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Effect of high and moderate intensity interval training on aerobic capacity of kho-kho players

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Abstract

For the purpose of the study Pre-Post Purposive sampling design was used. Fifteen state level male Kho-Kho players were selected and equally divided into three groups: HIITG, MIITG, and CG. Age ranged from 17-20 years. As variable Aerobic capacity and 50 meter drill of High and Moderate Intensity were taken. Two different types of Training were given to experimental groups for 6 weeks (3 days/week). The data was collected before and after training through Yo-Yo Intermittent Recovery Test (Level-1). Aerobic capacity has been expressed as estimated maximal oxygen uptake (VO_2 Max). For statistical analysis ANCOVA, Levene's Test of Equality, Descriptive Statistics and Bonferroni Post-Hoc Test were applied. The level of significance was set at $p < 0.05$. All the statistical analysis was performed in SPSS (Trial Version). As result there was a significant effect of high and moderate intensity interval training on aerobic capacity of Kho-Kho players.

Keywords: Aerobic capacity, high intensity, moderate intensity, interval training, 50mts drill, kho-kho

Introduction

Kho-Kho ranks as one of the most popular traditional sports in India. The origin of Kho-Kho is difficult to trace, but many historians believe, that it is a modified form of 'Run Chase', which in its simplest form involves chasing and touching a person. With its origins in Maharashtra, Kho-Kho in ancient times, was played on 'raths' or chariots, and was known as Rathore ("Indian Game," ND.). The rules of the game were framed in the beginning of the 20th century. At Gymkhana Poona, a Committee was formed in 1914, to frame its rules. The first ever rules on Kho-Kho were published from Gymkhana Baroda, in 1924. In 1959-60, the first national Kho-Kho championship was organised in Vijayawada (Andhra Pradesh). The Government has initiated the following awards for the game: Arjuna Award, Eklavya Award for men, Rani Laxmi Bai award for women, Veer Abhimanyu award for boys under 18, and Janaki award for girls under 16 ("Indian Game," n.d.). The game, Kho-Kho requires most of the components of physical fitness like strength, speed and endurance. The performance of a sportsman in any game or event depends on physical fitness. The physical fitness or condition is the important motor abilities namely neuron-physiological factors and sports performance in all sports depends to great extent on these abilities. Improvement and maintenance of physical fitness is the most important aim of sports training (Roy, De, & Nandi, 2016) [17]. It is such a game which requires aerobic capacity so much throughout the match and needed for getting highest performance. Aerobic capacity is the highest amount of oxygen consumed during maximal exercise in activities that use the large muscle groups in the legs or arms and legs combined. Aerobic capacity, aerobic power, functional capacity, functional aerobic capacity, maximal functional capacity, cardio respiratory fitness, cardiovascular fitness, maximal oxygen intake, and maximal oxygen uptake are terms that are often used interchangeably ("Physical Activity and Exercise," n.d.). The maximum amount of O_2 in ml an athlete can use in one minute/kg of body weight is called aerobic capacity ("Defined Terms," n.d.). Intensity is very important training variable. The more work an athlete performs per unit of time, the higher the intensity. Intensity is nothing but it is a function of neuromuscular activation. The assessment of intensity is specific to the exercise and the sport. The assessment of intensity is specific to the exercise and the sports. A sports person works at which intensity to be quantified on many ways.

Such as a: Maximum Heart Rate, b: Based on Primary Energy System engaged during Activity and c: As a Percentage of Best Performance of the athlete etc. Then, the best performance would represent a maximum intensity. The intensity can be classified into six intensity zone, like Super-maximal (>100), Maximal (90-100), Heavy (80-90), Medium (70-80), Low (50-70) and Very Low (<50) (Bompa & Haff, 2009b) [6]. Interval training is nothing but, it is such a training which deals with low to high intensity activities where rest period or recovery time is provided between two repetitions. Generally Interval training consists of increasing intensity workouts (low to high) that are interspersed by periods of rest (MacInnis & Gibala, 2017) [12], ("Interval training," 2019) [11]. So, the history and characteristics of Kho Kho games is very interesting and important one like other traditional games and sports across the country. So the game, Kho Kho is concerned its nature is something different than any other games and sports. It is such a game in which aerobic capacity plays an important role to become an excellent Kho Kho player. The present study has thus been designed to find out the effect of six weeks different intensity interval training on aerobic capacity of State Level Male Kho-Kho players and entitled "Effect of High and Moderate Intensity Interval Training on Aerobic Capacity of Kho-Kho Players."

Research Questions

1. Whether 50 meter drill of High and Moderate Intensity Interval Training will significantly improvement the aerobic capacity of State Level Male Kho-Kho players or not?
2. Which intensity interval training of 50 meter drill will improve most the aerobic capacity of State Level Male Kho-Kho players?

Purpose of the study

The purpose of the study was to find out the effect of High and Moderate Intensity Interval Training on Aerobic Capacity

of state level male Kho-Kho Players.

Methodology

Pre-Post Purposive sampling design was used for the present study. As subjects total fifteen (N=15) state level male Kho Kho players were purposively selected from Siliguri Mahakumar Kho Kho Association of West Bengal State and equally divided into three groups: High Intensity Interval Training Group (HIITG), Moderate Intensity Interval Training Group (MIITG) and Active Control Group (CG). For two experimental groups two different types of training were administered with high intensity (90%) and moderate intensity (70%) respectively. On the other hand no training was given to the active control group. Age ranged from 17-20 years. Only one physiological dependent variable was taken i.e. Aerobic capacity and one independent variable i.e. 50 meter drill of High and Moderate Intensity Interval Training was applied for 6 weeks (3 days/week) along with ten (10) repetitions in each session. The data was collected before and after the administration of training through Yo-Yo Intermittent Recovery Test (Level-1). Aerobic capacity has been expressed as estimated maximal oxygen uptake (VO₂ Max). For the statistical analysis One Way Analysis of Co-Variance (ANCOVA) was used to determine the effects of training on dependent variable along with Levene's Test of Equality, Descriptive Statistics and Bonferroni Post-Hoc Test also were applied. The effect size was reported with the 95% confidence for all analysed measures. The level of significance was set at p- 0.05. All the statistical analysis was performed using the SPSS statistical package (Trial Version)

1. Analysis & interpretation of data

The mean values, standard deviations (SD) along with standard error means (SEM) of HIITG, MIITG and CG on aerobic capacity have been presented in table: 01 in respect of pre and post-test.

Table 1: Mean, SD & SEM of HIITG, and MIITG & CG on Aerobic Capacity in Pre - Post Test of Kho Kho players

Variable			Pre test			Post test		
	Group	N	Mean	SD	SEM	Mean	SD	SEM
Aerobic Capacity {VO ₂ Max(ml.kg ⁻¹ .min ⁻¹)}	HIITG	5	46.34	±0.91	0.48	51.05	±0.77	0.60
	MIITG	5	47.35	±0.74	0.37	49.77	±1.13	0.60
	CG	5	45.87	±1.49	0.58	46.15	±1.90	0.60

ABBREVIATIONS: N = Number of Subjects (15), SD = Standard Deviation, SEM = Standard Error Mean, HIITG = High Intensity Interval Training Group, MIITG = Moderate Intensity Interval Training Group, CG = Control Group

It was evident from the above table no. 01 that the pre-test means and Standard Deviations of HIITG, MIITG and CG were 46.34±0.91, 47.35±0.74 and 45.87±1.49 (ml.kg⁻¹.min⁻¹) on aerobic capacity respectively; whereas the post-test means and Standard Deviations were 51.05±0.77, 49.77±1.13 and 46.15±1.90 (ml.kg⁻¹.min⁻¹) respectively. On the other hand the Standard Errors of HIITG, MIITG and CG in pre-test

were 0.48, 0.37 and 0.58 (ml.kg⁻¹.min⁻¹) whereas in post-test Standard Errors were 0.60, 0.60 and 0.60 (ml.kg⁻¹.min⁻¹) respectively. The mean values along with standard deviations (SD) of HIITG, MIITG and CG on aerobic capacity have been graphically presented below in figure no. 01. Applied for pair wise comparison which has been presented in table: 03

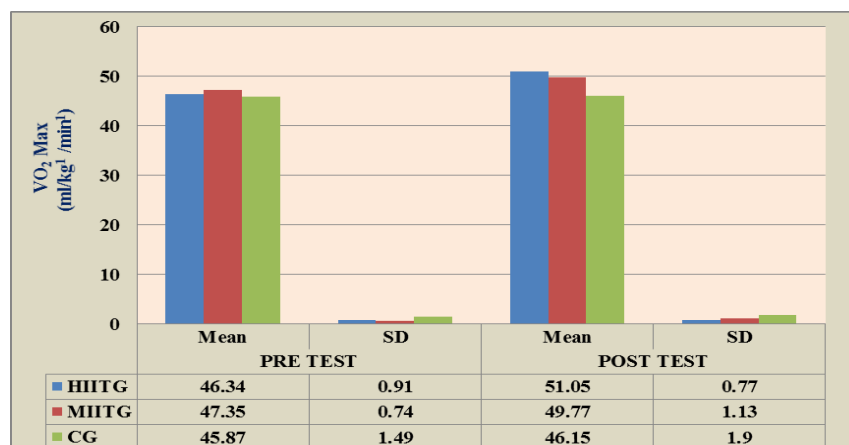


Fig 1: Mean and SD of HIITG, MIITG & CG on Aerobic Capacity in Pre and Post test

Table 2: One Way Analysis of Co-Variance (ANCOVA) Among Two Experimental Groups & One Control Group on Aerobic Capacity of Kho Kho players

Variable	Mean	Group			Sum of Squares	df	Mean Sum of Square	F-ratio	p-value (Sig.)	
		HIITG	MIITG	CG						
Aerobic Capacity {VO ₂ Max(ml.kg ⁻¹ min ⁻¹)}	Pre Test Mean	46.34	47.35	45.87	A	5.72	2	2.86	2.39	0.13
					W	14.38	12	1.20		
	Post Test Mean	51.05	49.77	46.15	A	64.68	2	32.34	17.73*	0.00*
					W	21.89	12	1.82		
	Adjusted Post Mean	51.21	49.01	46.74	A	48.53	2	24.26	27.29*	0.00*
					W	9.78	11	.89		

*Significant at 0.05 level, F_{0.05} (2, 12) = 3.89, F_{0.05} (2, 11) = 3.98 OR p≤0.05
 ABBREVIATIONS: df = Degrees of Freedom, A = Among Mean Variance, W = Within Group Variance

It was evident from the above ANCOVA table: 02 that in pre test ‘F’ - value and P - value were 2.39 and 0.13 (ml.kg⁻¹ min⁻¹) respectively, that’s mean P-value (0.13) is greater than 0.05 level of significant (P>0.05) with 2/12 degrees of freedom. Therefore, it is clear that there is no significant difference (P>0.05) in pre test phase among two experimental groups (HIITG & MIITG) and one control group (CG). However, in post test and adjusted post test mean, the F - values were 17.73 and 27.29 (ml.kg⁻¹ min⁻¹) respectively; whereas P - values were 0.00 and 0.00 (ml.kg⁻¹ min⁻¹) respectively, which revealed that P-values (0.00 & 0.00) are less than 0.05

level of significant (P<0.05) in both with 2/12 and 2/11 degrees of freedom. So, it was also clearly evident that there was significant difference (P<0.05) among two experimental groups (HIITG & MIITG) and one control group (CG) on aerobic capacity in post test and adjusted post test mean. It was also found that the improvement occurred of HIITG and MIITG due to training in percentage (%) in comparison to control group (CG) were 9.56% and 4.86% respectively As, the statistically significant difference (P<0.05) was found in post test and adjusted post test mean through analysis of co-variance (ANCOVA), therefore Bonferroni Post-Hoc Test was

Table 3: Bonferroni Post-Hoc Test among HIITG, MIITG & CG in Adjusted Post Test Means on Aerobic Capacity of Kho Kho players

Variable	GROUP			SEM	Mean Difference	p- value (Sig.)
	HIITG	MIITG	CG			
Aerobic Capacity {VO ₂ Max(ml.kg ⁻¹ min ⁻¹)}	51.21		46.74	.61	4.47	0.00*
		49.01	46.74	.70	2.27	0.02*
	51.21	49.01		.65	2.2	0.02*

*Significant at 0.05 level, or p≤0.05

From the table: 03 Bonferroni Post Hoc Test it has been clear that there is significant difference (P<0.05) of two experimental groups (HIITG & MIITG) in compare to control group (CG) in adjusted final means on aerobic capacity of Kho Kho players. Because, the mean difference between HIITG & CG, MIITG & CG were 4.47 and 2.27 respectively, whereas P - values were 0.00 and 0.02 (ml.kg⁻¹ min⁻¹) which clearly indicated that P-values (0.00 & 0.02) are less than 0.05 level of significant (P<0.05).

Further, the remaining one pair of experimental groups namely HIITG & MIITG also showed significant difference (P<0.05) between them. Because, the mean difference between HIITG & MIITG was 2.2 whereas, P - value was 0.02 (ml.kg⁻¹ min⁻¹), which clearly indicated

that P-value (0.02) is less than 0.05 level of significant (P<0.05) on aerobic capacity of Kho Kho players.

Discussion and findings

So, there is a statistically significant effect of 50 meter drill of high and moderate intensity interval training on aerobic capacity of State Level male Kho-Kho players. It was also evident that aerobic capacity of HIITG & MIITG was significantly increased due to six (6) weeks 50 meter drill in comparison to control group (CG). It was also evident that statistically pair wise significant difference existing between HIITG & CG, MIITG & CG and HIITG & MIITG. The reasons behind significant effect of 50 meter drill of High & Moderate Intensity Interval Training on Aerobic capacity have been discussed below.

Behind significant improvement on aerobic efficiency of Kho-Kho players the reasons are: Designing of Training Protocol, Proper Implementation of Training Protocol, Intensity of Training, Training load, Volume of Training and Training experience and efficiency of the subjects. In the present study the researcher designed training protocol abiding by Bompa Training Principles (Bompa & Haff, 2009) [15]. In the present study the investigator increased training load by decreasing the rest interval between repetitions in every two weeks respectively throughout the progression of training, but other things had been remained unchanged such as intensity, volume, repetitions and duration of the session and maintained the ratio (work : rest interval) between work and rest interval like: 1:5, 1:4 and 1:3 for 1st - 2nd week, 3rd - 4th week and 5th - 6th week respectively. For two experimental groups two different types of training were administered with high intensity (90%) and moderate intensity (70%) respectively. On the other hand no training was given to the active control group. The improvement happened due to six weeks 50 meter drill is nothing, but it is the adaptations of the muscles and all body systems to the applied training. Much research has been done on training adaptations associated with aerobic endurance exercise (Baechle & Earle, 2007) [4], (Defense Technical Information Center, 1999) [7], (Gaesser & Wilson, 1988) [9], (Hickson, Dvorak, Gorostiaga, Kurowski, & Foster, 1988) [10]. Aerobic metabolism plays a vital role in human performance and is basic to all sports, if for no other reason than recovery (Tomlin & Wenger, 2001) [13]. Metabolically, the Krebs cycle and electron transport chain are the main pathways in aerobic energy production. Aerobic metabolism produces far more ATP energy than anaerobic metabolism and uses fat, carbohydrates and proteins as fuel sources for generating ATP (Bompa & Haff, 2009) [1, 2, 15]. Intensity is one of the most important factors in improving and maintaining aerobic capacity. The short bouts of interval sprints with higher intensity improve the ability to consume maximal oxygen, if the interim rest period is also short. Callister and colleagues showed that long rest periods used with sprints improved sprint speed without significant increases in maximal aerobic power. Therefore, the training sessions giving more amount of recovery for long time between exercise bouts result in less improvement in aerobic capacity. The application of less rest periods between repetitions of high intensity training has been shown in various studies (Bompa & Haff, 2009) [1, 2, 15]. In the present study the researcher also provided shorter recovery periods between repetitions and as the progression of training he reduced rest interval maintaining the ratio: 1:5, 1:4 and 1:3 respectively. So far as the first and second research questions are concerned that yes, it is 50 meter drill of High & Moderate Intensity Interval Training which significantly improved aerobic capacity of State level male Kho-Kho players and on the other hand, only high intensity interval training (HIIT) mostly improved the aerobic capacity (9.56%) than moderate intensity interval training (4.86%) in comparison to control group (CG).

Conclusion

After the completion of discussion the following conclusions have been drawn by the investigator: It is concluded that there is significant effect of High &

Moderate Intensity Interval Training through 50 meter drill on aerobic capacity of state level male Kho-Kho players. It is further concluded that 50 meter drill of high intensity interval training improved most the aerobic capacity of state level male Kho-Kho players. It is further concluded that high intensity interval training (HIIT) is more effective, beneficial and superior than moderate intensity interval training (MIIT).

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