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Effects of Multimodal High-intensity Interval Training on Speed, Agility and Performance Level among Cricket Players

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ABSTRACT

Background: Multimodal high-intensity interval training emerges as a popular training method that combines aerobic and resistance training throughout a single exercise session for improving the lower body exercise capacity in professional cricket players. **Objective:** To determine the effects of this multimodal training on speed, agility and performance levels among cricket players. **Methodology:** The Pakistan Sports Board, Pakistan Cricket Board, and many cricket academies in Lahore conducted this randomized controlled experiment. Two groups of subjects were selected at random; one group underwent multimodal high-intensity interval training, while the other group received traditional training in six weeks. Before and during the intervention, the athletes' subjective performance scale, agility t-test, and speed test results were evaluated. A summary of the group measures taken throughouttime was displayed using frequency tables, pie charts, and bar charts. A paired sample t-test was used for the speed test score and agility t-test score. The Wilcoxon test was used for subjective sports performance satisfaction. An independent t-test was performed to compare the groups' analyses of speed test scores and agility test scores. Mann-Whitney U test was used for group analyses of subjective sports performance satisfaction. **Results:** Improvement in subjective sports performance satisfaction scale (p=.000), agility t-test (p=.000), and speed test (p=.000) was observed in multimodal training. Improvement in subjective sports performance satisfaction scale (p=.000), agility t-test (p=.000), and speed test (p=.000) were observed in conventional training. Multimodal training significantly improved outcome measures in comparison to conventional HIIT i.e. improved subjective sports performance satisfaction scale (p=.014), agility t-test (p=.013), and speed test (p=.015). **Conclusion:** The study concluded that the multimodal high-intensity interval training group was found more effective in improving subjectiveSports Performance Satisfaction scale, agility t-test, and speed test than conventional HIIT in cricket players.

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INTRODUCTION

The multifaceted cricket sports require a wide range of sophisticated motor skills, such as those related to interceptive, hitting, and far-aiming tasks.[1] 50 overs are played in a single day for an ODI match. The game's initial format, known as the test format, is the second format.[2] In a five-day cricket test match, each squad performs two innings, for a mean of 80 to 90 innings each day.[3] India won its first World Cup in 2007, and this version was founded in 2006. With 20 levels, the short game takes less than three hours to finish. There are two teams in it, and each has twenty overs to play.[4]

Athletic performance and motor fitness are closely connected ideas. The ability of a person's neuromuscular system to carry out a task or activity is referred to as motor fitness.[5] Athletes participate in specialized training regimens meant to strengthen these elements to increase their motor fitness and their athletic ability.[6] For instance, to increase strength and speed, a sprinter could use plyometric exercises, while a basketball player might include agility drills in their training.[7]

Numerous studies have found that the elements of motor skill differ according to the role in athletic activity, the type of match, and the competitors' sexes. Sports achievement can be strongly impacted through such distinctions.[8] Motor fitness was the most extensive examination of all the physical fitness components.[9] These actions can be carried out by a player with strong motor skills quickly, powerfully, and accurately.[10] Furthermore, by maintaining the body in good physical shape, motor fitness can aid in the prevention of injuries.[11]

Therefore, cricket players must sustain an exceptionally high standard of wellness.[12] When assessing motor fitness, other important elements including aggression, learning speed, teamwork, and education should be considered.[13] A player can develop endurance, speed, and power, as well as preserve perfect form, with the support of physical fitness.[14] Furthermore, a healthy motor skill set might help lower the chance of injury.[15] Cricket performance is heavily reliant on motor fitness, much like many other sports.[16] Historically, cricket has not placed the same value on fitness as other sports.[17] Motor fitness is crucial for aggressive fielding and rapid bowling, especially over-arm tosses, dashing between wickets, and hitting.[18] Athletes who possess adequate speed and agility can run more rapidly and perform better than those who do not.[19] In Australia, it was determined that, compared to other game formats, batting in the Twenty20 format demands more effort from the batsman.[20] The demand for South African cricket players surged by around 28% between 1970 and 1999 because of the way their matches are structured: four five-day, four three-day, and three one-day matches, with no one-day international matches.[21]

Renowned cricket coach Richard Stoner was taken aback by the squad's level of stamina and way of life when he visited Pakistan.[22] Professional cricket players should think about enhancing their aerobic fitness using a variety of general aerobic training methods, as studies have shown that aerobic performance aids in recuperation.[23] Sports-specific interval training is unique in that it replicates the stop-start nature of competition.[24] Repeated high-intensity (but not maximal) bursts lasting 45 to 2-4 minutes make up for HIIT.[25]

While moderate-intensity continuous training (MCT) is the gold standard advised in various guidelines, Workout with high-intensity intervals was acknowledged to be a substitute as well as a more successful regimen.[26] HIIT has recently been demonstrated to be a safe and effective strategy.[27] According to research, there is a higher chance of injury when practicing HIIT; this risk can only be reduced by adhering to the FITT principle and warming up properly.[28] A field test approach called the Yo-Yo intermittent recovery test involves many shuttles in a field that has been measured previously.[29]

The combination of many exercise kinds in a training program called multi-modal HIIT enhances agility and speed. Strength training activities are incorporated into it to enhance muscle power and strength. For quick motions like running, jumping, and throwing, this is crucial. Cricket players can enhance their overall performance on the pitch, decrease the chance of injury, and improve their speed and agility by combining several exercise types into a high-intensity training program. The purpose of the study was to determine the effects of multimodal HIIT training on speed, agility and performance levels among cricket players.

METHODOLOGY

The study is a randomized clinical trial study in which the data was collected from the Pakistan Sports Board, Pakistan Cricket Board and other cricket academies of Lahore. The research spanned six months following the approval of the synopsis. Using the Cleveland Clinic sample calculator and using parent studies done on Football players.[36] Pre-intervention value was 7.8 while post-intervention value was 7.5 with SD 0.3. By adding an attrition rate of 10% we get the sample size equal to 36. In Group A, Intervention was applied to the multimodal HIIT group and in Group B Control group was applied to the conventional HIIT group. The research employed a non-probability convenience sampling technique,utilizing a lottery method for randomization. Inclusion Criteria were age 18 to 30 years, male and female players volunteered to participate in the study.[29]

Exclusion criteria were systemic disease e.g. anaemia, SLE and multiple sclerosis, neuro-musculoskeletal disease e.g. muscular dystrophy, respiratory problems e.g. bronchitis, COPD and asthma, cardiovascular disease e.g. coronary heart disease, aortic disease and stroke[29]. Performance was assessed using the athletes' subjective performance scale (ASPS). Thirty questions make up the level of performance scale (LSPS), which measures seven essential components of athletic performance: speed, core training, anxiety and stress management, tolerance for discomfort, self-assurance, handling obstacles, and contentment. For the LSPS, the average Cronbach's value is 0.95.

Predictions that score on the LSPS show a stronger correlation with well-being (0.45) than with function (0.36) have been validated by analyses. According to reports, the scale's dependability was 0.96 after the match and 0.97 before it.[38] Participants initiated the t-test from the photocell at the starting point and were instructed to run to the cone positioned 10 meters ahead. Subsequently, they were required to run to the second cone on the left, situated 5 meters away, and then proceed to the third cone, parallel to the second cone and located 10 meters away. Participants then ran from the third cone back to the first cone. Finally, they jogged back to the starting point, completing the test by passing through the photocell.[13] The t-test has been deemed highly valid according to Pauole et al.

In terms of reliability, the t-test demonstrated a value of 0.95 (95% CI, 0.81–0.98).[39] The test setup involved marking out a sprint distance of 17.68 meters, utilizing the lines on a cricket pitch. Timing gates were strategically positioned at the start and finish, set as low to the ground as possible to measure the sliding bat. During the test, participants carried a cricket bat, ensuring the bat passed over the crease in the timing gate beam, triggering the measurement when the bat left the gate. The player then sprinted along the pitch, extending the bat and sliding it through the final gates. Participants were encouraged to continue running hard past the finish line. This test, commonly used in sports such as the NFL, soccer, and field hockey, has a high validity.[40] Its reliability is significantly enhanced when timing gates are employed.

It's essential to consider weather conditions and the type of running surface, documenting these factors alongside the results. If possible, setting up the track with a crosswind helps minimize the impact of wind on the test results.[38] Cone markings, timing gates, stopwatch, market flat surface, and measuring tape. All participants completed consent forms before the study began and after learning the important information about the therapies and research. Recruitment was carried out where the person fulfils all the inclusion criteria and is screened according to exclusion criteria. Afterwards, an agility test, sprint test values and a filled subjective performance scale questionnaire were taken. Following that, participants were randomized to either Group A or B.

The participants were assigned at random using the lottery technique, with the allocation kept secret using sealed envelopes. Group A included multimodal HIIT protocol followed by sprinting followed by 2 minutes of rest, burpees with 3-minute rest between sets and push-ups 4-5 reps at 80-100% of HR max with a total of 20 minutes' exercise per session a day 3 times a week followed by six weeks.[40] Group B included conventional protocol with 4-5 repetitions of 40 seconds maximum running at 80-100% HR max followed by 20 seconds of walking for 20 minutes' exercise per session 3 times a week followed by six weeks. The data was analyzed using SPSS for version 25. Statistical significance was set at P=0.05. The normality of the data was checked. Parametric tests were applied for the speed test

score and agility test score. A non-parametric test was applied for Subjective Sports Performance Satisfaction. The following tests were used: A summary of the group measures taken throughout time was displayed using frequency tables, pie charts, and bar charts. A paired sample t-test was used for the speed test score and agility t-test score. The Wilcoxon test was used for subjective sports performance satisfaction. Difference between Groups: An independent t-test was performed to compare the groups' analyses of speed test scores and agility test scores. Mann- Whitney test was used for group analyses of Subjective Sport Performance Satisfaction.

RESULTS

The total sample size of this study was 36. Group A had 18 participants and group B had 18 participants. Group A had a mean and standard deviation of age 20.66±2.08. Group B had a mean and standard deviation of age 21.22±2.18. Group A out of 18 had 14 (77.8%) male and 4 (22.2%) female. Group B out of 18 had 13 (72.2%) males and 5 (27.8%) females. The Shapiro-Wilk test was used for normality. The p-values were greater than the selected alpha 0.05, which indicates data of speed test score at Pre-treatment, the agility t-test score at Pre-treatment was normally distributed therefore the parametric test was applied.

The parametric test included a paired t-test that was used to determine the significant difference within group subjects and an independent sample t-test was used to determine the significant difference between the two groups. The p-value of the Shapiro-Wilk test for subjective sports performance satisfaction at pre-treatment was less than the selected alpha 0.05. The data of this variable was not normally distributed, therefore nonparametric test was applied. The significant difference between the group participants was ascertained using the Wilcoxon signed ranktest while the Man Whitney U test was used to determine the significant difference between the two groups. The pair t-test shows that there was a significant difference in the mean value of the speed test score and agility test score within group A and B subjects' post-treatment ($p<.05$).

Wilcoxon signed-rank test shows that there was a significant difference in the mean value of Subjective Sports Performance Satisfaction within group A and B subjects' post-treatment ($p<.05$). An independent sample t-test shows that there was a significant difference in the mean value of speed test score and agility t-test score between group A and B subjects after post-treatment ($p<.05$). The Man Whitney test shows that there was a significant difference in the mean value of subjective sports performance satisfaction between both group A and B post-treatment ($p<.05$).

DISCUSSION

The current study indicates a noteworthy improvement in cricket players through multimodal high-intensity interval training, specifically in the areas of speed, agility (as assessed by the t-test), and subjective sports performance satisfaction scale. The findings suggest positive effects on these performance parameters due to the implemented training regimen. A study was conducted by Suppiah et al. in 2019 that assessed how high-intensity functional interval training affected young badminton players' sprint, agility, and aerobic fitness.

Table 1. Subjective Sports Performance Satisfaction within Group A and B subjects

Subjective Sports Performance Satisfaction: Wilcoxon Signed-Rank Test					
Groups	**Performance Satisfaction**	**N**	**Mean±SD**	**Percentiles 50th (Median)**	**p-value**
Group A	Pre-treatment	16	38.16±7.40	40.50	.000
	Post-treatment	16	46.22±7.41	48.00	
Group B	Pre-treatment	16	36.50±7.50	36.00	.000
	Post-treatment	16	39.88±7.36	40.00	

Table 2. Speed Test score within group A and B Subjects

Speed Test Score: Paired t-test				
Groups	**Variable**	**N**	**Mean±SD**	**p-value**
Group A	Pre-treatment	16	4.14±.44	.000
	Post-treatment	16	3.32±.411	
Group B	Pre-treatment	16	4.01±.48	.000
	Post-treatment	16	3.70±.44	

Table 3. Agility Test within Groups A and B Subjects

Agility Test: Paired t-test				
Groups	**Variable**	**N**	**Mean±SD**	**p-value**
Group A	Pre-treatment	16	11.34±1.04	.000
	Post-treatment	16	7.65±.68	
Group B	Pre-treatment	16	11.70±.90	.000
	Post-treatment	16	8.48±1.15	

Table 4. Comparison of Subjective Sports Performance Satisfaction between Groups A and B subjects

Mann Whitney U Test: Subjective Sport Performance Satisfaction						
		N	**Mean Rank**	**Sum of Ranks**	**Z**	**p-value**
Subjective Sports Performance Satisfaction at Pre-treatment	Multimodal HIIT	18	19.69	354.50	-.686	.493
	Conventional HIIT	18	17.31	311.50		
	Total	36				
Subjective Sports Performance Satisfaction at Post-treatment	Multimodal HIIT	18	22.75	409.50	-2.446	.014
	Conventional HIIT	18	14.25	256.50		
	Total	36				

The experimental group (EG) engaged in high-intensity functional interval training and the control group (CG) engaged in traditional training. The findings demonstrated that after 10 weeks of high-intensity functional interval training, VO^2 max and agility performance increased significantly without adversely affecting the ability to sprint.[35] These findings are in harmony with the current study by showing the effectiveness of high-intensity interval training on speed and agility in players. The difference between the two studies is in the sport of athletes, the current study has taken cricket players, while the above study has taken badminton players.

A study conducted by Aschendorf et al. (2019) investigated how young female basketball players were impacted by a 5-week high-intensity interval training program tailored to basketball. Ten HIIT sessions tailored to basketball were added by the training group (TG) to theirusual team workout, while the other group carried on with their team training regimen and acted as CG. There were different basketball-specific drills in each HIIT session. Both with and without the ball, the sprint and agility tests in the TG showed clearly beneficial results.[30] The study results are in line with the present study by showing the beneficial effects of HIIT over agility and speed in players.

Table 5. Comparison of Speed Test Scores Between Groups A and B Subjects

	Treatment group of patients	N	Mean±SD	Mean Difference	p-value
Speed Test Score at Pre-treatment	Multimodal HIIT	18	4.14±.44	.131	.405
	Conventional HIIT	18	4.01±.48		
Speed Test Score at Post-treatment	Multimodal HIIT	18	3.32±.41	-.374	.013
	Conventional HIIT	18	3.70±.44		

Table 6. Comparison of Agility Test Score Between Groups A and B Subjects

	Treatment Group of Patients	N	Mean±SD	Mean Difference	p-value
Agility Test Score at Pre-treatment	Multimodal HIIT	18	11.34±1.04	-.358	.280
	Conventional HIIT	18	11.70±.90		
Agility Test Score at Post-treatment	Multimodal HIIT	18	7.65±.68	-.823	.015
	Conventional HIIT	18	8.48±1.15		

The stated study differs from the current study by genders of athletes taken, the current study has taken both genders, while the above study has taken only females. A study was conducted by Sanchez-Sanchez in 2018 that evaluated high-intensity training added to regular training on young female basketball players. The athletes were randomly assigned to either HIT with one (HIT-COD1) or three COD (HIT-COD3) changes of direction (COD). This was done to compare the effects of HIT with one versus three COD on young female basketball players' performance. Athletes completed the Triple Standing Dominant (TS-D) and Non-dominant (TS-ND) Jump, the Modified Agility T-test (MAT), the V-cut, the TS-D and TS-ND with COD tests, and the 30-15 Intermittent Fitness Test (30-15IFT).

In comparison to HITCOD1, HIT-COD3 showed higher gains in RSAm and VIFT, according to the between-group comparison. In conclusion, young female basketball players' performance is improved when HIT-COD drills are added to their basketball training, particularly when three CODs are included in HIT.[33] The study results follow the recent study by showing the positive effects of HIIT on agility in players. Another study was conducted by Carvutto et al. (2021) that evaluated how eight weeks of non-traditional training specifically, HIFT affected the agility and sprinting ability of young soccer players. The experimental group (NTT) engaged in HIFT, and the control group (TT) received conventional training. HIFT consisted of functional exercises, agility, HIIT, technical exercises, and the capacity to shift direction. To evaluate sprint performance and agility, respectively,following 8 weeks of training, a non-significant improvement in sprint performance was observed and a significant interaction Group x Time was discovered for NTT for agility.[31] The study resultsare in concordance with the current study by showing the beneficial effects of HIIT on agility, but in contrast with the current study, no beneficial effects of HIIT were observed on speed.

A systematic review was conducted by Faude et al., in 2017 to assess how multimodal injury prevention programs (IPP) affected young athletes' neuromuscular performance. The sports studied were hurling, basketball, field hockey, futsal, and Gaelic football. For balance/stability, leg power, isokinetic hamstring and quadriceps strength, and the hamstrings-to-quadriceps ratio, a little overall effect in favour of IPP was observed. For sprint skills and sport-specific

talents, a significant overall effect was discovered.[32] The study stated that multimodal IPP has a positive impact on sprint which is in alignment with the current study. A study conducted by Silva et al. (2022) examined the impact of high-intensity resistance training (HIRT) on the physical fitness of young adult male soccer players. HIRT intervention with a control group that engaged in merely routine technical and tactical training. It has been shown that eight weeks of three sessions per week of HIRT lead to notable gains in aerobic capacity, the ability to sprint at short (10 m) and medium (20 and 30 m) distances, and the ability to sprint repeatedly. The findings imply that HIRT may be a useful strategy for enhancing physical fitness and modifying the levels of hormones and antioxidants in adult male soccer players.[34] The study results are in line with the recent study by showing the positive effects of HIIT on sprint in athletes.

CONCLUSION

Multimodal high-intensity interval training and conventional protocol, both groups showed improvement in speed, agility and performance in cricket players. Significant improvement was observed in multimodal high-intensity interval training in improving speed, agility and performance in cricket players.

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