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High-Intensity Workouts for Female Rugby Players: Improving Speed, Agility, and Cardiovascular Fitness

Dr. Anjali.O[1], Dr. Sreekala KG[2]

[1]AssociateProfessor, Sree Neelakanda Government Sanskrit College, Pattambi,Kerala. Email: 9995915496a@gmail.com.Phone ;9995915496.

[2] Assistant professor, IASE, Thrissur. Email- sreekalaanilkumar@gmail.com.

Abstract
High-Intensity Interval Training (HIIT) involves alternating between short periods of high-intensity exercise and brief intervals of lower-intensity activity, significantly elevating heart rates. Despite evidence demonstrating HIIT's psycho-physiological benefits, there is a research gap regarding its potential to induce sport-specific adaptations for enhanced performance. Addressing this gap is crucial for providing evidence-based insights for athletes and coaches. This study investigates the impact of an 8-week HIIT program on speed, agility, and resting heart rate (RHR) in 30 female rugby players (aged 17-25) from Calicut University's inter-collegiate level. Divided into experimental and control groups, the former participated in a rugby specific HIIT regimen while the latter did not. Pre- and post-intervention assessments used a 60-meter sprint for speed, a stethoscope for RHR, and an agility cone drill. Results indicated significant improvements in the experimental group across all measures, with no significant changes in the control group, highlighting the efficacy of sport specific HIIT in enhancing performance.
Key words: *HIIT, Speed, Agility, Resting heart rate, Rugby.*

Introduction

High-Intensity Interval Training (HIIT) is an interval exercise regimen that alternates between short bursts of high-intensity movements, elevating the heart rate to at least 80% of its maximum, and brief periods of lower-intensity activity. As an alternative to moderate or low-intensity continuous workouts, HIIT effectively enhances both endurance and anaerobic performance. Despite sessions lasting only 15–30 minutes, HIIT offers benefits comparable to or greater than those of longer moderate-intensity exercise sessions. Although there is substantial evidence supporting the physiological benefits of HIIT, a notable gap exists in research focusing on HIIT's potential to induce sport-specific adaptations that enhance performance in chosen sports. Tailoring HIIT protocols to closely mimic the demands of specific sports is essential for optimizing performance. Sport-specific adaptations involve designing training programs that replicate the movements, intensity, and energy systems used in a particular sport. By addressing these unique demands through targeted HIIT protocols, athletes may achieve more transferable improvements in skills such as speed and agility. Closing this research gap is crucial for providing athletes, coaches, and sports scientists with evidence-based insights into how HIIT can be optimized for specific sports training. This includes understanding ideal work-to-rest ratios, exercise selection, and intensity levels that align with the requirements of individual sports. There is increasing recognition among researchers and practitioners of the importance of tailoring training programs to the specific needs of athletes in various sports. Ongoing and future studies focusing on sport-specific adaptations through HIIT are likely to contribute valuable insights to sports science and conditioning.

Gregory Dupont and colleagues (2004) observed significant enhancements in running performance among soccer players following a 10-week HIIT program. Florian Azad Engel and colleagues (2018) concluded that HIIT positively impacted running speed, oxygen consumption at various lactate- or ventilatory-based thresholds, and sprint running performance. Buchheit et al. (2009) compared high-intensity interval training (HIT) to specific game-based handball training (HBT) and found both effective for adolescent handball players, though HBT was preferred for its game-based specificity. Jaime Fernandez and colleagues (2015) found that combining high-intensity training with sport-

specific drills significantly improved VO2peak and VIFT in young tennis players, with notable enhancements in the 505 Agility Test, though no changes in sprint tests were observed. C.B. Harrison and colleagues (2015) suggested that a mix of game-based training and HIIT is the preferred method for improving aerobic power in young athletes.

To date, no comprehensive review has specifically examined the diverse adaptations resulting from HIIT exclusively in young athletes. This research gap is significant as responses to HIIT may differ in athletes compared to diseased or untrained children. A focused analysis through systematic reviews, investigating the specific adaptations, benefits, and potential considerations of HIIT in young athletes, is crucial. This exploration would provide essential insights into the unique physiological and performance effects of HIIT tailored to this demographic. Closing this research gap could significantly refine training protocols, enhance injury prevention strategies, and optimize overall performance in young athletes.

Methodology

Subjects

Thirty female rugby players, aged 17-25, from various colleges under Calicut University were selected for this study. They were randomly divided into two groups: the experimental group (N=15), which received HIIT, and the control group (N=15), which did not receive any training. Both groups underwent baseline assessments of speed, agility, and resting heart rate using appropriate tests. The experimental group participated in an 8-week HIIT program, while the control group received no training. Participants were fully informed about the study, provided signed informed consent, and were not given any incentives aside from refreshments. Participation was voluntary.

Design and Study Setting

This study utilized a two-group pretest-posttest design to evaluate the effect of a specially designed HIIT program on selected physical fitness components: speed, agility, and resting heart rate. The experiment was conducted simultaneously at two colleges of Calicut University. Participants were given a thorough explanation and demonstration of the HIIT program. The first two weeks of the program focused on foundational exercises, followed by two weeks of strength conditioning. Weeks four to five emphasized speed and power development, and the final 12 days included rugby-specific training. Post-training assessments of the fitness variables were conducted using the same tests as the baseline assessments. Participants also completed a demographic data sheet to provide information on age, gender, height, weight, and level of sport participation.

Resting Heart Rate

Resting heart rate (RHR) is the number of heartbeats per minute while at rest, sitting or lying down. For adults, a normal RHR ranges from 60 to 100 beats per minute. A lower RHR typically indicates a more efficient and fit heart. For instance, an athlete might have an RHR around 40 beats per minute. In this study, RHR was measured using a stethoscope for accuracy.

Flying Sprint Test

The flying sprint test measures an individual's speed over a 60-meter distance. This test can be conducted manually with a stopwatch or electronically with timing gates. It provides valuable information on an athlete's speed, acceleration, and power, helping identify strengths and weaknesses in performance.

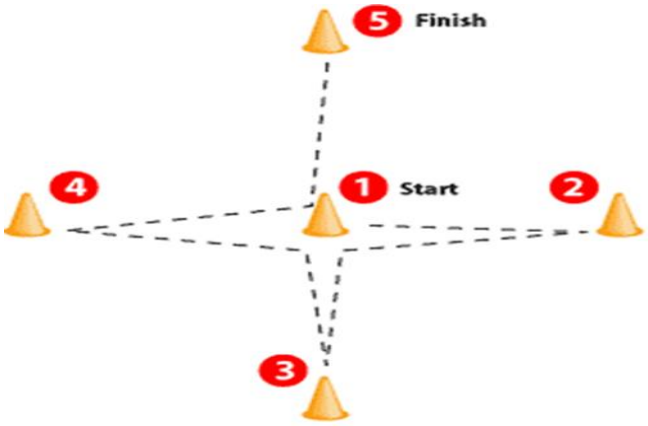
Agility Cone or Compass Drill

The agility cone drill, also known as the compass drill, assesses lateral movement, body control, and the ability to change direction. Equipment required includes a stopwatch or timing gates, measuring tape or chalk, five marker cones, and a flat, non-slip surface. Cones are arranged in a diamond shape with four outer cones placed 3 meters from a central cone.

Procedure:

1. The participant crouches behind the center cone, placing their left hand on it and facing forward.
2. They run to the right, touch the first cone, return to the center, and proceed to the next cone.
3. This sequence is repeated for all cones, ending with a sprint through the finish line.
4. Timing starts when the participant's hand leaves the center cone and stops when their chest crosses the finish line.
5. After a three-minute rest, the drill is repeated in the opposite direction (counter clockwise).

Scoring:
The time to complete the test is recorded in seconds to the nearest two decimal places for each direction. The average time of the two trials is calculated to determine the score.



8 WEEK RUGBY –SPECIFIC HIIT PROGRAMME				
	Frequency	***Duration***	***Session 1***	***Session 2***
Week 1-2 Foundation phase	2-3 sessions /week	20 minutes	**Cardiovascular Endurance** 30 seconds sprinting (at maximum effort) 30 seconds rest (light jogging or walking) Repeat for 15 minutes	**Basic Bodyweight Circuit** 40 seconds work (bodyweight squats, push-ups, lunges) 20 seconds rest Repeat for 15 minutes
Week 3-4 Strength and conditioning	3 sessions /week	25 minutes	**Interval Sprints and Agility** 20 seconds sprinting (maximum effort) 40 seconds agility drills (e.g., ladder drills) Repeat for 20 minutes	**Strength Circuit** 30 seconds work (weighted squats, bench press, rows) 30 seconds rest Repeat for 20 minutes
Week 5-6 Power and speed development	3-4 session/week	30 minutes	**Interval Sprints and Agility** 20 seconds sprinting (maximum effort) 40 seconds agility drills (e.g., ladder drills) Repeat for 20 minutes	**Strength Circuit** 30 seconds work (weighted squats, bench press, rows) 30 seconds rest Repeat for 20 minutes
Week 7-8 Rugby-specific Training	4-5 session/week	35 minutes	**Rugby-Specific Drills** Incorporate movements specific to rugby (e.g., shuttle runs, tackle simulations, quick direction changes) Repeat for 30 minutes	**Advanced Strength and Conditioning Circuit** 40 seconds work (dynamic movements, compound exercises) 20 seconds rest Repeat for 30 minutes

Statistical analysis

Statistical analysis consisted of basic statistics to determine pre- and post-test means and standard deviations. A paired samples t-test was used to determine if a significant change took place in the measurements at post-test. Data was analysed using commercial software (Statistical Package for Social Sciences (SPSS) Version 23, Chicago, IL) and statistical significance set at $P<0.05$.

Results and Discussion

Table 1 shows the mean and SD of each pair (pre and post)of the three variables (BMI, balance and core strength) for experimental as well as control group. In experimental group it is clear that for each pair, the mean scores of the post groups were better (lower score in RHR47.60±2.16) and Agility (time taken to complete cone/ compass test) (11.60 ±.95) indicate an improved performance than the pre group, with uniformly lower values SD. In speed ability (time taken to complete 75 mts sprint) post groups mean scores (9.726 ±.730) are higher than the pre group (10.32 ±.89). In the case of control group there was not much differences between the pre and post test scores.

TABLE 1 Descriptive statistics

Physiological variables		**HIIT training group (Experimental group) N=15**		**RUGBY Group (Control group N=15)**	
		Mean	**SD**	**MEAN**	**SD**
RESTINGHEART RATE(RHR)	PRE TEST	48.4667	2.64215	50.1333	2.44560
	POST TEST	47.6000	2.16465	49.8667	2.41622
AGILITY(Agility cone/compass drill Test)	PRE TEST	12.0807	1.01515	12.3934	.88183
	POST TEST	11.6053	.95397	12.3720	.78406
SPEED (time in seconds for 60 Mts dash)	PRE TEST	10.3280	.89359	10.7467	.74896
	POST TEST	9.7260	.73029	10.7480	.74957

**A lower score in RHR, Agility and Speed indicates improved performance

Figure 1.Comparison of pre and post test scores of HIIT training of Experiment and Control group

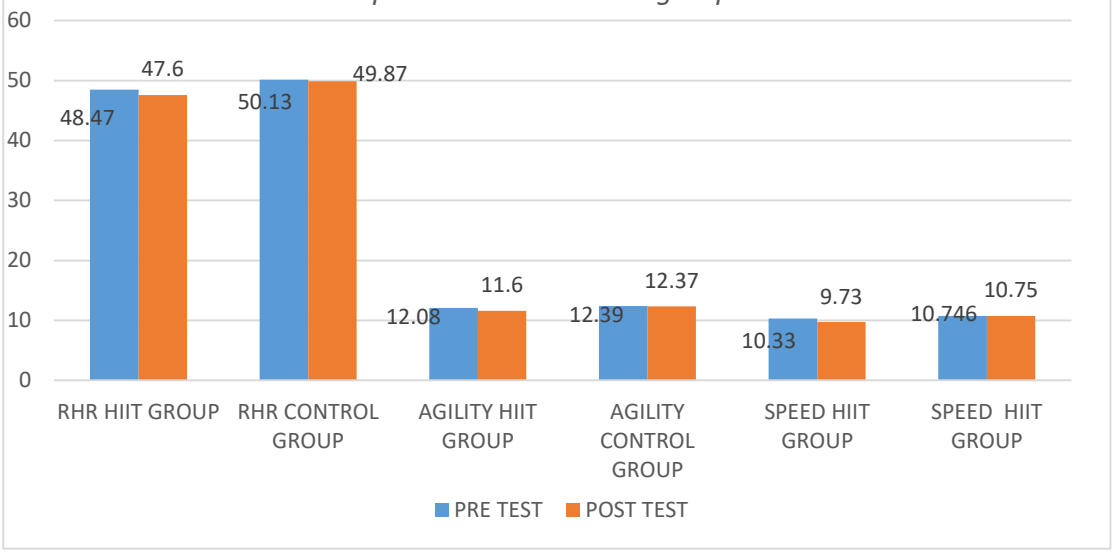


Table 2 indicates the results of Paired T test conducted on the pre post test scores of HIIT training group and controlled group. It is seen that in the case of HIIT group there is significant difference (P<0.01) exist between the pre and post group indicating the positive effect of the training program. The score of control group shows no significant difference in any of the selected variables (P>0.001).

Table 3.Paired sample T test of HIIT

Fitness components	HIIT Group N=15				CONTROL GROUPN=15			
	MEAN DIFFERENCE	SD	t	P VALUE	MEAN DIFFERENCE	SD	t	P VALUE
RESTING HEART RATE (RHR)	.86667	.91548	3.666	.003	.26667	.70373	1.468	.164
AGILITY (CONE/COMPASS Test)	.47533	.39172	4.700	.000	.02140	.22803	.363	.722
SPEED (Time in seconds for 50 mts dash)	.60200	.28897	8.068	.000	-.00133	.01922	-.269	.792

Discussion

The current study's findings indicate that participants who underwent an 8-week High-Intensity Interval Training (HIIT) program experienced positive outcomes, including improvements in Resting Heart Rate (RHR), agility, and speed. These results are consistent with previous research that consistently demonstrates enhancements in various fitness components. For instance, a study by Gregory Dupont and colleagues (2004) on soccer players revealed significant improvements in running performances after a 10-week HIIT program. Additionally, a 2018 review study by Florian Azad Engel and colleagues concluded that HIIT had a predominantly positive impact on running speed, oxygen consumption at various thresholds, and sprint running performance. HIIT,

characterized by alternating short bursts of intense exercise with periods of rest or lower-intensity activity, serves as a potent cardiovascular challenge. This structured interval format not only fortifies the cardiovascular system but also fosters efficiency in blood circulation and oxygen delivery, ultimately resulting in a lower resting heart rate over time. The cardiovascular adaptations induced by HIIT play a pivotal role in optimizing oxygen delivery to muscles, thereby enhancing their capacity to perform at heightened intensities and elevating overall speed and agility.

Limitations of the study

The current study is subject to certain limitations. Firstly, the sample size was restricted, and a larger population might have yielded more comprehensive and impactful results. Secondly, the study focused exclusively on young, active female rugby players, and as such, the findings cannot be generalized to the non-athletic population.

Conclusion

The results of the 8-week High-Intensity Interval Training (HIIT) program indicate that it effectively reinforces the body and complements overall fitness. This finding has practical implications for physical educators, coaches, and fitness trainers, providing them with a valuable tool to enhance physical performance. Implementing HIIT exercises in training programs is particularly beneficial for several compelling reasons. Firstly, HIIT exercises place a strong emphasis on speed, agility, and cardiovascular fitness, which are integral components in virtually all sports. The development of these abilities not only allows athletes to generate more speed and stamina but also helps in reducing the risk of injuries associated with physical activity. Moreover, the challenging nature of HIIT goes beyond physical improvements; it also plays a crucial role in fostering mental toughness and resilience. Athletes engaging in HIIT regularly develop the mental fortitude necessary to withstand the physical and mental demands of competitive sports. This mental resilience can contribute significantly to an athlete's ability to perform optimally under pressure. However, it is important to approach the incorporation of HIIT into an athlete's training regimen with careful consideration. Individual fitness levels, specific sport requirements, and overall training goals should be considered to design a tailored HIIT program that maximizes benefits while minimizing the risk of injury. Consulting with sports performance professionals or coaches is recommended to ensure that the HIIT program is well-suited to the athlete's needs and aligns with the demands of their sport.

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