Acute Effect of Anaerobic Exercise on Cortisol, Growth and Testerone Hormone Levels

Anaerobik Egzersizin Kortizol, Growth ve Testesteron Hormon Seviyeleri Üzerine Akut Etkisi

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Abstract: The aim of this study was to determine the effect of anaerobic exercise on cortisol, growth, and testosterone hormones in wrestlers according to gender. A total of 16 wrestlers, 8 females and 8 males, aged between 18 and 23 years and actively engaged in sports, participated in the study. Measurements of height, weight, blood and hormone levels were taken before and after exercise. The data obtained were evaluated using SPSS 23 software, and the Wilcoxon test and Mann Whitney U test were used to test the significance of the difference between two independent groups. When the levels of cortisol, growth, and testosterone hormones were examined before and after anaerobic exercise in male athletes, it was found that growth (z=-2.10, p<0.03) and testosterone (z=-2.52, p<0.01) hormone levels increased after anaerobic exercise, and the difference was statistically significant. No statistically significant difference was found in cortisol hormone (P>0.05). In female athletes, when cortisol, growth, and testosterone hormone levels were examined before and after anaerobic exercise, it was found that cortisol (z=-2.24, p<0.02) hormone levels increased after anaerobic exercise, and the difference was statistically significant. No statistically significant difference was found in growth and testosterone hormones (p>0.05). It is thought that sports scientists can contribute to sports science by researching the effects of exercise on hormone secretion more comprehensively with different age, gender, branch, and different training methods.

Keywords: Hormonal, anaerobic exercise, cortisol, growth, testosterone.

Özet: *Anaerobik egzersizin güreşçilerde cinsiyete göre kortizol, growt ve testosteron hormonları üzerine etkisinin belirlenmesi amaçlanmıştır. Çalışmaya 18- 23 yaş aralığına sahip aktif olarak spor yapan 8 kadın ve 8 erkek olmak üzere toplamda 16 güreşçi gönüllü olarak katılmıştır. Katılımcıların boy, vücut ağırlığı ölçümü, kan ve hormon değerleri egzersizden önce ve egzersizden sonra alınmıştır. Elde edilen veriler SPSS 23 programında değerlendirilerek Wilcoxon Testi ve iki bağımsız gruplarda farkın önemliliğini test eden Mann Whitney U testi kullanılmıştır. Erkek sporcularda kortizol, growth, testosteron hormonlarının anaerobik egzersiz öncesi ve sonrası seviyeleri incelendiğinde, anaerobik egzersiz sonrasında growth (z=-2,10, p<0,03) ve testosteron (z=-2,52, p<0,01) hormon seviyelerinin yükseldiği, farkın ise istatistiksel olarak anlamlı olduğu bulunmuştur. Kortizol hormonunda istatistiksel olarak anlamlı bir farklılık bulunamamıştır (P>0,05). Kadın sporcularda ise kortizol, growth, testosteron hormonlarının anaerobik egzersiz öncesi ve sonrası incelendiğinde, anaerobik sonrasında kortizol (z=-2,24, p<0,02) hormon seviyesinin yükseldiği, farkın ise istatistiksel olarak anlamlı olduğu bulunmuştur. Growth ve testosteron hormonlarında istatistiksel olarak anlamlı bir farklılık bulunamamıştır (p>0,05). Kadın ve Erkek sporcularda kortizol, growth ve testosteron hormon seviyeleri karşılaştırıldığında, sporcuların testosteron hormon seviyesinde anaerobik egzersiz öncesi (0,00) ve sonrası (0,00) farkın istatistiksel olarak anlamlı olduğu bulunmuştur. Ayrıca sporcuların kortizol (0,00) ve growth (0,00) hormon seviyelerinde anaerobik egzersiz öncesi farkın istatistiksel olarak anlamlı olduğu bulunurken, egzersiz sonrasında anlamlı bir farklılık bulunamamıştır (p>0,05). Spor bilimcilerin egzersizin hormon salgılanması üzerine etkilerini farklı yaş, cinsiyet, branş ve farklı antrenman metotları ile daha kapsamlı bir şekilde araştırması spor bilimine katkı sağlanabileceği düşünülmektedir.*

Anahtar Kelimeler: *Hormon, anaerobik egzersiz, kortizol, growth, testosteron.*

Received: 31.05.2023 / Accepted: 17.09.2023 / Published: 20.10.2023
https://doi.org/10.22282/tojras.1306820

Citation: *Şahin, M., Özdemir, S., Civan, A.H., Uzun, M. E., Çetin, T., Pişkin, M. (2023). Acute Effect of Anaerobic Exercise on Cortisol, Growth and Testerone Hormone Levels, The Online Journal of Recreation and Sports (TOJRAS), 12 (4), 566-572.*

INTRODUCTION

During exercise, various changes occur in the internal environment of our body, and in order for these changes to be reversed, the nervous and endocrine systems must work together in a coordinated manner (Guyton and Hall, 2015). The endocrine system, which works in harmony with the nervous system, is responsible for the storage of energy molecules and the regulated use of hormonal responses in order to provide appropriate cellular function and meet the body's physiological demands (Cheng et al., 2018). Through the hormones it secretes during exercise, the endocrine system causes various changes in almost all systems of the body, leading to increases or decreases in hormone levels (Fox et al., 2012; Hall, 2015). It is thought that the increases in some hormone secretions may be related to anaerobic exercises (Meckel et al., 2009).

As it is known, anaerobic performance is particularly important in team sports such as ice hockey, football, basketball, American football, during sudden attacks or pressure-defense moments, in middle-distance runs nearing the end of attacks, in short-distance runs (100m, 200m), in short-distance swimming branches (50m, 100m), in throwing and jumping sports, wrestling, tennis, gymnastics, and many other sports that require power formation (Özkan et al., 2007). These short-term and high-intensity exercises can lead to energy depletion, fluid and mineral loss, and at the same time, put the body under stress. As a result of high blood pressure, fluid and mineral losses, the body protects itself and ensures the homeostasis of metabolism through endocrine responses to remove the stresses.

The acute endocrine response to anaerobic exercise typically contributes to the muscle phenotype associated with anaerobic exercise. This phenotype occurs largely due to the catabolic and anabolic hormones that are secreted during and after anaerobic exercise (Ehrman et al., 2018). Hormones are chemical substances that are released into body fluids by endocrine organs and have effects on target organs. In hormone secretion, decreasing hormones increase the secretion through feedback mechanisms, and when the secretion is increased, there is a decrease in the secretion (Ergen et al., 2007).

Kortizol, accounting for approximately 95% of all glucocorticoid activity, plays a major role in immune function and metabolism (McGuigan et al., 2004; Kraemer et al., 2005). Cortisol, a catabolic hormone secreted by the adrenal glands, mobilizes energy substrates (such as carbohydrates, fats, and proteins) and suppresses immune function (Duclas and Tabarin, 2016). When cortisol is secreted, it is taken up by various tissues in the body, such as skeletal muscle, liver and adipose tissue (Hill et al., 2008). Cortisol presence in these different tissues mediates critical physiological processes that help recovery and exercise capacity such as supporting the breakdown of proteins into amino acids in skeletal muscle and hydrolyzing triglycerides in adipose tissue into free fatty acids and glucose (Hackney and Walz, 2013). Short rest periods separated by heavy or high-intensity exercises seem to be necessary to activate cortisol secretion during anaerobic exercise (Szivak et al., 2013). However, the effect of anaerobic exercise on cortisol levels is not yet clear and could be exercise-specific.

Testosterone is the primary male hormone that plays an active role in muscle growth. In men, the main source of testosterone hormone is the Leydig cells of the testes, but it is also secreted by the adrenal cortex (Thomas et al., 2009). Like glucocorticoids, testosterone also affects skeletal muscle. The most notable feature of testosterone is that it directly stimulates glycogen synthesis in the levator ani muscle, while it indirectly affects other skeletal muscles. In both cases, testosterone increases glycogen content by increasing the function of enzymes responsible for glucose phosphorylation and glycogen synthesis (Çakmakçı, 2013). Generally, testosterone activates pathways that stimulate glucose metabolism and protein synthesis in skeletal muscle (Sato and Iemitsu, 2014). Similarly, high-intensity exercises appear to be a strong stimulus for testosterone secretion (Vingren et al., 2009). Testosterone secretion differs between men and women. Generally, the testosterone level in women is lower throughout the day, while in men, it is higher in the morning and decreases throughout the day. In men, anaerobic exercises appear to increase resting testosterone levels (Kraemer et al., 1998).

The growth hormone (GH) regulates basic growth, development, metabolism, and reproductive processes (Eliakim et al., 2014). Exercise is a powerful physiological stimulant that leads to the release of the growth hormone by activating the insulin-like growth factor-I (IGF-I) system, which is a key regulator of linear growth, muscle mass increase, and decrease in body fat percentage (Armstrong and Van Mechelen, 2017). The growth hormone has pleiotropic effects on carbohydrate, lipid, and protein metabolism, and a single increase in GH reflects an increase in the concentration of circulating free fatty acids and ketone bodies, which stimulate lipolysis and ketogenesis, respectively (Djurhuus et al., 2004).

Increases in hormonal concentrations with exercise are important for modulating physiological functions as well as for repairing body tissues. Hormonal responses to exercise occur during activity and regulate metabolism. Rest after exercise and tissue repair and reshaping are also linked to hormonal responses. As a result, hormones and receptors mediate exercise adaptation (Kraemer et al., 2011). In this study, the aim was to determine the effects of anaerobic exercise on cortisol, growth, and testosterone hormones in wrestlers according to gender.

METHODS

Research Model: Experimental model was used in the research.

The Purpose of the Research: In this study, the aim was to determine the effects of anaerobic exercise on cortisol, growth, and testosterone hormones in wrestlers according to gender.

Research Group: A total of 16 wrestlers, consisting of 8 females and 8 males actively engaged in sports between the ages of 18-23, voluntarily participated in this study. The subjects were selected from among athletes who had not experienced any neurological, auditory-visual (vestibuler-visual) disorders in the last year and had not suffered any serious injuries in their upper and lower extremities in the last 6 months (determined by the information form given to the athletes before the application). Additionally, attention was paid to ensure that female athletes were not in their menstrual period. All individuals who voluntarily participated in the study were informed about the study beforehand and signed a document stating that they participated in the study of their own accord. Prior to the tests, the athletes underwent a medical examination. The research was conducted in the laboratory of Hasan Doğan School of Physical Education and Sports at Karabük University. Ethics committee approval was obtained for the study from Karabuk University, Non-Interventional Clinical Research Ethics Committee with the decision numbered 2023/1342. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Wingate Anaerobic Power Test: The Wingate Anaerobic Power Test was conducted using a modified Monark 824 model (made in Sweden) Foot Cycle Ergometer, connected to a computer with compatible software. Prior to the tests, height adjustments were made for each athlete. The resistance on the foot ergometer was set at 75gr/kg for each athlete during the test. Athletes were instructed to reach the highest pedal speed possible without resistance as quickly as possible. Once maximum speed was reached (almost 3-5 seconds later), the resistance calculated at 75gr/kg was applied, and the test began. Athletes pedaled at their highest speed against this resistance for a duration of 30 seconds. Throughout the test, athletes were verbally encouraged and motivated.

Body Weight and Height Measurement: The subjects' body weights were measured on a scale with 0.01 kg precision, with bare feet, in kilograms. Their heights were measured in a standing position, with bare feet, using a metal meter with a fixed precision of 0.01 cm on the scale.

Blood and Hormone Analysis: The blood samples of the athletes participating in the study were taken by nurses on an empty stomach under the supervision of a specialist doctor before and after exercise. From all subjects, 8 ml of blood was taken from the forearm elbow veins twice, once at rest before exercise and once after aerobic exercise test (fatigue) and collected in gel biochemistry tubes (BD Vacutainer' gel tube Sunnyvale, CA, USA). The samples were centrifuged at 3500 rpm for 10 minutes and the serums were separated. The obtained serums were transported to the laboratory in compliance with cold chain rules. Cortisol, growth hormone, and testosterone tests were performed using the electrochemiluminescence method on the Roche Cobas e601 (Roche Diagnostics, Germany, Mannheim) device from the samples. The obtained results were evaluated by a biochemistry specialist and reported.

Statistical Analysis: The SPSS 16.0 package program was used for the statistical analysis of the data. The Kolmogorov-Smirnov test, histogram graph, and Q-Q plots were used to evaluate the normality of the data. Non-parametric tests were used as the data did not show normal distribution. The Wilcoxon test, which tests the significance of the difference between the scores of two different measurement sets dependent on each other in the comparison of the averages of cortisol, growth, and testosterone levels before and after anaerobic exercise of wrestlers, and the Mann Whitney U test, which tests the significance of the difference between two independent groups, were used in the study.

RESULTS

Table 1. Physical values of the athletes participating in the study

	Gender	n	Min	Max	X
Age (Year)	Man	8	19,00	23,00	20,62
	Women	8	19,00	25,00	21,00
Height (Cm)	Man	8	172,00	181,00	176,25
	Women	8	160,00	175,00	169,37
Weight (Kg)	Man	8	71,00	87,00	77,62
	Women	8	48,00	67,00	57,75

Table 2. Pre- and post-test values of cortisol, growth hormone, and testosterone parameters in men

	Tests	n	Rank Average	Rank Sum	Z	P
Cortizol (µg/dl)	Pre-Test	8	6,17	18,50	-,070	,94
	Post-Test	8	3,50	17,50		
Growth Hormon (ng/mL)	Pre-Test	8	3,00	3,00	-2,10	,03*
	Post-Test	8	4,71	33,00		
Testosteron (ng/dL)	Pre-Test	8	,00	,00	-2,52	,01*
	Post-Test	8	4,50	36,00		

*p<0,05

As shown in Table 2, the levels of cortisol, growth hormone, and testosterone hormones before and after anaerobic exercise in male athletes were evaluated by the Wilcoxon test to determine if there was a significant difference. The evaluation revealed a significant increase in growth (z=-2.10, p<0.03) and testosterone (z=-2.52, p<0.01) hormone levels after anaerobic exercise, with the difference being statistically significant. No statistically significant difference was found in cortisol hormone (p<0.05).

Table 3. Pre- and post-test values of Cortisol, Growth Hormone, and Testosterone parameters in women

	Tests	n	Rank Average	Rank Sum	Z	P
Kortizol (µg/dl)	Pre-Test	8	2,00	2,00	-2,24	,02*
	Post-Test	8	4,86	34,00		
Growth Hormon (ng/mL)	Pre-Test	8	5,50	22,00	-,56	,57
	Post-Test	8	3,50	14,00		
Testosteron (ng/dL)	Pre-Test	8	6,25	25,00	-,98	,32
	Post-Test	8	2,75	11,00		

*p<0,05

As seen in Table 3, the Wilcoxon test was used to evaluate whether there was a significant difference between pre- and post-test levels of Cortisol, Growth Hormone, and Testosterone parameters in female athletes. According to this analysis, it was found that there was a significant increase in Cortisol levels (z=-2.24, p<0.02) after anaerobic exercise, indicating a statistically significant difference. However, no significant differences were found in Growth Hormone and Testosterone levels (p<0.05).

Table 4. The comparison of cortisol, growth, and testosterone levels before and after anaerobic exercise in female (n:8) and male (n:8) athletes

	Tests	Male Mean±SD	Female Mean±SD	U	P
Kortizol (µg/dl)	Pre-Test	11,88	5,13	5,00	,00*
	Post-Test	10,31	6,69	17,50	,12
Growth Hormon (ng/mL)	Pre-Test	5,00	12,00	4,00	,00*
	Post-Test	8,50	8,50	32,00	1,00
Testosteron (ng/dL)	Pre-Test	12,50	4,50	,00	,00*
	Post-Test	12,50	4,50	,00	,00*

*p<0,05

As seen in Table 4, when the cortisol, growth, and testosterone hormone levels of female and male athletes were compared, a statistically significant difference was found in the testosterone hormone levels of athletes before (p<0.00) and after (p<0.00) anaerobic exercise. In addition, while a statistically significant difference was found in the cortisol (p<0.00) and growth (p<0.00) hormone levels of athletes before exercise, no significant difference was found after exercise (p<0.05).

DISCUSSION

Hormonal changes in the body during exercise have been a subject of research by sports scientists when reviewing sports literature. This study was conducted to examine the effect of anaerobic exercise on certain hormone levels based on gender. The study found a significant difference in cortisol and growth hormone levels before and after anaerobic exercise in male athletes, while no significant difference was found in testosterone hormone levels. When looking at the hormone levels of female athletes, a significant increase in cortisol levels before and after exercise was observed, while no significant difference was found in growth and testosterone hormone levels. When examining the hormone levels of male and female athletes before exercise, a significant difference was observed in cortisol, growth, and testosterone levels, while only a statistically significant difference in testosterone hormone levels was detected after exercise.

Various stress situations occur in the human body during exercise. Therefore, the release rates of stress hormones increase with an increase in the intensity of exercise. It is said that changes can occur in the hormone levels of cortisol, adrenaline, noradrenaline, growth hormone (GH), endorphins, prolactin, and testosterone in individuals experiencing stress (Civan et al., 2018).

Hormonal changes during exercise can occur for various physiological reasons, such as triggering cardiovascular adjustments, activating energy production pathways and mobilizing energy substrates, which may lead to changes in hormone levels to facilitate the maintenance of adequate hydration (Hackney & Lane, 2015). Fink et al. (2018) investigated the role of hormones in muscle hypertrophy. Resistance training is said to cause elevations in important endogenous hormones, such as testosterone (T), GH.

In a study conducted on athletes who exercise excessively, the hormonal responses of the endocrine system were examined in two stages. These are the hyperactivity phase and the hypoactivity phase. In the hyperactivity phase, elevations in circulating levels of hormones such as cortisol, adrenocorticotropic hormone, catecholamines, and prolactin were reported in response to rest or acute exercise sessions (Fry et al., 2005). In the hypoactivity phase, it is reported that the levels of some hormones such as adrenocorticotropic hormone, cortisol, catecholamines, GH, follicle-stimulating hormone, testosterone, luteinizing hormone and thyroid are suppressed (Hackney, 2008).

In a study by Schwarz and Kindermann (1990), beta-endorphin, adrenocorticotropic hormone, cortisol, and catecholamines were examined during aerobic and anaerobic exercise. Twelve volunteers performed exhausting graded exercise and 1-minute anaerobic cycle ergometer exercise at 2-hour intervals. Venous blood samples were taken before and up to 20 minutes of recovery after exercise to determine the concentrations of adrenocorticotropic hormone, adrenaline, cortisol and noradrenaline. The result of this study found that cortisol hormone levels increased significantly only in the anaerobic exercise group, while other hormones remained unchanged.

The study conducted by Brownlee et al. (2005) aimed to determine the relationship between circulating cortisol (C) and testosterone (T) at rest and after exercise. The study, which involved 45 physically active male participants, reported a significant negative relationship between cortisol and testosterone hormones after exercise. This finding supports the idea that testosterone decreases observed following certain physical exercise types may be associated with increases in cortisol as a response to that exercise. It has been reported that there is a direct relationship between testosterone levels and vertical jump height and power output in professional footballers, sprinters, and elite athletes (Bosco et al., 1996).

Thomas et al. (2009) examined the effects of anaerobic exercise on salivary cortisol, testosterone, and immunoglobulin (A) in 15-16 year old boys. All participants were subjected to 6 × 8 seconds sprints with 30 seconds of rest intervals in an anaerobic exercise protocol. The study reported a significant increase in cortisol and testosterone hormone levels before and after exercise ($p \leq 0.05$). Similar to previous studies, the difference in post-exercise testosterone hormone levels in this study is parallel to our own study (Di Luigi et al. 2006; Thomas et al. 2009).

In the study by Kochańska-Dziurowicz et al. (2001), the aim was to examine the changes in prolactin and testosterone levels in young female athletes during acute physical effort. The hormone levels of 13 short-distance runners were measured before exercise, immediately after exercise, and 30 and 90 minutes after the test on a bicycle ergometer. The study reported a significant increase in testosterone concentration immediately after exercise and that testosterone levels returned to pre-exercise levels 90 minutes after completing the test.

Physically active individuals have been reported to exhibit weakened cortisol responses to acute exercise compared to inactive individuals. In a study conducted to compare salivary cortisol levels, perceived exertion, and emotional responses to acute exercise in 13 male cross-country runners and 13 non-runners, cortisol and emotional responses were recorded before, during, and after a 30-minute running exercise. The results of the study indicated no significant difference in cortisol hormone levels between the groups. It was also reported that cortisol increased from the beginning to the 29th minute of exercise and decreased until 30 minutes after exercise, with lower cortisol levels observed in cross-country runners (Rudolph and McAuley, 1998).

In a study conducted by Jacks et al. (2002) to examine changes in cortisol levels in response to exercise at three different intensities, it was found that cortisol hormone levels were high during the 59th minute of exercise ($p < 0.004$) and at the 20th minute of recovery ($p < 0.004$) during high-intensity exercise. No significant difference in cortisol concentration was reported between rest, low, and moderate intensity exercise. As a result, it was stated that high-intensity and long-duration exercise significantly increases salivary cortisol.

In a study by Viru et al. (2001) investigating the hormonal responses of prolonged continuous exercise, a group of 12 endurance athletes were subjected to a 2-hour running training session. To evaluate the subjects' hormone response, a 10-minute exercise at 70% maximum oxygen uptake was performed before (1st test) and after (2nd test) the 2-hour run, and measurements were taken. In addition, a 1-minute anaerobic power test was applied to evaluate the athletes' muscle strength. Cortisol, growth hormone, testosterone, and insulin values were obtained before and after the 1st and 2nd tests. The results of the 1st test showed an increase in cortisol and growth hormone levels and a decrease in insulin levels, while no changes were observed in testosterone levels. After the 2-hour running training, a decrease in insulin levels, an increase in growth hormone levels, and variable responses in cortisol and testosterone levels were reported.

In this study, when we looked at the hormone levels of male athletes before and after Wingate-based anaerobic training, it was found that growth and testosterone hormone levels increased, and the difference was statistically significant, while no statistically significant difference was found in cortisol hormone. When we looked at the hormone levels of women before and after Wingate-based anaerobic training, it was found that cortisol hormone levels increased and there was a significant difference. No statistically significant difference was found in growth and testosterone hormones. When we looked at the hormone levels of male and female athletes before exercise, a significant difference was observed in cortisol, growth, and testosterone levels. However, after exercise, only a statistically significant difference was found in testosterone hormone levels. Based on our findings, it was determined that some of the hormonal changes we identified after anaerobic exercise are similar to those in the sports literature.

Recommendations: It is believed that sports scientists can contribute to sports science by conducting more comprehensive research on the effects of exercise on hormone secretion using different age, gender, branch, and different training methods.

Ethical text: In this article, adherence to journal writing guidelines, publication principles, research and publication ethics rules, and journal ethics rules has been maintained during the research process. The responsibility for any potential violations related to the article lies with the author. Ethics committee approval was obtained for the study from Karabuk University, Non-Interventional Clinical Research Ethics Committee with the decision numbered 2023/1342.

Conflict of Interest: There are no personal or financial conflicts of interest among the authors in this study.

Statement of Researchers' Contribution Rates: The authors contributed equally at all stages of the research.

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı: Anaerobik egzersizin güreşçilerde cinsiyete göre kortizol, growt ve testosteron hormonları üzerine etkisinin belirlenmesi amaçlanmıştır.

Araştırma Soruları: Güreşçilerde anaerobik egzersizin kortizol, growth ve testesteron hormon seviyeleri üzerine etkisi var mı? Cinsiyete göre farklılıklar oluşmakta mıdır?

Literatur Araştırması: Akut bir anaerobik egzersize karşı endokrin yanıt, tipik olarak anaerobik egzersizle ilişkilendirilen kas fenotipine katkı sağlamaktadır. Bu fenotipin büyük ölçüde anaerobik egzersiz esnasında salgılanan ve sonrasında etkisini gösteren hem katabolik (kortizol gibi) hem de anabolik (testosteron, IGF-1 ve büyüme hormonu gibi) hormonlardan dolayı gerçekleşmektedir (Ehrman et al., 2018). Hormonlar vücut sıvılarına endokrin organlar tarafından salınarak hedef organlarda etkilerini gösteren kimyasal maddelerdir. Hormon salınımında geri besleme (feedback) mekanizması yoluyla azalan hormonların salınımı artar, arttığında ise salınımda azalma olur (Ergen et al., 2007). Anaerobik egzersiz esnasında kortizol salgısını aktive etmek için kısa dinlenme dönemleriyle ayrılmış ağır yükteki veya yüksek yoğunluktaki egzersizlerin gerekli olduğu görünmektedir (Szivak et al., 2013). Ancak bununla birlikte, anaerobik egzersizlerin kortizol seviyeleri üzerine etkisinin henüz net olmaması gerçekleştirilen egzersiz uyarısına özgü olabileceği düşünülebilir. Genel anlamda, testosteron iskelet kasında glikoz metabolizmasını ve protein sentezini uyaran yolları aktive eder (Sato and Iemitsu, 2014). Benzer şekilde yüksek yoğunluktaki egzersizler testosteron salgılanması için güçlü bir uyaran olarak görünmektedir (Vingren et al., 2009). Büyüme hormonunun, karbonhidrat, lipit ve protein metabolizması üzerine pleiotropik etkileri vardır ve tek bir GH artışı lipoliz ve ketogenezin uyarılmasını yansıtan serbest yağ asitleri ve keton cisimlerinin dolaşımdaki konsantrasyonları arttırır (Djurhuus et al., 2004; Thomas et al., 2013).

Yöntem: Çalışmaya 18- 23 yaş aralığına sahip aktif olarak spor yapan 8 kadın ve 8 erkek olmak üzere toplamda 16 güreşçi gönüllü olarak katılmıştır. Katılımcıların boy, vücut ağırlığı ölçümü, kan ve hormon değerleri egzersizden önce ve egzersizden sonra alınmıştır. Elde edilen veriler SPSS 23 programında değerlendirilerek Wilcoxon Testi ve iki bağımsız gruplarda farkın önemliliğini test eden Mann Whitney U testi kullanılmıştır.

Sonuç ve Değerlendirme: Erkek sporcularda kortizol, growth, testosteron hormonlarının anaerobik egzersiz öncesi ve sonrası seviyeleri incelendiğinde, anaerobik egzersiz sonrasında growth ($z=-2{,}10$, $p<0{,}03$) ve testosteron ($z=-2{,}52$, $p<0{,}01$) hormon seviyelerinin yükseldiği, farkın ise istatistiksel olarak anlamlı olduğu bulunmasına karşılık kortizol hormonunda istatistiksel olarak anlamlı bir farklılık bulunamamıştır ($P<0{,}05$). Kadın sporcularda ise kortizol, growth, testosteron hormonlarının anaerobik egzersiz öncesi ve sonrası incelendiğinde, anaerobik egzersiz sonrasında kortizol ($z=-2{,}24$, $p<0{,}02$) hormon seviyesinin yükseldiği, farkın ise istatistiksel olarak anlamlı olduğu bulunmasına karşılık grorth ve testesteron hormonunda istatistiksel olarak anlamlı bir farklılık bulunmamıştır. Growth ve testosteron hormonlarında istatistiksel olarak anlamlı bir farklılık bulunamamıştır (p<0,05). Kadın ve Erkek sporcularda kortizol, growth ve testosteron hormon seviyeleri karşılaştırıldığında, sporcuların testosteron hormon seviyesinde anaerobik egzersiz öncesi (0,00) ve sonrası (0,00) farkın istatistiksel olarak anlamlı olduğu bulunmuştur. Ayrıca sporcuların kortizol (0,00) ve growth (0,00) hormon seviyelerinde anaerobik egzersiz öncesi farkın istatistiksel olarak anlamlı olduğu bulunurken, egzersiz sonrasında anlamlı bir farklılık bulunamamıştır (p<0,05). Erkek ve kadın sporcuların egzersiz öncesi hormon seviyelerine bakıldığında kortizol, growth ve testosteron sevilerinde anlamlı bir fark olduğu görülürken, egzersiz sonrasında sadece testosteron hormon seviyelerinde istatistiksel olarak anlamlı bir fark olduğu tespit edilmiştir. Spor bilimcilerin egzersizin hormon salgılanması üzerine etkilerini farklı yaş, cinsiyet, branş ve farklı antrenman metotları ile daha kapsamlı bir şekilde araştırması spor bilimine katkı sağlanabileceği düşünülmektedir.