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Original Article

Comparison of low -intensity steady state training versus high-intensity interval training on key health-related physical fitness components

RAMON CARLO MASAGCA[1]
[1]College of Sports, Exercise, and Recreation, Bulacan State University, PHILIPPINES

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Abstract:
This study investigated the impact of three different training regimens—Low-Intensity Steady State (LISS), High-Intensity Interval Training (HIIT), and Random Physical Activity (RPA)—on diverse facets of physical fitness among 144 college students with no prior regular exercise experience. The objective is to assess the effectiveness of these training protocols in improving cardiorespiratory endurance, muscular endurance, and flexibility levels. To evaluate the impact of each training program, both within-group and between-group comparisons are performed. The procedures include a ten-week intervention period for each group, during which fitness evaluations such as the One-minute Push-up Test (OMPUT), Plank Test (PT), Sit-and-Reach Test (SART), and 3-minute Step Test (3MST) are conducted. The statistical analyses include the use of the Kruskal-Wallis test and followed by Tukey-Kramer analysis for comparisons between groups, along with paired t-tests for comparisons within groups. The in-group comparison showed significant improvement in all components for both genders. LISS improved flexibility, cardiorespiratory endurance, and muscular endurance.
Keywords: low-intensity steady state, high-intensity interval training, physical activity.

Introduction

Increased cardiovascular endurance is associated with improved physical well-being, including enhanced cerebral white matter integrity (Johnson et al., 2012), reduced risk of high blood pressure (Sui et al., 2017), enhanced ability to perform multiple activities (Wong et al., 2015), and potential decrease in coronary heart disease and mortality (Gander et al., 2015). Muscular endurance, vital for fitness (Robert and Hockey, 1973), predicts lower BMI (Ding & Jiang, 2020; García-Hermoso et al., 2019), reduces obesity risk, and is linked to lower all-cause mortality and cardiovascular disease risk (Corder et al., 2019), emphasizing its role in weight management and disease prevention. Flexibility, crucial for physical well-being, is particularly important in athletics, positively influencing essential fitness components such as muscle power and strength (Arntz et al., 2023). Low cardiovascular fitness predicts cardiovascular disease and mortality in adults (Raghuveer et al., 2020; Zeihen et al., 2019). Physical inactivity is a recognized predictor of cardiovascular disease, with engagement in moderate and high-intensity exercise regimens mitigating its effects (Franklin et al., 2022). Low cardiovascular fitness correlates with higher body mass index and increased waist circumference, elevating susceptibility to cardiovascular disease (Berge et al., 2019; Carbone et al., 2020). It also correlates with psychological distress and is established as a predictor of psychological health (Zeihen et al., 2019). High cardiovascular fitness is associated with increased mental toughness, particularly among athletes (Latif et al., 2022). Despite its health significance, low muscular endurance adversely affects athletic performance, increases injury risk, and correlates with cardiovascular diseases and metabolic factors (Ambegankar et al., 2012; Artero et al., 2012; Cohen et al., 2014; Walker et al., 2017). It also impacts psychological well-being, increasing susceptibility to anxiety and psychiatric conditions (Ganasarajah et al., 2019; Ortega et al., 2012). Premature mortality, especially through an elevated risk of suicide before the age of 55, further underscores the implications of low muscular endurance (Ortega et al., 2012). Poor trunk flexibility is linked to arterial stiffness, affecting athletic performance and causing lower back pain in elite divers (Carroll & Mock, 2023; Shrimpf et al., 2019). Enhancing cardiovascular endurance, muscular endurance, and flexibility through regular exercise is vital for overall health and well-being, mitigating the risk of cardiovascular diseases, improving mental health, and promoting general fitness and disease prevention.

High-intensity interval training (HIIT), characterized by brief bouts of exercise at near-maximal effort interspersed with short recovery periods (Mari, 2021), is efficacious for enhancing cardiorespiratory endurance (Hurst et al., 2019) and exercise capacity (Atakan et al., 2021). HIIT has demonstrated effectiveness in improving VO2max comparable to repeated sprints and moderate-intensity continuous training (Stankovic et al., 2023; Ramirez-Velez et al., 2019). Studies have shown HIIT to enhance flexibility in various populations, including high school students and military personnel (Muanjai et al., 2021; Baynaz

Corresponding Author: RAMON CARLO MASAGCA, E-mail: ramoncarlo.masagca@bulsu.edu.ph

et al., 2017; Sukarno et al., 2023). Additionally, HIIT training has been associated with improved muscular strength and endurance, as evidenced by increased maximum push-up repetitions and enhanced performance in various athletic activities such as soccer, field hockey, rugby, tennis, and cross country (Islam et al., 2020; Bento & Raimundo, 2021; da Silva et al., 2021; Impellizzeri et al., 2008; Meckel et al., 2014; Safania et al., 2011; Harrison et al., 2015a; Sandbakk et al., 2013, 2011; Fernandez-Fernandez et al., 2015). Conversely, exercise significantly improves cardiorespiratory fitness, surpassing Tai Chi in cardiovascular endurance enhancement (Steele et al., 2021). Additionally, a positive relationship exists between aerobic power and muscle fitness (Zoeller et al., 2005). Endurance training conducted three times per week for 12 weeks effectively enhances hamstring flexibility (Raja, 2021). Moreover, Zoeller et al. (2005) emphasize the significant impact of low-intensity steady-state (LISS) training on upper extremity and core strength. Hence, both high-intensity interval training (HIIT) and LISS training, positioned at opposing extremes of the intensity continuum, are effective therapies for improving cardiovascular endurance. In conclusion, HIIT and LISS training are effective methods for improving cardiovascular endurance, flexibility, and muscular strength, offering versatile options for enhancing overall fitness.

Recent comparative study has demonstrated the effectiveness of both HIIT and LISS exercises in improving cardiovascular factors, including body composition and cardiorespiratory fitness (Steele et al., 2021; Martin-Smith et al., 2020; Atakan et al., 2021). While HIIT is particularly effective for enhancing aerobic capacity, especially among the senior population (Atakan et al., 2021), both HIIT and LISS exercises have been found to produce similar effects on VO2max and outcomes of the Wingate test in untrained individuals (Foster et al., 2015). However, there is a lack of investigation into the comparative effectiveness of different training programs in enhancing physical fitness components such as cardiopulmonary endurance, muscular endurance, and flexibility. Therefore, this study aims to evaluate the efficacy of HIIT and LISS in enhancing specific health-related physical fitness components, including a comparison of HIIT with LISS to assess their effectiveness.

Materials and methods

Research Design

The study employed quantitative study to examine the impact of three training program, namely LISS, HIIT, and RPA on several health-related fitness components of untrained collegiate students. Specifically, the study will utilize an experimental design known as a single group pretest-post test design. This design will be conducted among groups to examine the impact of a certain type of exercise on each group. Furthermore, it employs the Kruskal-Wallis test to assess the possible variation among different types of exercise. Finally, scores that exhibited a significant difference were subjected to Tukey Kramer analysis.

Participants and Sampling

The study included 144 untrained collegiate students who were selected using a random selection method. The data was divided into three groups: LISS (n=48), HIIT (n=48), and RPA (n=48). Table 1 displays the gender distribution of the participants. An investigation conducted recently analyzed exercise preferences among three training programs. LISS comprises 30 men and 18 females, whilst HIIT is formed of 29 females and 19 males. The RPA group has 27 females and 21 males.

Table 1. Sample distribution

Group	Female	Male	.ll
LISS	18(12.50%)	0(20.83%)	48(33.3%)
HIIT	29(20.15%)	9 (13.19%)	48(33.3%)
RPA	27(18.75%)	1 (14.58%)	48(33.3%)
Total	**74(51.39%)**	**0(48.61%)**	**144(100%)**

Table 2 displays the demographic characteristics of the participants. The LISS group had an average height of 1.68 ±0.09 meters, an average weight of 59.78 ±8.06 kilograms, and an average BMI of 21.18 ±3.44. The HIIT group had an average height of 0.08 ± 0.08 meters. The average weight was 53.79 ± 12.49 kilograms. The mean BMI was 19.35 ± 3.81. The RPA group had an average height of 1.61 ±0.07 meters, an average weight of 52.05 ±10.64 kilograms, and an average BMI of 20.03 ±3.32.

Table 2. Characteristics data of the participants

Group	Height	Weight	BMI
LISS	1.68 ± .09	59.78± 8.06	21.18±3.44
HIIT	1.66 ± 0.08	53.79 ± 12.49	19.35 ± 3.81
RPA	1.61 ±. 07	52.05± 10.64	20.03 ± 3.32

Instruments

The study utilized selected health-related fitness component tests, including the 3-minute step test (3MST), one-minute push-up test (OMPUT), plank test (PT), and sit-and-reach test (SART). The 3MST assesses cardiopulmonary endurance through submaximal exercise (Shakya et al., 2023), while the OMPUT measures muscular endurance in the arms and pectoral muscles (Fischer et al., 2016). The plank test (PT) evaluates overall core muscle endurance (Tong et al., 2014), and the SART assesses hamstring flexibility (Jiang et al., 2022). These tests are established methods for evaluating specific physical fitness components among untrained college students.

Data Gathering Procedure

The HIIT workout adheres to a work-to-rest ratio of 2:1. The participant performed the exercise for a duration of 30 seconds. Following this, there will be a 15-second interval of rest. This will be the protocol followed until all nine exercises have been completed. Table 3 shows the exercises included in the training program.

Table 3. 10-week high-intensity interval training program

	Week 1-3	Week 4-6	Week 7-10
Station	**Exercise**		
1	Jumping Jacks	Jumping Squats	Maximal Jump
2	BW Squats	Push ups	Lateral Jumps
3	Push ups	Russian Twist	Calf jump
4	High knees	Bicycle crunches	Flutter kicks
5	Mountain climber	Plank shoulder taps	Dead bug position
6	Burpees	Jump Lunges	Glute bridge
7	Lunges	Side plank R	hinge and squat
8	Calf jump	Side plank L	Forward Lunge
.9	Butt kicks	Leg Raise	Static Lunge

Table 4 shows the individuals who were assigned to perform LISS cardio workouts, such as jogging. It was emphasized that the exercise intensity should fall between a range of 1 to 4 on the Rating of Perceived Exertion (RPE) scale. The initial time was set to 10 minutes and gradually increased throughout the week.

4. 10-week low-intensity steady-state training program: Jogging

Week 1 10 mins *RPE: 1*	**Week 2** 10 mins, 30 secs *RPE: 1*	**Week 3** 11 mins *RPE: 1*	**Week 4** 11 mins, 30 secs *RPE: 2*	**Week 5** 12 mins *RPE: 2*
Week 6 12 mins, 30 secs *RPE: 2*	**Week 7** 13 mins *RPE: 3*	**Week 8** 14 mins, 30 secs *RPE: 3*	**Week 9** 14 mins *RPE:4*	**Week 10** 15 mins, 30 secs *RPE: 4*

In contrast, the RPA group was instructed to engage in personally chosen physical activities for a duration of one hour, at least three times per week, during a period of ten weeks. Subsequently, all subjects underwent identical fitness assessments. The same procedure was administered in the post test phase.

Statistical Analysis

The study employed a paired t-test to examine the potential impact of the three training programs on participants within their respective groups. To conduct a comparison across groups, the Kruskal-Wallis test was employed, which is a non-parametric alternative to the one-way ANOVA. Subsequently, Tukey-Kramer analysis was utilized on the scores that exhibited a significant difference among the groups in order to determine which pairwise comparisons are statistically significant.

Potential Ethical Issue

The participants were provided with a detailed briefing on the study, which included a discussion about their rights within the study context. Subsequently, individuals were requested to provide informed consent by signing a consent letter. Afterwards, a Physical Readiness Questionnaire was given to determine if there were any hidden medical issues among the subjects. In conclusion, it is crucial to emphasize that the obtained data will be treated with the highest level of confidentiality and will be disclosed to the owner upon their request.

Results

Table 5 illustrates the outcomes of pre-test and post-test evaluations for female, male, and overall participants following a 10-week LISS training program, revealing significant improvements in various fitness measures. For female participants, significant enhancements were observed in the OMPUT ($p < .05$, T-value: -3.91), PT ($p < .05$, T-value: -4.22), and SART ($p < .05$, T-value: -6.10). The 3MST showed a significant decrease ($p < .05$, T-value: 2.13). Conversely, male participants experienced a significant decrease in the OMPUT ($p < .05$, T-value: -5.13), while improvements were observed in the PT ($p < .05$, T-value: -3.75) and SART ($p < .05$, T-value: -7.02). Overall, there were significant improvements in the OMPUT ($p < .05$, T-value: -7.21), PT ($p < .05$, T-value: -4.60), SART ($p < .05$, T-value: -8.32), and 3MST ($p < .05$, T-value: 8.01) for all participants.

Table 5. Pre and Post-test of the LISS group

	Pre-test	Post-test	P-Value	T-Value
Female				
OMPUT	14.21 ± 8.91	20.07 ± 10.51	<.05	-3.64
PT	74.67 ± 59.05	90.07 ± 52.86	<.05	-3.35
SART	43.21 ± 10.09	48.36 ± 9.39	<.05	-5.33
3MST	156.29 ± 42.13	144.07 ± 35.80	<.05	1.60
Male				
OMPUT	15 ±7.95	19.73 ±10.40	<.05	-4.49
PT	106.39 ± 55.00	122.65 ±49.52	<.05	-2.92
SART	42.20 ± 9.10	48. 13 ± 9.58	<.05	-6.14
3MST	171.45 ± 32.16	140.58 ± 29.59	<.05	8.24
All				
OMPUT	14.80 ±8.06	19.81 ±10.27	<.05	-6.31
PT	98.17 ± 56.90	114.20 ± 51.11	<.05	-3.76
SART	42.46 ±9.34	48.19 ±9.53	<.05	-7.59
3MST	167.52 ± 34.80	141.48 ± 30.21	<.05	7.33

Table 6 summarizes the pre-test and post-test evaluations for both male and female subjects, along with a comprehensive analysis. Among female participants, the One-Minute Push-up Test (OMPUT) showed a significant improvement ($p < .05$, $T = 1.89$), while the Sit and Reach test (SART) demonstrated a significant improvement ($p < .05$, $T = 3.46$), and the 3-Minute Step Test (3MST) revealed a notable reduction ($p < .05$, $T = -2.25$). Conversely, in the male group, OMPUT displayed a significant decrease ($p < .05$, $T = -4.14$), and the 3MST demonstrated a significant decrease ($p < .05$, $T = 5.22$). Across all participants, OMPUT showed a substantial improvement ($p < .05$, $T = -4.13$), while SART showed improvement ($p < .05$, $T = -6.61$), and 3MST demonstrated a substantial increase ($p < .05$, $T = 5.42$). PT did not show significant change ($p = 0.12$, $T = 1.34$).

Table 6. Pre and Post-test of the HIIT group

	Pre-test	Post-test	P-Value	T-Value
Female				
OMPUT	13.42±9.06	16.17±7.27	<.05	1.89
PT	75.84±37.61	87.58±65.39	0.20	1.34
SART	48.75±8.83	56.67±11.80	<.05	3.46
3MST	158.25±42.67	129.50±47.08	<.05	-2.25
Male				
OMPUT	14.76±9.02	21.18±11.57	<.05	-4.19
PT	129.66±78.07	138.71±90.95	0.16	-1.44
SART	46.18±10.21	52.12±8.48	<.05	-6.67
3MST	172.82±40.63	130.82±34.23	<.05	5.22
All				
OMPUT	14.31±8.70	19.32±10.74	<.05	-4.13
PT	115.13±71.10	122.39±85.58	.12	-1.57
SART	46.07±10.88	51.28±13.44	<.05	-6.61.
3MST	166.43±43.98	125.86±42.60	<.05	5.42

Table 7 illustrates significant improvements in various fitness evaluations among female, male, and overall participants. Specifically, OMPUT showed notable improvement among female participants ($p < .05$, $T = -5.26$), while SART exhibited significant improvement ($p < .05$, $T = -5.06$), and 3MST demonstrated significant improvement ($p < .05$, $T = 4.97$). In male participants, PT demonstrated a notable reduction ($p < .05$, $T = 0.67$), and across all participants, OMPUT showed noteworthy improvement ($p < .05$, $T = -5.60$), PT demonstrated significant improvement ($p < .05$, $T = -1.08$), SART showed notable improvement ($p < .05$, $T = -3.36$), and 3MST demonstrated significant improvement ($p < .05$, $T = 5.07$).

Table 7. Pre and Post-test of the RPA group

	Pre-test	Post-test	P-Value	T-Value
Female				
OMPUT	9.88±7.45	13.34±7.88	<.05	-5.26
PT	71.16±31.87	80.90±37.94	0.10	-1.32
SART	48.32±12.17	52.37±11.49	<.05	-5.06
3MST	143.71±35.18	128.32±34.12	<.05	4.97
Male				
OMPUT	11.72±9.95	15.01±11.55	0.06	-1.80
PT	98.29±62.56	85.71±45.35	< .05	0.67

SART	45.29±10.66	48.43±16.73	0.33	-0.45
3MST	136.14±15.73	129.29±14.02	0.14	-1.19
All				
OMPUT	12.31±15.66	15.75±15.49	<.05	-5.60
PT	73.85±39.61	81.24±38.81	<.05	-1.03
SART	47.88±11.90	51.79±12.25	<.05	-3.36
3MST	146.60±33.05	128.46±31.88	<.05	5.07

Table 8 summarizes fitness assessment results for three distinct training protocols: LISS, HIIT, and RPA. Significant differences were identified among participants post-test. OMPUT revealed significant differences (p < .05) with an H-value of 8.05, ranking RPA third in effectiveness compared to HIIT and LISS. PT also showed significant differences (p < .05) with an H-value of 10.70, placing RPA third in effectiveness. Significant differences (p < .05) were reported in SART, with an H-value of 3.13, indicating LISS as the most effective protocol. Although 3MST indicated a significant difference (p < .05), the H-value of 5.38 suggested possible variances in cardiovascular endurance outcomes among the training protocols.

Table 8. Between-group comparison among LISS, HIIT, and RPA groups

	LISS	HIIT	RPA	P-VALUE	H-VALUE
OMPUT	19.00±10.27	19.32±10.74	15.75±15.49	<.05	8.05
PT	114.20 ± 51.11	122.39±85.58	81.24±38.81	<.05	10.70
SART	48.19 ±9.53	51.28±13.44	51.79±12.25	<.05	3.13
3MST	141.48 ± 30.21	125.86±42.60	128.46±31.88	<.05	5.38

Table 9 displays the fitness assessment outcomes for three distinct training protocols: LISS , HIIT, and RPA . The ranks were determined by utilizing post-test scores to identify significant variations among female participants in the study.The OMPUT revealed statistically significant differences (p-value: <.05) with a high H-value of 3.44. According to the post-test scores ranking, RPA had a lower value compared to both LISS and HIIT, placing third in terms of effectiveness.The PT did not yield any statistically significant differences (p-value: 0.40), with an H-value = 1.84.The SAR did not yield any statistically significant differences (p-value: 0.23), with an H-value of 1.49. The 3MST revealed significant differences (p-value: <.05) with an H-value of 41.412. According to the post-test scores ranking, RPA had a lower value compared to both LISS and HIIT, placing third in terms of effectiveness.

Table 9. Between-group comparison among LISS, HIIT, and RPA female groups

	LISS	HIIT	RPA	P-VALUE	H-VALUE
OMPUT	20.07 ± 10.51	16.17±7.27	13.34±7.88	<.05	3.44
PT	90.07 ± 52.86	87.58±65.39	80.90±37.94	.40	1.84
SART	48.36 ± 9.39	56.67±11.80	52.37±11.49	.23	1.49
3MST	144.07 ± 35.80	129.50±47.08	128.32±34.1	<.05	41.41

Table 10 displays fitness assessment outcomes for three distinct training protocols: LISS, HIIT, and RPA, alongside corresponding p-values and H-values indicating significant disparities among male participants. No statistically significant differences were found in the OMPUT (p = 0.45, H-value = 0.81), PT (p = 0.96, H-value = 4.69), SART (p = 0.40, H-value = 0.93), or 3MST (p = 0.42, H-value = 0.89).

Table 10. Between-group comparison among LISS, HIIT, and RPA male groups

	LISS	HIIT	RPA	P-VALUE	H-VALUE
OMPUT	19.73 ±10.40	21.18±11.57	15.01±11.55	.45	.81
PT	122.65 ±49.52	138.71±90.95	80.90±37.94	.96	4.69
SART	48. 13 ± 9.58	52.12±8.48	48.43±16.73	.40	.93
3MST	141.48 ± 30.21	130.82±34.23	129.29±14.02	.41	.89

Discussion

The study underscores LISS exercise's effectiveness in enhancing physical fitness, revealing significant improvements across all fitness components among female, male, and overall participants. Notable enhancements were observed in OMPUT, PT, SART, and 3MST for both genders and overall, emphasizing LISS's impact on muscular endurance, particularly in upper extremities and core strength, as well as cardiorespiratory endurance. These findings align with previous literature linking aerobic power to muscular fitness and highlight LISS as a targeted program for improving multiple aspects of physical fitness. Further study is warranted to explore LISS's effects comprehensively, particularly its impact on various components of cardiorespiratory fitness (Zoeller et al., 2005; Schlindler et al., 2008; Raja, 2021).

The HIIT intervention resulted in varied outcomes in pre-test and post-test assessments among female and male participants. Women showed significant improvements in OMPUT and enhanced performance in SART, while men exhibited a notable drop in OMPUT and a major decline in 3MST. Overall, HIIT led to substantial enhancements in OMPUT and improved SART, accompanied by a notable increase in 3MST for all individuals. However, the PT yielded no statistically significant alterations across the groups. These findings highlight the diverse influence of HIIT training on various evaluations and participant groups. Prior studies corroborate the improvement in muscular endurance and flexibility resulting from HIIT exercise (Islam et al., 2020; Afyon et al., 2021; Lu et al., 2023; Belli et al., 2022). Further study should prioritize investigating the impact of HIIT training on different aspects of physical fitness using a range of field testing methods.

The study demonstrates significant enhancements in various fitness evaluations post-intervention, with notable improvements observed in OMPUT and SART among female participants, while males showed a non-significant rise in OMPUT and a significant drop in PT. Overall, all individuals exhibited notable improvements in OMPUT and enhancement in PT, alongside advancements in SART and 3MST. These findings highlight the beneficial effects of the intervention on physical fitness, with variations observed among different participant groups. Contrary to previous studies, the current investigation contradicts earlier findings regarding the impact of physical activity on core endurance (Akduman et al., 2019). Furthermore, the study contributes to existing literature by revealing associations between scores on the International Physical Activity Questionnaire and various components of physical fitness, underscoring the predictive ability of physical activity on cardiovascular fitness and aerobic capacity (Silva-Batista et al., 2013; Dyrstad et al., 2016; Mynarski et al., 2009; Straatmann et al., 2015; de Cunha et al., 2013).

The data reveals disparities among female participants in the One-minute Push-up and 3MST tests, with RPA ranking third, while no notable differences were detected among males. Across all participants, significant improvements were observed in the One-minute Push-up and PT, with RPA achieving the third position. LISS emerged as the top performer in the SART, and possible disparities in cardiovascular endurance were noted in the 3MST among different protocols. Prior study by Islam et al. (2020) and da Silva et al. (2021) supported the efficacy of HIIT training in enhancing muscular endurance and upper body strength, respectively. Further investigation is warranted to explore the disparity of HIIT methods using alternative tests targeting different areas of the body. Additionally, studies have shown that HIIT enhances flexibility in various field tests (Muannai et al., 2021; Baynaz et al., 2017). The effectiveness of HIIT training in improving muscular endurance, core strength, and flexibility across diverse populations and fitness assessments underscores its potential benefits in different contexts. Further study should examine its impact on specific anatomical regions and incorporate sport-specific physical assessments for a comprehensive understanding of its advantages.

Conclusions Both genders demonstrated substantial improvements in all components within the in-group comparison, with LISS enhancing flexibility, cardiorespiratory endurance, and upper-body muscular endurance, HIIT improving upper body flexibility, cardiorespiratory endurance, and upper limb muscular endurance, and RPA enhancing all aspects. However, the training program had no impact on core muscle endurance in both males and females, with women not seeing improvement in core muscular endurance. Nevertheless, the workout regimen enhanced the core muscular endurance of male participants. During the intergroup comparison, the HIIT group exhibited superior levels of muscular endurance and cardiorespiratory endurance, while the RPA group demonstrated the greatest level of flexibility. Among female participants, LISS demonstrated the greatest enhancement in upper-limb muscle endurance, whereas RPA exhibited the most significant improvement in cardiorespiratory fitness. No statistically significant differences were seen among the male participants in the three training programs. Incorporating HIIT exercises may benefit overall cardiorespiratory fitness and muscular endurance, while regular physical exercise is advisable to enhance flexibility, particularly in the lower extremities. Gender differences should be considered in selecting training methods. Further investigation into the impact of LISS on individual muscle groups and its effectiveness in improving cardiorespiratory endurance using diverse field testing is recommended. Additionally, creating sport-specific HIIT programs to improve core strength in athletes is proposed, emphasizing the significance of assessing cardiorespiratory endurance using sport-specific fitness testing. It is essential to customize exercise regimens according to gender-specific results and investigate the correlation between levels of physical activity and various dimensions of physical fitness. Future studies should examine the influence of training programs on multiple facets of fitness concurrently, and further study should be conducted to examine the effectiveness of LISS exercises in improving cardiorespiratory endurance, incorporating a range of field tests and considering the impact of LISS on different body parts and flexibility.

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