

The Effect of E-Sports Games on Stress Hormones and Biochemical Parameters of Athletes

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ABSTRACT

Background: It is suggested that there is a relationship between e-sports games on stress hormones and biochemical parameters of athletes.

Aim: The most distinguishing feature of digital games is competition, stress, and physiological changes in the organism. It is a significant event that includes these features in e-sports, which is becoming increasingly popular in the digital world. The physiological and psychological effects of e-sports, which are performed in a competitive environment, on the organism during competitions are unknown. The purpose of this study was to determine the effects of players competing in e-sports competitions on some hormonal and biochemical parameters formed in the organism during the tournaments.

Methods: In the research group, there were 20 volunteer male e-sports players competing in e-sports competitions. Samples were taken from the players in the research 30 minutes before and after an e-sports match. In the samples taken; Cortisol, ACTH, testosterone, glucose, insulin, urea, creatinine, bilirubin direct and total bilirubin levels were determined.

Results: As a result of the study, it was revealed that e-sports players' cortisol, ACTH, and testosterone levels increased significantly. It was determined that there was a statistical difference in the stress hormones pre-post test values of the research group ($p < 0.05$). While it was determined that there was a significant difference in the pre-post test values of the participants' glucose, insulin, urea, creatinine and bilirubin total levels ($p < 0.05$), there was no statistically significant difference in the direct level of bilirubin ($p > 0.05$).

Conclusion: As a consequence, stress, anxiety, and physiological effects experienced during e-sports competition have been shown to significantly affect stress hormones and some biochemical parameters. In light of these observations, we believe that it would be beneficial to consider these parameters in order to enhance the performance of e-sports players.

Keywords: E-Sports, Stress, Hormone, Biochemistry.

INTRODUCTION

The popularity of e-sports, the rate of media coverage, and the number of participants and spectators have all grown dramatically in recent years. As a result, research and scientific studies on the issue of e-sports began to gain popularity. Recent e-sports research commonly defines e-sports as an activity played in an individual or team-level competitive context with both professional and amateur-level rating systems. Furthermore, e-sports is a growing sport that requires perceptual-cognitive abilities, fine motor coordination, and psycho physiological alterations to participate at a high level.^{1,2,3,4}

E-sports (electronic sports) are competitive video games in which teams or individuals play against one another. Furthermore, some academics regard it as a competitive sport in which players may develop their mental skills and hand-eye coordination while playing.⁵ The digital game elements of e-sports, as well as the stress that happens in the competitive atmosphere of e-sports participants, cause psychophysiological abnormalities in the organism.

Even though there is no common definition of stress, it is defined as the sum of an individual's responses to various mental and physical issues produced by physiological or psychological factors. Although stress can be acute, chronic, or traumatic in the organism,⁶ it is also a psycho physiological response that includes cognitive evaluation and physiological changes in response to stress, health-threatening, or stimuli in the organism.⁷ All these

interactions as a result of stress trigger strong neuro endocrine responses in the organism, and as a result, the release of stress hormones cortisol, testosterone, ACTH and biochemical changes (glucose, urea, insulin, bilirubin, creatinine, etc.) occur in the body.⁸ The data obtained from the studies also reported that the biological responses of the individual to stress are the release of hormones and the increase in biochemical reactions.^{9,10,11}

High stress markers; including hormones (cortisol, testosterone, ACTH) and biochemical changes (glucose, urea, insulin, bilirubin, creatinine, etc.) before and during a sports competition or competition affect the performance of athletes.^{12,13,14}

As a result, just as it is critical for exercise participants to increase their performance parameters and improve their cognitive performance during warm-up protocols, it is critical to uncover the stress in the e-sports environment and its effects on (cognitive, motor, and psychophysiological) performance in order to develop future sports psychology training and intervention techniques for e-sports participants.^{15,16,17,18} There is a need for experimental investigations to back up the claim that it is linked to stress. The purpose of this study was to assess the influence of athletes competing in e-sports contests on various hormonal and biochemical markers produced in the body during competitive competitions.

MATERIAL AND METHOD

Research Group: The research group consisted of 20

volunteer male e-sports players who participated in e-sports competitions and did not have any metabolic disorders. The study sought to ascertain the impact of stress, anxiety, and physiological changes encountered during an e-sports tournament on stress hormones and specific biochemical indicators.

Biochemical Measurements: Samples were taken from the athletes twice, 30 minutes before and after the e-sports competitions. In order to determine cortisol, ACTH, testosterone, glucose, insulin, urea, creatinine, bilirubin direct and bilirubin total levels, samples taken from e-sports players before and after the competition. The analysis of the samples taken was done by experts in a private hospital laboratory.

Analysis of Data: In the analysis of the data, it was analyzed using the SPSS package program. Normality test was applied to determine whether the data within the group showed a normal distribution. After it was determined that the data showed a normal distribution, Paired Samples t-test was applied to compare the pre-post test data of the research group. Significance was taken as $p < 0.05$.

RESULTS

Table 1: Table 1. Stress Hormones Pre-post Test Values of Athletes (mean \pm s)

Measurements	Pre-Test		Post-Test	
	\bar{X}	Ss	\bar{X}	Ss
Cortisol	3,08	0,78	3,19	0,17
Testosterone	8,52	0,33	8,61	0,30
ACTH	23,42	0,34	23,68	0,49
Glucose	89,50	1,31	93,10	1,91
Insulin	14,22	0,10	15,81	0,39
Urea	13,00	3,21	10,65	2,99
Bilirubin Total	0,65	0,11	0,64	0,10
Bilirubin Direct	0,18	0,01	0,17	0,01
Creatinine	0,64	0,08	0,66	0,07

Table 1 shows the pre-post test mean values of the hormones cortisol, testosterone, ACTH, and glucose, insulin, urea, creatinine, bilirubin direct and bilirubin total levels.

Table 2: Athletes' Biochemical Parameters t-Test Analysis

	Pre-Test	Post-Test	t	p
Cortisol (U/L)	3,08 \pm 0,78	3,19 \pm 0,17	2,635	0,01*
Testosterone (mg/dl)	8,52 \pm 0,33	8,61 \pm 0,30	4,639	0,00*
ACTH (U/L)	23,42 \pm 0,34	23,68 \pm 0,49	3,516	0,00*
Glucose	89,50 \pm 1,31	93,10 \pm 1,91	6,990	0,00*
Insulin	14,22 \pm 0,10	15,81 \pm 0,39	10,756	0,00*
Urea	13,00 \pm 3,21	10,65 \pm 2,99	2,906	0,00*
Bilirubin Total	0,65 \pm 0,11	0,64 \pm 0,10	3,611	0,00*
Bilirubin Direct	0,18 \pm 0,01	0,17 \pm 0,01	1,027	0,31
Creatinine	0,64 \pm 0,08	0,66 \pm 0,07	4,756	0,00*

* $p < 0.05$

When Table 2 is examined, hormonal and biochemical values of e-sports players before and after the competition are given. It was determined that there was a statistically significant difference between the pre-post test values of the participants' cortisol, testosterone and ACTH

levels ($p < 0.05$). While it was determined that there was a statistically significant difference between the pre-post-test values of glucose, insulin, urea, bilirubin total and creatinine levels of the research group ($p < 0.05$), it was determined that there was no statistically significant difference in terms of the pre-post-test value of the bilirubin direct level ($p > 0.05$).

DISCUSSION AND CONCLUSION

This day, the advancement of technology has had an impact on the area of sports, as it has in every other field, and has resulted in the formation of the notion of e-sports. According to reports, e-sports, which are based on digital games and also provide a competitive setting, show metabolic, psychological, physiological, and hormonal reactions in the organism. However, the hormonal changes that occur in e-sports participants' bodies during competition have not been revealed. The goal of this study is to uncover certain hormonal and biochemical changes that e-sports participants cause in their bodies during contests.

It is well understood that the competitive atmosphere and stress levels in sports create various alterations in the organism. Competition and stress are one of the activities in which the most intense atmosphere is experienced in e-sports, which is one of these sports branches, and coping with stress is one of the crucial components in being successful. In this regard, the psychophysiological stress reaction that happens during e-sports tournaments induces physiological and hormonal changes in the organism.^{3,19} Cortisol, testosterone, and ACTH hormone levels have been found to produce substantial alterations. Schmidt et al., (2020) examined the physiological changes of the competitive environment created in e-sports competitions on the athletes and determined that the cortisol levels of the athletes increased significantly before and after the competition.²⁰ Mendoza et al., (2021) official In a study investigating the effect of the role of experience on cortisol levels of athletes in an e-sports competition, they found that experienced e-sports players had higher pre- and post-competition cortisol levels than inexperienced e-sports players.²¹ Zilioli and Watson (2012) determined that the digital game they played by creating a competitive environment significantly affected the cortisol and testosterone levels of undergraduate students.²² In a different study, Leis and Lautenbach (2020) reported that competitions in which a competitive environment is created affect the athletes psycho physiologically in their compilation studies in which they examine the studies on e-sports.⁷ Mehrsafari et al., (2019) examined the effect of stress and related psycho hysiological responses on competitive performance in elite wushu athletes, in an eight-week wushu training program, in an eight-week wushu training program, there was no increase in cortisol levels in the control group, no change in alpha-amylase levels, and no change in alpha-amylase levels in the experimental group where they gave attention-based training. and they reported that they observed a decrease in alpha-amylase levels.²³

Cunniffe et al., (2015), in their study examining the effects of indoor and away competition on the psycho physiological variables of elite rugby players, determined

that there was a change in cortisol and testosterone hormone levels according to the difference in the venue of the competition.²⁴ Oliveira et al., (2009) examined the effect of win-losing status of female football players on hormonal parameters, and they determined that there was a change in testosterone levels of the winning team athletes compared to the losing team athletes, while there was no difference in cortisol levels.²⁵ Páez and Martínez-Díaz (2021) found in their study that the level of anxiety experienced before the competition in young swimmers affects the release of stress hormones.²⁶ Siart et al., (2017) examined the relationship between cortisol and testosterone levels and performance of the Austrian track and field team athletes competing in the European Games in Baku, and reported that the hormone levels of the athletes changed significantly from twenty-four hours before the competition to the time of the competition.²⁷ Pilz-Burstein et al., (2010) investigated the hormonal effects of combat simulation in taekwondo players and found that taekwondo combat simulation application significantly affected the cortisol and testosterone levels of athletes.²⁸

Along with the competition or training, some physiological changes occur in the organism. Regular exercise programs are an effective method for metabolic changes as well as increasing glucose and insulin tolerance in the organism. These changes are the biological responses that determine the performance of the athletes.²⁹ As a result of the research, it has been determined that the competitive environment of e-sports players before and after the competition affects the glucose, insulin, urea, creatinine, bilirubin direct and bilirubin total levels of the athletes. Sousa et al. (2020) determined in their study that the physiological changes of the players before and after the two types of e-sports game sessions differ.³⁰ In their study, Erdoğan and Sarıkaya (2020) determined that regular exercise program caused changes on glucose, urea, creatinine and some biochemical parameters of athletes.³¹ Palanichamy et al., (2020) in a review study examining the effect of e-sports on stress, reported that e-sports cause physiological and psychological health problems due to its competitive nature and excessive play.³² In their study, Schiavon et al., (2013) reported that the insulin and glucose levels of the participants increased significantly after an acute exercise.³³ Akbulut (2020) determined that his regular exercises were effective on glucose, uric acid and some biochemical parameters of university students.³⁴ In Malin et al. (2016) study they determined that exercises of different intensity caused changes on glucose, insulin and some biochemical parameters of the research group.³⁵ Pancar et al., (2021) reported in their study that football training caused differences in glucose, insulin, cortisol and ACTH levels of the participants.^{36,37}

As a consequence, it was discovered that the e-sports games played by the research participants raised cortisol, testosterone, ACTH, glucose, insulin, and creatinine levels while decreasing urea and bilirubin levels. Current research indicates that digital games played in a competitive atmosphere, along with stress, impact the hormonal and biochemical markers of e-sports participants. Existing data may be increased by include new athlete groups and age groups in future research, raising the bar for athletic

performance.

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