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A Study on the effect of different intensity Training on Aerobic Efficiency of Kho Kho Player

Lanjewar Kunal Anil [1] * , Dr. Vinod Gupta [2]

1. PhD Student, Calorx Teacher's University,Ahmedabad,Gujarat, India, India
isobesin@gmail.com ,
2. Dept. of Physical Education,PhD Guide,Calorx Teacher's University,Ahmedabad, Gujarat, India, India

Abstract: The impact of varying training intensities on the aerobic efficiency of junior Kho-Kho players competing at the state level is investigated in this research. In order to examine the effect of high, moderate, and mixed interval training intensities on the players' aerobic capacity (as measured by VO2 Max), the study used a 50-meter drill. Each of the study's experimental groups outperformed the control group in terms of aerobic efficiency, with HIIT demonstrating the greatest increase. Athletes participating in high-intensity sports, such as Kho-Kho, may benefit greatly from intensity-specific training, according to this research.

Keywords: Sports, Kho-Kho, Athletes, Game, Training, Junior, Aerobic Efficiency

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INTRODUCTION

Playing games and sports in India dates back to ancient times. Some of the games and sports that have been played there include Kho-Kho, Kabaddi, Dog and the Bone, Gilli Danda, Kancha, Lattoo, Antakshari, and Chhupam Chhupai (Hide and Seek). When it comes to these indigenous games, Kho-Kho is one of the most popular games throughout the whole country, as well as in India and the Asian subcontinent. The history of the game of Kho-Kho is rather extensive. The game was first introduced in the Indian state of Maharashtra as a result of its widespread appeal among those who speak Marathi. Trying to figure out where Kho-Kho originated is a really difficult task. [1] A great number of historians believe that everything is nothing more than a modified form of the classic "Run Chase," the most fundamental version of which involves pursuing and touching a person of interest. Rathera was the name given to the game of Kho-Kho in the Indian state of Maharashtra. In ancient times, it was played on raths, which are traditional chariots. [2]

Playing Kho-Kho is similar to playing any other Indian sport in that it is simple, inexpensive, and enjoyable. This game is more thrilling than others since it requires practically all aspects of physical fitness, including agility, strength, speed, endurance, and a certain amount of skill. However, it is more interesting than others because it requires dodging, feinting, and controlled bursts of speed. Your growth as a team will include the development of values such as obedience, sportsmanship, loyalty, and responsibility. [3]

Kho-Kho is mentioned as a sport that dates back to ancient times in the Mahabharata, which is one of the oldest legendary works of the classics and should never be overlooked. The present edition of the game

does not comply to the same severe standards as the more recent versions, despite the fact that it takes place in 1914, during World War I. When I was there, the playground and the poles that separated the center lane were both totally level at that time. [4]

The evidence implies that this game has been played informally for a significant amount of time. The Deccan Gymkhana Club of Pune made an attempt to formalize the game in order to enhance its popularity throughout the country before it was officially recognized. [5] During the initial establishment of the Akhil Maharashtra Shareerika Shikshan Mandal in 1935, the norms of Aryapatya Kho-Kho and Hu-Tu-Tu were made available to the public. A number of adjustments have been made in order to better accommodate the overall playing environment. An essential component of the Indian game Kho-Kho, which translates to "Game of Chase" in English, is the "Active Chase," which is considered to be one of the most significant components of animal existence. [6]

Lokmanya Tilak, a notable Indian politician, is credited with establishing the first set of regulations at the Deccan Gymkhana in Pune, which was later named after him. However, the poles that would ordinarily be used to demarcate the central channel of the field were not present on the first stage, which was responsible for defining the boundaries of the playground. [7] The other players were directed to run around the two players who were stationed at the place, and they were to return to the center of the field since they were not as talented as the other players. The experts were enthralled by the game and came to the realization that it needed a top athlete who had rapid reflexes, excellent nerve reflexes, quick movement, and enormous endurance. In 1919, the game of Kho Kho was established on a field that was specified to be oval in shape and measured 44 yards in length and 17 yards in breadth. [8]

Throughout the annals of Kho-Kho history, there was never a predetermined course of action for the game. Within the first several decades of the 20th century, the Kho-Kho laws were first created. Gymkhana Baroda was the location where the Kho-Kho rules were first published in 1924. This transpired after the establishment of a committee in 1914 with the purpose of drafting the rules. [9]

In spite of the fact that each side has twelve players, only nine of them are allowed to take part in a game. The women's and men's teams each take turns pursuing and sprinting for seven or nine minutes throughout each of the two innings that they compete in. There will be a period of seven minutes for both the Sub Junior Boys' and Girls' competitions. Every single match is comprised of two innings in duration. For men, women, and junior boys and girls, there will be a break of six minutes after each innings. On the other hand, for sub-junior boys and girls, the pauses will be five minutes and three minutes, respectively. With the exception of the lobby, the dimensions of the field are as follows: 27 meters by 16 meters for men and women, 24 meters by 14 meters for junior boys and girls, and 27 meters by 14 meters for sub junior boys and girls. [10]

RESEARCH METHODOLOGY

- **Subject Selection**

At the outset, forty (40) male kho-kho players, spanning the ages of twelve to seventeen, were selected from the Raipur Kho-Kho Association in Chhattisgarh State. Initially, they were given a 50-meter sprint to complete, and their times were recorded down to the closest tenth of a second. After then, we sorted the

players' performances by how well they performed and placed them in one of three groups: the top 14 (the highest category), the middle 12 (the average or medium category), and the bottom 14 (the lowest category). In the end, twelve (12) participants were chosen for the study from the three groups mentioned before, with eight (8) individuals rejected from the top and bottom groups, respectively. Intentionally excluding the top four (4) players from the highest category and the worst four (4) players from the lowest category served to create more balanced groupings. Finally, the thirty-two participants were split evenly into four groups: HIITG, MIITG, CHMIITG, and CG, which stood for both the high and moderate intensity interval training groups.

- **Variables Selection**

The researcher discovered that aerobic and anaerobic efficiency significantly impact Kho-Kho players' performance after doing thorough searches, studies, and reviews of relevant material. However, no research on the aerobic and anaerobic efficiency of the Kho-Kho game has been conducted as of yet. Based on these sentiments and opinions expressed by coaches and experts in the area, as well as evaluations of relevant literature, the researcher chose the following factors to include in the current study:

- **The Dependent Variables were**

a. Aerobic Efficiency and.

b. Anaerobic Efficiency.

- **The Independent Variable was:**

50 Meters Drill of Different Intensity.

ADMINISTRATION OF TESTS

Test: Yo-Yo Intermittent Recovery Test (Level-1)

Jens Bangsbo, a soccer physiologist, devised the Yo-Yo Intermittent Recovery Test (Level-1) in 1990 and gave its first presentation in 1994 (Bangsbo, 1994). The validity and reliability of the test were further examined by Bangsbo and his colleagues.

Validity: r = 0.86

Reliability: r = 0.79

This test for aerobic fitness level is now being used by football teams from several nations, as well as by cricket teams from India, England, and Australia. This test is used to measure the aerobic fitness level of players in almost all games and sports, not only cricket and football.

Action to take: Twenty meters and five meters apart were three lines delineated by cones. Upon receiving the administrator's signal or order (via recorded beep), the subjects were instructed to begin running about 20 meters behind the center line, which is the beginning line. At the signal from the recorded beep, the

participants turn around and go back to the beginning. Subjects were required to walk or jog around the opposite cone, return to the starting position, and wait for the next beep during an active recovery phase that lasted 5 or 10 seconds between each 20-meter shuttle run. When participants failed to finish a shuttle within the allotted time, they were given a warning; the next time, they were removed from the experiment.

Scoring: The subject's score is determined by the level and number of shuttle jumps (20 meters) that they were able to complete before the recording beep caught up with them. The subject's most recent level was noted on their own score sheet. The final score was obtained after consulting the Yo-Yo Intermittent Recovery test norms table. You may get your VO2 Max from this level score. We may also manually calculate VO2 Max by looking at the distance that each participant has accomplished. For example,

YYIR1 test: $V0_2$ Max (ml/kg/min) = IR1 distance (m) × 0.0084 + 36.4

- **Reliability Of Data**

We assured the data's dependability by establishing the tester's and instrument's reliability.

- **Tester Reliability**

A number of practice sessions were held for testing procedures, methodologies, and techniques under the leadership of the supervisor to ensure that the researcher was well-versed in all aspects of the tests and measurements. Lastly, before to administering the examinations, the researcher held a practice session with all of the assistants, including coaches and experts.

- **Instrument Reliability**

The Physiology Laboratory of Visva-Bharati University's Department of Physical Education and Sport Science in Santiniketan authorized and calibrated all of the stop watches used to assess the participants' performance in the RAST test.

All markings were made using a calibrated and authorized measuring tape from the Physiology Laboratory at Visva-Bharati, Santiniketan's Department of Physical Education and Sport Science. The physiology laboratory at Visva-Bharati, Santiniketan's Department of Physical Education and Sport Science, calibrated and authorized the usage of the weighing equipment that participants wore in order to determine power (in Watts) related to anaerobic efficiency. Sony Private Limited developed the high-quality speakers that were used to play the Yo-Yo Intermittent Recovery test's recorded beep at level 1.

Analytical Method

The current research used the following statistical approaches for data analysis and interpretation:

a. Levene's Test of Equality and Descriptive Statistics were used to assess the groups' homogeneity.

b. The impact of a 50-meter drill with varying intensities on the aerobic and anaerobic efficiency of male Kho Kho players competing at the junior state level was investigated using One-Way Analysis of Co-

Variance (ANCOVA).

c. Whether there were notable changes in the analysis of covariance (ANCOVA), the Bonferroni Post-Hoc Test was used to examine whether there were significant differences in the pairwise means of the three experimental groups and the control group.

d. A significance threshold of p-0.05 was inculcated.

e. For every metric that was examined, the effect magnitude was announced with a 95% confidence level.

f. IBM SPSS Software, Version 25, was used for all statistical analyses.

RESULTS

The descriptive statistics for the four groups (HIITG, MIITG, CHMIITG, and CG) with regard to the pre- and post-test results for aerobic efficiency. The table also includes standard deviations (SD) and standard error means (SEM).

Table 1: Descriptive Statistics Pre- and post-test averages, standard deviations, and means for aerobic efficiency in kho-kho players for HIITG, MIITG, CHMIITG, and CG

Variavle	Pre test					Post test				
Aerobic Efficiency (Expressed As VO_2 Max)	GROUP	N	MEAN	SD	SEM	MEAN	SD	SEM	95% Confidence Interval	
									Lower Bound	Upper Bound
	HIITG	8	44.88	±2.18	0.40	49.77	±1.81	0.29	49.52	50.71
Unit:	MIITG	8	45.89	±2.83	0.35	48.50	±2.03	0.29	47.43	48.63
$ml.kg^{-1}$.	CHMIITG	8	45.09	±2.07	0.36	48.92	±1.27	0.29	48.50	49.69
min^{-1}	CG	8	45.39	±3.84	0.34	45.56	±0.73	0.29	44.90	46.09

The pre-test means of HIITG, MIITG, CHMIITG, and CG on aerobic efficiency were 44.88, 45.89, 45.09, and 45.39 (ml.kg¯1. min¯1), respectively. The post-test means, on the other hand, were 49.77, 48.50, 48.92, and 45.56 (ml.kg¯1. min¯1), respectively. The pre-test standard deviations for aerobic efficiency in the four groups (HIITG, MIITG, CHMIITG, and CG) were ±2.18, ±2.83, ±2.07, and ±3.84 respectively, whereas the post-test standard deviations were ±1.81, ±2.03, ±1.27, and ±0.73 respectively.

The standard error means of the four groups with regard to aerobic efficiency were 0.40, 0.35, 0.36, and 0.34 (ml.kg¯1. min¯1) in the pre-test, and 0.29, 0.29, 0.29, and 0.29 (ml.kg¯1. min¯1) in the post-test, as shown in table no. 01.

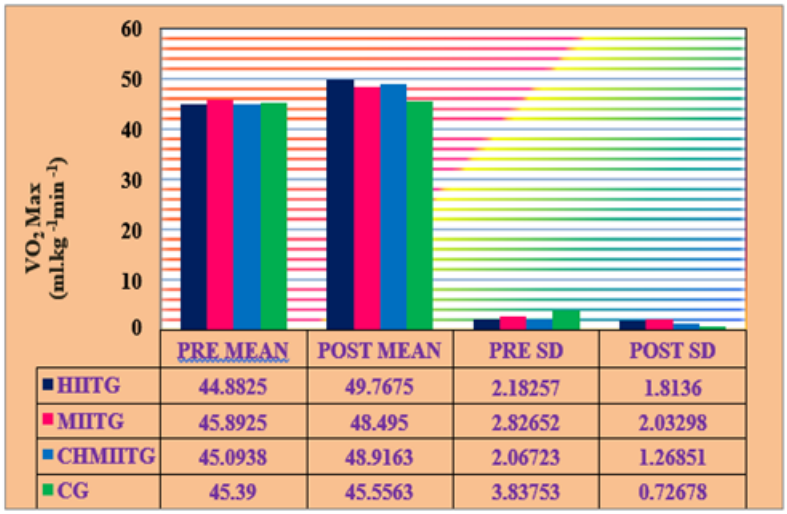

Figure 1: Standard Deviation of Pre- and Post-Test Aerobic Efficiency Measurements for Kho-Kho Players (HIITG, MIITG, CHMIITG, and CG)

Table 2: Pre- and post-tests on kho-kho players' aerobic efficiency: a one-way analysis of covariance (ANCOVA) including four groups

Variable		Group					Sum of Squares	df	Mean Sum of Square	F-ratio	p-value (Sig.)
	MEAN	HIITG	MIITG	CHMIITG	CG						
Aerobic Efficiency (Expressed As VO_2 Max) Unit: $ml.kg^{-1}.min^{-1}$	Pre Test Mean	44.88	45.89	45.09	45.39	A	4.60	3	1.53	0.19	0.90
						W	222.27	28	7.94		
	Post Test Mean	49.77	48.50	48.92	45.56	A	80.36	3	26.79	4.68*	0.01*
						W	160.44	28	5.73		
	Adjusted Post Mean	50.11	48.03	49.09	45.50	A	93.87	3	31.29	46.29*	0.000*
						W	18.25	27	0.68		

Results from the ANCOVA table (#02) show that the F-value and P-value for the pre-test were 0.19 and 0.90, respectively, with 3/28 degrees of freedom, indicating that the mean P-value of 0.90 is more than the 0.05 threshold of significance (P˜0.05). Thus, it was evident that the three experimental groups (HIITG, MIITG & CHMIITG) and the control group (CG) did not vary significantly in terms of aerobic efficiency in the pre-test period.

With 3/28 and 3/27 degrees of freedom in both cases, the P-values (0.01 and 0.000) are less than the 0.05 level of significance (P<0.05). Nevertheless, the "F"-values for the post test and adjusted post test mean were 4.68 and 46.29, respectively. As a result, differences in aerobic efficiency were statistically significant among the four experimental groups (HIITG, MIITG, CHMIITG) and the control group (CG).

Also, in terms of aerobic efficiency, the training groups showed significant improvements compared to the control group (CG): HIITG gained 10.15 percent, MIITG gained 5.58 percent, and CHMIITG gained 7.91 percent.

After determining that there was a statistically significant difference between the post-test and adjusted post-test means using analysis of covariance (ANCOVA), the researcher compared the means of each pair of variables using the Bonferroni Post-Hock test, as shown in table no.: 03.

Table 3: Aerobic Efficiency of Kho-Kho Players: A Bonferroni Post-Hoc Test Comparing HIITG, MIITG, CHMIITG, and CG with Regard to Adjusted Post-Test Means

Variable	Group				SEM	Mean Difference	p- value (Sig.)
	HIITG	MIITG	CHMIITG	CG			
Aerobic Efficiency (Expressed As VO_2 Max) Unit: $ml.kg^{-1}.min^{-1}$	50.11	48.03		45.50	0.41	4.62*	0.000*
				45.50	0.41	2.54*	0.000*
			49.09	45.50	0.41	3.60*	0.000*
	50.11	48.03			0.41	2.08*	0.000*
	50.11		49.09		0.41	1.02	0.12
		48.03	49.09		0.41	-1.06	0.10
*Significant at 0.05 level, p≤0.05							

According to the results of the Bonferroni Post-Hoc Test (table no. 03), the experimental groups (HIITG, MIITG, CHMIITG) vary significantly from the control group (CG) with regard to the adjusted final means of the aerobic efficiency of Kho-Kho players. For the reason that the (ml.kg¯1. min¯1) adjusted mean differences for HIITG & CG, MIITG & CG, and CHMIITG & CG were 4.62, 2.54, and 3.60, respectively. In contrast, the P-values for all three matched groups were less than the 0.05 threshold of significance ($p<0.05$), as shown by the values of 0.000, 0.000, and 0.000, respectively.

Additionally, it can be shown in table no.: 03 that the aerobic efficiency of Kho-Kho players differs significantly between the two experimental groups, HIITG and MIITG. It is evident that the P-value (0.000) is less than the 0.05 threshold of significance ($p<0.05$) due to the fact that the adjusted mean difference was 2.08 (ml.kg¯1. min¯1), particularly between the two groups (HIITG & MIITG).

Nonetheless, there was no statistically significant difference between the other two sets of experimental groups, HIITG and CHMIITG and MIITG and CHMIITG. The reason behind this is that in regards to the aerobic efficiency of Kho Kho players, the adjusted mean difference between the two pairs of experimental groups (HIITG & CHMIITG and MIITG & CHMIITG) was 1.02 and -1.06 (ml.kg¯1. min¯1), respectively, with P-values of 0.12 (P¸0.05) and 0.10 (P¸0.05).

DISCUSSION

A player's ability to work aerobically and anaerobically is crucial in the game of Kho-Kho. Physical fitness components like as speed, strength, agility, endurance, response ability, kinesthetic sense, etc. are also very necessary for this game, in addition to aerobic and anaerobic efficiency. Not a single study that could demonstrate the proportion of aerobic and anaerobic efficiency required for this game was located by the researcher. Based on what we know about the game, however, it clearly calls for a very high degree of aerobic and anaerobic fitness. You may get the energy your muscles need to work out in an aerobic or

anaerobic environment. When muscle contractions are quick and forceful, anaerobic mechanisms provide the energy. In contrast, aerobic processes and, later, aerobic metabolism provide the energy for longer periods of muscle contractions (Bayek, 2011).

Regarding the first study question, it was: "would the 50 Meters Drill significantly enhance the aerobic efficiency of male Kho-Kho players at the junior state level?" All three experimental groups HIITG, MIITG, and CHMIITG saw substantial improvements in aerobic efficiency compared to the control group (CG) after completing the 50-meter drill of varying intensities of interval training. Results showed a significant improvement when the experimental groups were given the 50 Meters Drill to complete for eight weeks. The athletes' improved performance after the 50 Meter Drill is only the result of their bodies adjusting to the exercise.

There has been a plethora of research on the training adaptations linked to aerobic endurance. All sports rely on aerobic metabolism, which is fundamental to human performance (Tomlin & Wenger, 2001). When aerobic energy is produced, the primary metabolic processes are the electron transport chain and the Krebs cycle. Aerobic metabolism utilizes fuel sources such as fat, carbs, and proteins to generate ATP, resulting in much more energy than anaerobic metabolism. Training for many sports is necessary because of the complex interplay between aerobic and anaerobic metabolism (Gregory & Travis, 2015a) One of them, Kho-Kho, also requires the anaerobic and aerobic metabolic systems to work together.

An increase in maximum oxygen uptake (VO2 Max) together with an increase in maximal cardiac output is one of the most often observed adaptations to aerobic endurance training. This has been studied by Brooks et al. (1996), Drinkwater and Horvath (1972), Hickson and colleagues (1988), and Vogel et al. (1986). Oxygen consumption reaches its maximum during maximally exerted activity. Even if oxygen is still available, peak oxygen intake has been reached when consumption can no longer rise to meet needs. According to Åstrand et al. (2003), an athlete's genetic potential and beginning fitness level are two factors that influence the extent to which aerobic endurance training may enhance aerobic power, which can range from 5% to 30%.

As a result, the current research found that physiological adaptations and mechanical alterations were crucial underlying the substantial increase on aerobic efficiency. The correct implementation of the 50-meter drill of varying intensities during interval training is solely responsible for the increase in aerobic efficiency. According to Åstrand et al. (2003), an athlete's aerobic power may be increased by 5% to 30% via aerobic endurance training and the adaptations that occur to the muscles as a result of training. All of the training that takes place during the year need to be of varying intensities.

The training intensity may be measured and established in a variety of ways. As a percentage of the best performance, one may measure the training intensity (Schmolinsky, 2004). A peak performance would thus signify the highest level of intensity. Here are six intensity zones: Super-maximal (>100), Maximal (90-100), Heavy (80-90), Medium (70-80), Low (50-70), and Very Low (<50). Researchers used three intensity zones high (Maximum), moderate (Medium), and a mix of the two in this investigation.

Training load should be increased gradually; this is a fundamental aspect of sports training. When making adjustments to volume and intensity in an effort to raise training load. Approaches to adjusting the training

load include: (T. Bompa & Haff, 2009)[Open Access].

a) Make the training session last longer.

b) Train there more often.

c) Train with more sets and repetitions each drill.

d) Extend the time or distance covered in each repeat or drill.

Methods for adjusting the level of difficulty in a workout include:

a) Go faster as you cover the same distance.

b) Make the amount heavier.

c) Maximize the exercise's potential energy output.

d) Shorten the time between sets of tactical exercises or repetitions.

e) Participate in more tournaments while training

Accordingly, the researcher in this study added more training load and thought of a training regimen that adhered to Bompa training principles. While other variables like intensity, volume, repetitions, session duration, etc. were left unchanged, the researcher in this study gradually increased training load by decreasing the rest interval between repetitions every two weeks. Over the course of the training, he kept the work-to-rest interval ratio (WRI) at 1:5, 1:4, 1:3, and 1:2 for weeks one through two, three through four, five through six, and seven through eight, respectively. In this study, the researcher divided the participants into three groups and gave each one of them one of three training protocols: HIIT, MIIT, or CHMIIT, which stands for a combination of the two extremes. Through a 50-meter drill, individuals were given three different types of high-intensity interval training (HIIT), moderate-intensity interval training (MIIT), and a combination of the two (CHMIIT). Consequently, the aerobic capacity of junior state level kho-kho players improved significantly across all experimental groups compared to the control group (CG).

When it comes to developing and maintaining aerobic power, intensity is a major consideration. Interval sprints, when performed with brief but intense rest periods in between, may increase maximum oxygen intake. Callister et al. (2015b) demonstrated that including extended rest intervals during sprints increased sprint speed without substantially increasing peak aerobic power (Gregory & Travis, 2015b) [Open Access]. Hence, decreasing gains in aerobic capacity are the outcomes of training sessions that are longer and have a greater quantity of rest in between episodes. Multiple studies have shown that training with shorter recovery times between high-intensity intervals improves endurance performance by enhancing metabolic processes in skeletal muscles (Gibala & McGee, 2008). The researcher in this study also used shorter rest intervals between repetitions, decreasing them as the training progressed while keeping the ratios at 1:5, 1:4, 1:3, and 1:2, respectively.

The Bonferroni Post-Hoc Test revealed that the control and experimental groups were significantly different. Following the right protocols for high-intensity interval training, moderate-intensity interval

training, or a mix of the two yielded notable improvements in all of these outcomes. Aerobic efficiency improved by 10.15%, 5.58%, and 7.91% compared to the control group after eight weeks of HIITG, MIITG, and CHMIITG training, respectively. Perhaps it was a result of training at various intensities. The HIITG, MIITG, and CHMIITG groups received eight weeks of exercise at 90%, 70%, and a mix of 90% and 70% intensity, respectively. The control group did not receive any training. According to the aforementioned research, increasing aerobic endurance via high-intensity interval training is superior to that with moderate-intensity interval training. The highest percentage difference, according to the literature and research, is between HIITG and CG, the second maximum is between CHMIITG and CG, and the smallest is between MIITG and CG.

However, when it comes to the aerobic efficiency of Kho-Kho players, HIITG is significantly different from MIITG. This is due to the fact that they received varying forms of interval training, which greatly improved their performance. However, there is no discernible difference between MIITG and CHMIITG and HIITG and CHMIITG. In particular, there is a difference, although a non-significant one, between HIITG and CHMIITG, and MIITG and CHMIITG. It was also clear that CHMIITG improved more than MIITG and almost as much as HIITG; in terms of improvements across experimental groups, CHMIITG ranked second. The use of HIIT and MIIT training in conjunction caused this to occur. In particular, this set of participants alternated between high- and moderate-intensity training sessions. There was no significant difference between HIITG and CHMIITG, or between MIITG and CHMIITG, which is why its adaption processes were much better than MIITG. With regard to the enhancement, the HIITG, CHMIITG, and MIITG were ranked first, second, and third, respectively. Not only is HIIT superior than MIIT, but CHMIIT is also advantageous, as is shown in the current research. Consequently, compared to MIIT, HIIT and CHMIIT are much better.

The Kho-Kho players' aerobic efficiency was the subject of the third study question, which aimed to determine the optimal intensity training for the 50-meter drill. In fact, the 50-meter drill's high-intensity interval training (HIIT) was the most effective in increasing Kho-Kho players' aerobic efficiency, with CHMIIT and MIIT following closely behind.

CONCLUSION

According to the research, junior state level Kho-Kho players may greatly improve their aerobic efficiency via the use of varied intensity interval training. In terms of effectiveness, HIIT was determined to be tops, followed by a mix of high and moderate intensity, and finally moderate intensity on its own. In sports that call on both aerobic and anaerobic capabilities, the findings show how important it is to have a specific intensity training program to boost performance. These results provide strong evidence that Kho-Kho players may significantly enhance their physical fitness and competitive ability by including exercises of varying intensities into their training programs.

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