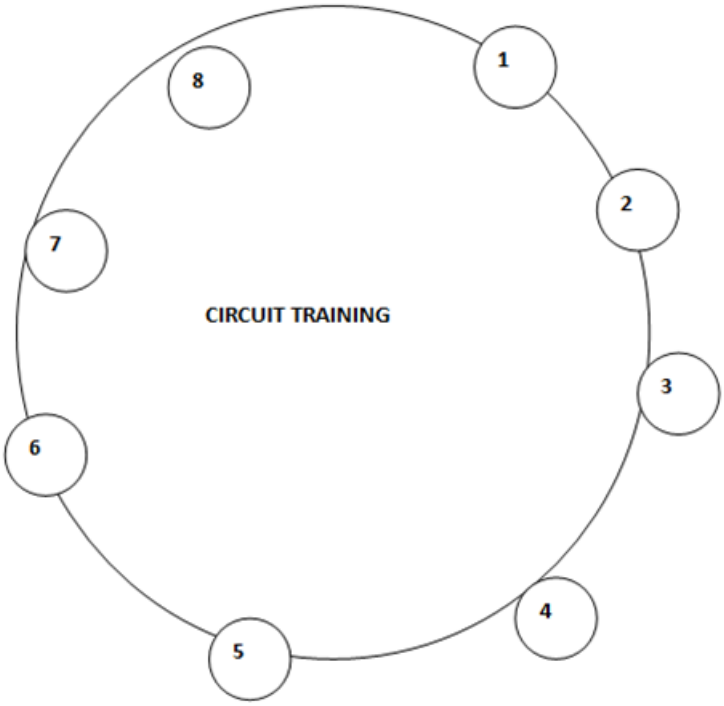

DIAGRAM SHOWING CIRCUIT TRAINING SCHEDULE

1. High knee action
2. Pouncing
3. Hopping
4. Skipping
5. Push ups
6. Sit ups
7. Squat thrust
8. Full Squat Jump (Forward and backward)

Table 2: Training Schedule For Circuit Training

Day	First three weeks		Fourth to Sixth Weeks	
	Each Station	Set	Each Station	Set
Monday	45 Sec	2	45 Sec	3
Tuesday	50 Sec	3	50 Sec	4
Wednesday	55 Sec	4	55 Sec	5
Thursday	50 Sec	5	50 Sec	5
Friday	55 Sec	4	55 Sec	4
Saturday	60 Sec	3	60 Sec	3

MEASURING SINGLE CHAIN RUN AND DOIUBLE CHAIN RUN

In a kho kho game situation, the chaser was asked to stand in the first post line and the subject for whom the single chain test was administered was asked to sat in the first box. On command 'go', the chaser run to the subject and gave 'Kho'. The timer was asked to start the stop watch at the moment of giving 'kho' to the subject. Immediately the subject began to run in single chain form in zig zag manner crosses the second line post and came back in the same way and cross the first line post. And the timer was asked to stop the stop watch which formed the single chain run time.

Similarly for double chain run, the subject began to run in double chain form in zig zag zag manner which forms the double chain time. Score was the time elapsed from the moment the subject was given 'kho' and moment of time crossed the line post.

EXPERIMETNAL DESIGN AND STATISTICAL ANALYSIS

The study was formulated as a true random group design consisting of a pre-test and post test. The subjects (N=75) were randomly assigned to three equal groups of twenty five school boys. The groups were designed as experimental group I – plyometric training group, experimental group II Circuit training group and control group respectively. Pre test was conducted for all the 75 subjects on selected performance variables. The experimental groups (plyometric and circuit training) participated in respective training for a period of six weeks. The control group did not participated in any of the training programme. The post test was conducted on the above said dependent variables after a period of six weeks for all the three groups. The obtained data were subjected to statistical analysis using ANCOVA. When significant F values obtained the results were further subjected to post hoc analysis using Scheffee's confidence interval test.

RESULTS

Table 3: Computation Of Analysis Of Covariance On Single Chain Run

	PLYOMETRIC	CIRCUIT TRAINING	CONTROL	SOURCE OF VARIANCE	SUM OF SQUARES	DF	MEAN SQUARES	OBTAINED F
Pre Test Mean	17.34	16.99	17.16	Between	1.8	2	0.90	
Standard Deviation	0.97	1.18	0.94	Within	83.7	72	1.16	0.78
Post Test Mean	15.04	14.04	17.34	Between	127.1	2	63.54	
Standard Deviation	0.87	1.25	0.97	Within	76.8	72	1.07	59.60*
Adjusted Post Test Mean	14.13	14.99	17.13	Between	118.0	2	59.02	
				Within	62.6	71	0.88	66.95*
Mean Diff	-2.30	-2.95	0.18					

(In Seconds)

Table F-ratio at 0.05 level of confidence for 2 and 72 (df) =3.13, 2 and 71(df) =3.13 .

*Significant

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table iv

Table 4: Post Hoc Analysis On Scores On Single Chain Run

MEANS			Mean Difference	Required C I
Plyometric Training	Circuit training	Control		
14.13	14.99		0.86*	0.67
14.13		17.13	3.00*	0.67
	14.99	17.13	2.14*	0.67

* Significant

Table 5: Computation Of Analysis Of Covariance On Double Chain Run

	PLYOMETRIC	CIRCUIT TRAINING	CONTROL	SOURCE OF VARIANCE	SUM OF SQUARES	DF	MEAN SQUARES	OBTAINED F
Pre Test Mean	17.14	16.72	17.28	Between	6.2	2	3.10	
Standard Deviation	1.17	1.08	1.16	Within	98.6	72	1.37	2.26
Post Test Mean	15.04	13.13	17.14	Between	215.6	2	107.79	
Standard Deviation	0.96	1.26	1.17	Within	92.7	72	1.29	83.74*
Adjusted Post Test Mean	13.35	15.02	17.09	Between	164.7	2	82.37	
				Within	57.8	71	0.81	101.10*
Mean Diff	-2.10	-3.59	-0.15					

(In Seconds)

Table F-ratio at 0.05 level of confidence for 2 and 72 (df) =3.13, 2 and 71(df) =3.13 .

*Significant

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table XV

Table 6: Post Hoc Analysis Scores On Double Chain Run

MEANS			Mean Difference	Required C I
Plyometric Training	Circuit training	Control		
13.35	15.02		1.66*	0.64
13.35		17.09	3.73*	0.64
	15.02	17.09	2.07*	0.64

* Significant

DISCUSSIONS ON THE FINDINGS

The ANOVA results shown in Tables III and V, there was no significant different at pre test scores of single chain run timings and double chain run timings which proved that the random assignment of the subjects were successful and their scores before the training were equal and there was no significant differences. However the post experimental scores F values were significant, which proved the experimental treatments significantly improved performance variables of kho kho players. Taking into consideration of the pre test means and post test means adjusted post test means were determined and analysis of covariance was done and the obtained F value 66.95 on single chain run and 101.10 on double chain run were greater than the required value of 3.13 and hence it was accepted that the plyometric training and circuit training, significantly improved the performance variables of kho kho playersd.

The post hoc analysis results presented in Tables IV and VI on single chain run and double chain run on

the obtained ordered adjusted means proved that there was significant differences existed between control group and plyometric training group and control group and circuit training group. This proved that due to six weeks plyometric training single chain run of the School Kho Kho players improved significantly.

While comparing between the two experimental groups, it was found that plyometric training group was significantly better than circuit training group in improving single chain run and double chain run of school kho kho players.

CONCLUSIONS

Based on the results of this study, it was found plyometric training was better than circuit training in improving performance variables of school kho kho players.

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