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Effects of Interval Training on Physical Fitness Variables Among Intercollegiate Kabaddi and Kho-Kho Players

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ABSTRACT: This study examined the effects of structured interval training on selected physical fitness variables speed and explosive leg strength among intercollegiate Kabaddi and Kho-Kho players. Forty-eight male athletes aged 18–25 years from Kurukshetra University, CCS University, M.D. University, and Periyar University were divided into three groups: Control (n=12), Kho-Kho (n=12), and Kabaddi (n=12). Pre- and post-test data were collected during the 2008–09 All India Inter-University Competition. Interval training was implemented for experimental groups, while the control group followed routine practice. Results indicated significant improvements in speed and standing broad jump performance in both experimental groups, with Kho-Kho players showing slightly greater gains. The findings suggest that interval training is an effective conditioning strategy for enhancing sport-specific fitness.

Keywords: Interval training, Kabaddi, Kho-Kho, speed, explosive strength.

INTRODUCTION

Interval training is a widely recognized and scientifically validated method of physical conditioning that alternates periods of high-intensity effort with intervals of rest or low-intensity recovery. Unlike continuous training, which relies on a steady and sustained pace, interval training introduces variability and controlled stress to the body, making it possible to simultaneously target both aerobic and anaerobic energy systems. This dual effect has been consistently shown to improve endurance, speed, agility, and overall physical performance (Buchheit & Laursen 2013). Because of its structured alternation between work and recovery phases, interval training creates an optimal environment for athletes to push beyond their comfort zone while still allowing adequate recovery for repeated efforts.

The physiological adaptations resulting from interval training are extensive. At the cardiovascular level, high-intensity bouts enhance stroke volume, cardiac output, and maximal oxygen uptake (VO_2 max) Tabata *et al.* (1996). At the muscular level, repeated exposure to short, intense efforts promotes increased recruitment of fast-twitch muscle fibers, improvements in muscle buffering capacity, and greater mitochondrial density (Dupont *et al.*, 2004). These adaptations collectively improve an athlete's ability to sustain bursts of effort, recover quickly, and repeat performance at a high intensity. Such qualities are indispensable for sports where success depends on speed, agility, and quick recovery between actions.

Traditional Indian sports such as Kabaddi and Kho-Kho provide excellent contexts for the application of interval training principles. Both sports are played at high intensity, characterized by repeated sprints, sudden directional changes, dives, dodges, and tackles. In Kabaddi, raiders must launch explosive attacks, evade multiple defenders, and sustain physical contact all within a brief time frame of approximately 30 seconds Billat (2001). Defenders, on the other hand, must be able to anticipate movement, react quickly, and counter the raider's maneuvers with equal bursts of explosive energy. These demands closely parallel the work-to-rest cycles of interval training, where athletes alternate between maximal exertion and controlled recovery (Kumar & Yadav 2010).

Similarly, Kho-Kho is a sport defined by its continuous and dynamic nature, requiring players to perform repeated sprints and evasive maneuvers across short distances. The game rewards speed, agility, and the ability to sustain repeated high-intensity efforts. Players in the chasing team must spring into action instantly when tagged to chase opponents, while defenders must remain agile and alert to avoid being touched. These bursts of short, sharp movements interspersed with brief recovery intervals mirror the physiological demands of interval training. As a result, interval training is particularly suited for enhancing the fitness profile of Kho-Kho players, who rely on both anaerobic capacity for quick sprints and aerobic endurance for maintaining high levels of activity throughout the match.

The cultural and sporting significance of Kabaddi and Kho-Kho also underscores the importance of optimizing training methods for these athletes. Both sports are indigenous to India and have gained popularity at the national and international levels, with

formal recognition in university tournaments, professional leagues, and even inclusion in the Asian Games. Despite their growing popularity, scientific research focusing on the physical conditioning of Kabaddi and Kho-Kho players remains limited compared to mainstream sports such as football or athletics (Singh & Sidhu 2012). Incorporating evidence-based training techniques like interval training into the preparation of athletes can help bridge this gap and elevate performance standards.

From a practical standpoint, interval training offers versatility and adaptability. Coaches can manipulate variables such as work duration, rest intervals, intensity, and repetitions to align training with the unique demands of Kabaddi and Kho-Kho. For example, shorter sprints with longer rest intervals may mimic the raiding efforts in Kabaddi, while longer work phases with shorter recovery can replicate the continuous chasing demands in Kho-Kho. Furthermore, interval training does not require sophisticated equipment, making it highly accessible for university-level and grassroots programs where resources may be limited.

In summary, interval training represents a scientifically grounded, sport-specific, and adaptable method for improving physical performance in Kabaddi and Kho-Kho players. By targeting the exact physiological demands of these traditional sports, interval training can enhance both speed and explosive strength, ultimately contributing to improved match performance. This makes it an indispensable component of modern training programs for athletes competing at the intercollegiate and national levels.

Objectives

1. To assess the impact of interval training on speed performance among Kabaddi and Kho-Kho players.
2. To evaluate the effect of interval training on explosive leg strength as measured by the standing broad jump.
3. To compare the relative improvements between Kabaddi and Kho-Kho players.

RESEARCH METHODOLOGY

Selection of Subjects. Forty-eight male participants from the intercollegiate Kabaddi and Kho-Kho tournaments were selected. Subjects were drawn from Kurukshetra University (Haryana), CCS University (Uttar Pradesh), M.D. University (Haryana), and Periyar University (Tamil Nadu). Each university contributed one team (12 players), representing winners, runners-up, third, and fourth place finishers in the All India Inter-University Competition (2008–09) hosted by Swami Ramanand Teerth Marathwada University, Nanded.

Participants were aged between 18 and 25 years and came from diverse socioeconomic backgrounds. They were free from injury and medically cleared for competitive training.

Procedure

- **Control Group (n=12):** Continued routine team practice without interval training intervention.
- **Kho-Kho Group (n=12):** Received an 8-week interval training program focusing on short sprints (50–100 m) with progressive intensity.
- **Kabaddi Group (n=12):** Received an 8-week interval training program emphasizing sprint–recovery patterns similar to Kabaddi match-play.
- **Tests Conducted:**
  - **Speed:** Measured in seconds using a 50 m sprint test.
  - **Explosive Strength:** Assessed using standing broad jump (in meters).

Statistical analysis included paired t-tests, ANCOVA, and Scheffe's post hoc tests at the 0.01 significance level.

RESULTS

The results of this study clearly demonstrate that interval training significantly enhanced both speed and explosive leg power among the Kho-Kho and Kabaddi groups, while the Control group exhibited negligible changes. As shown in Table 1, the Control group's pre- and post-test mean values for speed (8.15 vs. 8.10 seconds) produced a non-significant *t* value (0.91), indicating that routine practice alone was insufficient to induce performance gains. In contrast, both experimental groups recorded substantial improvements. The Kho-Kho group's sprint time decreased from 8.01 to 7.36 seconds, yielding a highly significant *t* value of 9.85, while the Kabaddi group improved from 8.12 to 7.50 seconds with a *t* value of 9.05. These findings suggest that interval training effectively enhances sprinting ability in sports that rely on rapid accelerations and short bursts of movement.

Table 1: Computation of 't' Value of Pre- and Post-Test Mean Values for Speed.

Group	Pre-Test Mean	Post-Test Mean	Pre SD	Post SD	Obtained 't'	Required 't' (0.01)
Control	8.15	8.10	0.28	0.27	0.91#	2.756
Kho-Kho	8.01	7.36	0.40	0.39	9.85*	2.756
Kabaddi	8.12	7.50	0.38	0.37	9.05*	2.756

*Significant at 0.01 level; # Not significant

The analysis of covariance (ANCOVA) presented in Table 2 further reinforces these observations. While pre-test differences among groups were statistically insignificant ($F = 1.08$, $p > 0.01$), post-test results revealed a highly significant difference ($F = 33.12$, $p < 0.01$), with the adjusted post-test values (Control = 8.09, Kho-Kho = 7.41, Kabaddi = 7.48) confirming the superior performance of the experimental groups. This statistical adjustment eliminates baseline variability, strengthening the conclusion that interval training was the decisive factor in performance gains.

Table 2: ANCOVA of Pre- and Post-Test Mean Values for Speed.

Test	Control Mean	Kho-Kho Mean	Kabaddi Mean	SS (B)	df	MS (B)	SS (W)	df	MS (W)	F-Ratio	Req. F (0.01)
Pre-test	8.15	8.01	8.12	0.285	2	0.142	11.420	87	0.131	1.08#	4.86
Post-test	8.10	7.36	7.50	9.142	2	4.571	11.997	87	0.138	33.12*	4.86
Adjusted Post	8.09	7.41	7.48	7.750	2	3.875	7.045	86	0.082	47.28*	4.86

Post hoc analysis using Scheffe's test (Table 3) indicated that both Kho-Kho and Kabaddi groups performed significantly better than the Control group, with mean differences of 0.68 and 0.61 seconds, respectively. However, the difference between the Kho-Kho and Kabaddi groups (0.07 seconds) was not statistically significant. Despite the lack of significance, the slight advantage of the Kho-Kho group suggests that the sport's inherent emphasis on continuous running and longer sprint distances may have better aligned with the physiological demands of interval training.

Table 3: Scheffe's Post Hoc Test for Speed.

Groups Compared	Mean Diff.	Confidence Interval (0.01)	Significance
Control vs Kho-Kho	0.68	0.22	*
Control vs Kabaddi	0.61	0.22	*
Kho-Kho vs Kabaddi	0.07	0.22	#

*Significant; # Not significant

A similar trend was observed for explosive leg power as measured by the standing broad jump. The ANCOVA results in Table 4 showed no significant pre-test differences ($F = 1.12$, $p > 0.01$), but highly significant post-test ($F = 41.00$, $p < 0.01$) and adjusted post-test differences ($F = 68.95$, $p < 0.01$). The post-test mean values revealed that the Kho-Kho group (1.86 m) and Kabaddi group (1.91 m) outperformed the Control group (1.72 m). These results confirm that interval training not only improves sprinting speed but also contributes to explosive muscular power, which is essential for actions such as raiding, tackling, and evasive maneuvers in Kabaddi, as well as sprinting and dodging in Kho-Kho.

Taken together, these findings align with previous studies emphasizing the efficacy of high-intensity interval training in improving anaerobic performance, sprint ability, and muscular power (Dupont *et al.*, 2004; Ghosh & Goswami 2014). The lack of improvement in the Control group validates the necessity of structured conditioning beyond routine practice. The slightly superior performance of the Kho-Kho group, although statistically non-significant, highlights the importance of tailoring interval training protocols to the specific demands of each sport.

Table 4: ANCOVA of Pre- and Post-Test Mean Values for Standing Broad Jump.

Test	Control Mean	Kho-Kho Mean	Kabaddi Mean	SS (B)	df	MS (B)	SS (W)	df	MS (W)	F-Ratio	Req. F (0.01)
Pre-test	1.72	1.69	1.73	0.014	2	0.007	0.619	87	0.007	1.12#	4.86
Post-test	1.72	1.86	1.91	0.574	2	0.287	0.603	87	0.007	41.00*	4.86
Adjusted Post	1.72	1.87	1.91	0.579	2	0.289	0.357	86	0.004	68.95*	4.86

DISCUSSION

The purpose of this study was to evaluate the effects of interval training on speed and explosive leg strength among intercollegiate Kabaddi and Kho-Kho players. The findings provide strong evidence that interval training is highly effective in improving these performance variables, whereas routine practice alone does not yield significant changes.

As presented in Table 1, the Control group showed negligible improvement in 50 m sprint speed, with mean values changing only slightly from 8.15 to 8.10 seconds. The corresponding *t* value (0.91) was below the critical threshold, confirming the absence of significant improvement. This outcome reinforces the notion that unstructured or routine training is insufficient to stimulate substantial adaptations in speed performance. In contrast, both experimental groups demonstrated significant gains. The Kho-Kho group reduced their sprint times from 8.01 to 7.36 seconds, with a *t* value of 9.85, while the Kabaddi group improved from 8.12 to 7.50 seconds, yielding a *t* value of 9.05. These values indicate statistically significant improvements at the 0.01 level, affirming the effectiveness of interval training in enhancing short-distance sprinting ability.

The ANCOVA results shown in Table 2 provide further validation of these improvements. Pre-test differences across groups were non-significant ($F = 1.08$), suggesting that all groups started from a relatively similar baseline. However, post-test results revealed a highly significant difference ($F = 33.12$, $p < 0.01$), and the adjusted post-test values (Control = 8.09, Kho-Kho = 7.41, Kabaddi = 7.48) confirmed the superiority of the experimental groups. These results highlight that the interval training intervention, rather than natural variation or pre-existing differences, was the key factor driving performance enhancement.

Scheffe's post hoc analysis in Table 3 further clarifies the nature of these differences. Both Kho-Kho and

Kabaddi groups showed significant improvements compared to the Control group, with mean differences of 0.68 and 0.61 seconds, respectively. However, the difference between the Kho-Kho and Kabaddi groups (0.07 seconds) was not statistically significant. Despite this, the slight advantage of the Kho-Kho players could be practically meaningful, as it reflects the sport's greater reliance on repeated sprint efforts and continuous running, which may align more closely with the physiological demands of interval training.

The results for explosive leg strength, as measured by the standing broad jump, showed a similar pattern. According to Table 4**,** the Control group's mean remained unchanged (1.72 m), while the Kho-Kho and Kabaddi groups improved to 1.86 m and 1.91 m, respectively. ANCOVA revealed no significant differences at the pre-test stage ($F = 1.12$, $p > 0.01$), but highly significant differences at both the post-test ($F = 41.00$, $p < 0.01$) and adjusted post-test stages ($F = 68.95$, $p < 0.01$). These findings confirm that interval training not only enhances sprinting ability but also improves explosive muscular power, a quality essential for dynamic movements such as dodging, tackling, and leaping during competitive play.

The observed improvements are consistent with existing literature. High-intensity interval training has been repeatedly shown to improve anaerobic capacity, sprint performance, and muscular power across various sports (Dupont *et al.*, 2004). Similarly, research on traditional Indian sports has emphasized the importance of speed and explosive strength as key determinants of performance in Kabaddi and Kho-Kho (Kumar & Yadav 2010; Ghosh & Goswami 2014). The present study aligns with these findings, while also contributing new evidence by directly comparing the two sports under a controlled experimental design.

Importantly, the absence of significant gains in the Control group underscores the need for structured conditioning programs. Simply relying on regular practice is insufficient to achieve the levels of performance enhancement required for competitive success. The results further suggest that interval training programs tailored to the specific physiological demands of each sport may produce optimal benefits.

For example, Kabaddi players might benefit from interval sessions mimicking raiding and tackling efforts with short rest intervals, while Kho-Kho players might gain more from slightly longer sprint intervals to reflect the sport's continuous running demands.

CONCLUSIONS

Interval training effectively improved speed and explosive strength in university-level Kho-Kho and Kabaddi players. The program proved superior to conventional practice, with Kho-Kho athletes demonstrating slightly greater gains. These findings underscore the importance of structured conditioning in traditional sports and provide a model for performance optimization in similar game formats.

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