Original Article

Examining The Effects Of High-Intensity Resistance Training On Hormonal Factors In University Male Football Players

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Abstract

High intensity resistance training (HIRT) effect on both cortisol and testosterone and contributes to improved performance in football players. The purpose of this study was to determine the effect of eight-week HIRT intervention on cortisol and testosterone of male university football players. For this purpose, 24 football players between the ages of 19 and 25 were recruited. Blood Samples of 12 players were collected before and after eight weeks of HIRT. While, remaining 12 players were considered as controls and did not underwent HIRT. The collected data were subjected to statistical analysis using GraphPad Prism version 6.0 software. The findings of current study revealed that cortisol had significantly declined after HIRT group. Whereas, testosterone levels demonstrated significant elevation after eight weeks of HIRT intervention. The results also showed that there was no significant difference in cortisol and testosterone in the control group. This study's results concluded that eight weeks of high-intensity resistance training (HIRT) improved the performance of university male football players.

High intensity resistance training, cortisol, testosterone, football players

Introduction

Regular physical exercise is essential for maintaining optimal health and enhancing sports performance. In competitive sports, such as football, players constantly seek innovative training methods to improve their physical attributes and gain a competitive edge (Thomas et al., 2016). High-intensity resistance training (HIRT) has emerged as a promising approach to enhancing muscular strength, power and endurance, leading to improved athletic performance. While, the effects of HIRT on muscular adaptations have been extensively studied, its impact on hormonal factors in football players remains relatively unexplored (Spake, 2017).

Football is a physically demanding sport that requires players to possess high levels of strength, power, agility and endurance. These physical attributes are closely linked to the hormonal within an athlete's body (Ziv & Lidor, 2009). To date, limited research has been conducted on the specific effects of HIRT on hormonal levels in football players. Therefore, this study aims to fill this gap by examining the effects of a structured high-intensity resistance training program on hormonal profiles, including testosterone and cortisol in university male football players. By investigating these factors, we seek to elucidate the potential benefits and adaptations induced by HIRT in this specific player population. This research study will contribute to the existing body of literature on resistance training and its effects on physiological markers in football players. Findings from this study will provide valuable insights for coaches, trainers and players, allowing them to optimize training protocols, enhance performance and develop tailored strategies to improve hormonal in male football players.

Methodology

This study utilized a randomized controlled design to investigate the effects of high-intensity resistance training (HIRT) on the hormonal level of university male football players. The convenience sampling technique was employed to select twenty-four (19 to 25 years) participants from the men's Sports Department, Punjab University Football Club and the Department of Sport Sciences and Physical Education, University of the Punjab, Lahore. To ensure equal distribution, simple randomization was used to allocate the participants into two groups: the HIRT Experimental Group (n = 12) and the Control Group (n = 12). The participants had an average age of 22 ± 0.22 years, a height of 156 ± 0.77 cm, a weight of 70 ± 0.45 kg and a body mass index of 21.8 ± 0.34 kg/m^2.

Inclusion criteria

The research sample for this study consisted of football athletes who met specific inclusion criteria. These criteria included: (i) having a minimum of five years of professional experience in football (ii) completing a mandatory period of strength and conditioning training for football lasting at least two years (iii) maintaining freedom from injuries for at least one month before the start of the experimental session and throughout the intervention phase (iv) abstaining from the use of anabolic steroids or hormonal precursors for at least one year before and during the intervention period (v) refraining from taking any medication during both the evaluation and experimental phases.

Exclusion criteria

The exclusion criteria for this study included: (i) sustaining any type of injury during the entire duration of the study, (ii) not obtaining medical approval to engage in resistance training (iii) missing more than 15% of the scheduled training sessions during the intervention period. Detailed information regarding the study, including its potential risks and benefits, was thoroughly explained to the participants. They provided verbal consent and signed a consent form, indicating their voluntary participation. Following that, the players underwent a familiarization process with the test protocols.

Testing Procedures

Before each evaluation, participants were provided with a 24-hour rest period. The blood sample took place under consistent environmental conditions, with a mean air temperature of 30°C for the pre-test and 32°C for the post-test, during the hours of 11:00 AM to 12:00 PM.

Training Intervention

The 8-week training program was implemented at the beginning of the season. Before the experimental study, all players underwent a standardized training schedule led by the coaches. This schedule encompassed various on-field training sessions that emphasized strength and conditioning, as well as technical and tactical training, alongside formal matches. In the control environment, the training consisted of five sessions per week. Two sessions focused on endurance training, while one session each was dedicated to speed, strength and recovery (tapering). In contrast, the HIRT group in the current study engaged in three HIRT sessions along with two sessions specifically focused on strategies and tactics. The control group exclusively participated in five sessions concentrating on technique and tactics. All training sessions took place outdoors and commenced with a 10-minute general warm-up, involving jogging and static stretching. This was followed by a drill-based warm-up lasting approximately 15 to 20 minutes. The main exercises centered around sport-specific technical and tactical aspects. At the end of each session, a 10 to 15-minute cool-down period involving gentle running and stretching movements was carried out. The organization and structure of the open-field training sessions remained consistent throughout the days for both groups. During the HIRT sessions, participants were instructed to exert maximum effort and perform all exercises at their highest intensity level. The instructor provided verbal encouragement and supervised the sessions to ensure adherence to the prescribed intensity and technique guidelines.

Blood Sampling

Blood samples, specifically for cortisol and testosterone analysis, were obtained both before and after the testing period. The blood samples were collected from the antecubital vein using 15-mL vacutainer tubes. To ensure

accuracy and adherence to standardized procedures, a standard medical laboratory assisted the entire sample collection procedure.

Statistical Procedures

The collected data were subjected to statistical analysis using GraphPad Prism version 6.0 software. Descriptive statistics, including mean and standard deviation, were employed to summarize the data. To determine significant differences between the pretest and posttest measurements, a paired sample t-test was conducted.

Table 4.1 Represent the results of Paired Sample t-test of Hormonal levels

parameters	Groups	Protocol	n	Mean ± SD	Percentage Difference	P-Value
Cortisol (**µ**g/dL)	Experimental	Pre	12	11.24 ± 0.58	29↓***	< 0.001
		Post		7.96 ± 0.39		
	Control	Pre		11.36 ± 0.54	-	0.6
		Post		11.20 ± 0.59		
Testosterone (ng/mL)	Experimental	Pre		23.41 ± 2.46	51↑***	<0.001
		Post		35.40 ± 2.61		
	Control	Pre		23.01 ± 1.87	-	0.7
		Post		22.83 ± 1.55		

µg/dL: microgram per desiliter, **ng/mL**: nanogram per milliliter, ↓: decrease, ↑: increase, ***significance at P < 0.001.

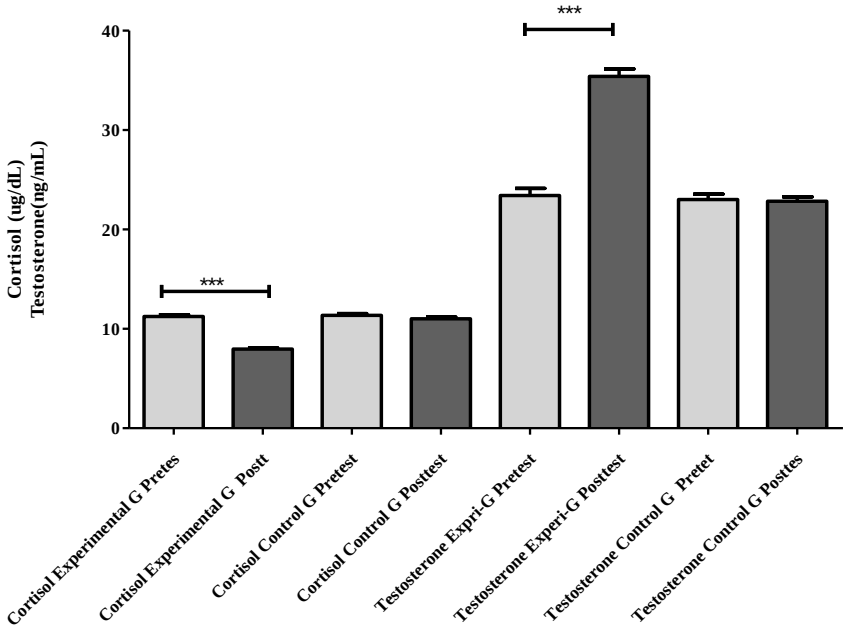

Figure 4.1 Represent the results of Paired Sample t Test of Hormonal Test

Table, 4.1:

Results revealed that the experimental group cortisol had a significant (P<0.001) declined and testosterone had significant (P<0.001) elevated pre and post-test after eight weeks of high-intensity resistance training (HIRT) intervention. The results also showed that there was no significant difference in cortisol and testosterone in the control group.

Discussion

High-intensity resistance training (HIRT) is a popular training method known for its ability to enhance muscular strength, hypertrophy, and overall physical performance. The current study results revealed that the Experimental group's cortisol had significantly declined and testosterone had significantly elevated pre and post-test after eight weeks of high-intensity resistance training (HIRT) intervention. The results also showed that there was no significant difference in cortisol and testosterone in the control group. This discussion aims to explore the effects of an 8-week HIRT program on cortisol and testosterone levels, based on previous research studies.

Cortisol is released by the adrenal glands in response to stressors, including intense exercise. Acute bouts of exercise, such as resistance training, can lead to an increase in cortisol levels as part of the body's adaptive response. However, chronic elevations in cortisol may be associated with negative health outcomes. Several studies have investigated the effects of HIRT on cortisol levels over 8 weeks, and the findings consistently demonstrate a decrease in cortisol levels following HIRT interventions. For example, a study by Arazi and Asadi (2011) examined the effects of an 8-week HIRT program on hormonal responses in young men. They reported a significant reduction in cortisol levels after the 8-week training period, indicating an attenuation of the cortisol response to exercise. Furthermore, a study by Uchida et al. (2012) examined the effects of an 8-week high-intensity interval resistance training program on hormonal responses in untrained men. They found that cortisol levels significantly decreased following the training intervention. Additionally, the study showed that the decrease in cortisol was accompanied by improvements in other hormonal markers, such as increases in testosterone and growth hormone levels. The reduction in cortisol levels observed following an 8-week HIRT program may be attributed to various factors. Firstly, HIRT often involves progressive overload, which allows the body to adapt to the training stimulus, leading to improvements in cortisol regulation. Additionally, the metabolic and anabolic demands of HIRT can positively impact hormonal balance, resulting in a decrease in cortisol levels. It is important to consider that cortisol response to exercise is influenced by various factors, including individual variability, training status, exercise volume, and recovery duration. Furthermore, the specific characteristics of the HIRT program, such as intensity, volume, and frequency, may influence the cortisol response. The findings from the mentioned studies suggest that a well-designed 8-week HIRT program can elicit beneficial adaptations in cortisol levels. Current research on the effects of 8-week HIRT programs consistently indicates a decrease in cortisol levels. This suggests that HIRT can lead to adaptations in the stress response system, resulting in a blunted cortisol response over time. These findings highlight the potential benefits of HIRT for cortisol regulation and overall well-being. However, it is crucial to consider individual variability and the influence of various training program characteristics.

Testosterone is a hormone that plays a vital role in muscle protein synthesis, muscle growth and the regulation of various physiological processes in the body. Resistance training, including HIRT, has been shown to elicit acute and chronic increases in testosterone levels, promoting an anabolic environment conducive to muscle development. Several studies have examined the effects of an 8-week HIRT program on testosterone levels and consistently demonstrate significant increases in testosterone following such interventions. For instance, a study by Crewther et al. (2016) investigated the hormonal responses to an 8-week HIRT program in recreationally active men. They found a significant increase in testosterone levels following the training intervention. These findings suggest that HIRT can stimulate favorable adaptations in testosterone production over 8 weeks. Similarly, a study by Willoughby et al. (2017) examined the effects of an 8-week high-intensity resistance training program on hormonal responses in recreationally trained men. The results revealed a significant increase in testosterone levels after the 8-week training period. These findings further support the notion that HIRT can promote an anabolic hormonal environment through the elevation of testosterone.

Furthermore, a study by Fry et al. (2013) investigated the effects of an 8-week HIRT program on hormonal responses in resistance-trained men. The findings demonstrated a significant increase in testosterone levels following the training intervention. Additionally, the study observed significant improvements in muscular strength and power, suggesting a potential association between increased testosterone levels and enhanced physical performance.

The increases in testosterone levels observed following an 8-week HIRT program can be attributed to various factors. HIRT typically involves high-intensity exercises with a focus on compound movements, which are known

to stimulate a robust hormonal response. Additionally, the progressive overload principle employed in HIRT allows for adaptations in the endocrine system, resulting in an upregulation of testosterone production.

It is worth noting that individual variability, training status, exercise volume, and recovery duration can influence the testosterone response to exercise. Additionally, other factors such as nutrition, sleep, and overall lifestyle play a role in optimizing testosterone levels. Therefore, adherence to a well-structured HIRT program, coupled with a supportive lifestyle, is important for maximizing the benefits of testosterone elevation through resistance training.

In conclusion, the existing research consistently demonstrates that an 8-week HIRT program leads to significant increases in testosterone levels. These findings highlight the potential of HIRT to create an anabolic environment conducive to muscle growth, strength gains, and overall physical performance.

Conclusion

The current study results revealed that the Experimental group's cortisol had significantly declined and testosterone had significantly elevated pre and post-test after eight weeks of high-intensity resistance training (HIRT) intervention. The results also showed that there was no significant difference in cortisol and testosterone in the control group. This study's results concluded that eight weeks of high-intensity resistance training (HIRT) improved the performance of university male football players.

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