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The Effect of Violent and Non-Violent Computer Games on Changes in Salivary Cortisol Concentration in Male Adolescents

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ABSTRACT

Computer games have turned into a pastime for children and adolescents. The present research involves a report of the effect of these games on salivary cortisol as a stress hormone in male adolescents. The subjects included 50 male adolescents with an age range of 17-19 who were exposed to 30 minutes of either violent or non-violent computer games. Four saliva samples were taken including: before the game (T1), 15 minutes into the game (T2), immediately after the game (T3), and 20 minutes after the game (t4). The results of multivariate analysis of variance revealed that violent video games have led to a significant increase in the level of salivary cortisol while playing and that this level remained constant after the game, but non-violent video games did not increase the level of cortisol secretion in subjects ($P < 0.05$).

Keywords: Violent and non-violent computer games, cortisol, adolescents.

INTRODUCTION

Selling video and computer games has remarkably increased during the past few decades and it appears to be one of the sectors with minimum economic downturn. According to the data from NPD Group that measures consumer purchasing, selling video game consoles as well as software, hardware, and gadgets for playing video games has been around 10.3 billion dollars in the US in 2002 which set a record for two consecutive years. Considering these numbers and expecting that the sales of video and computer games will grow, it is not surprising that a new research context has been developed in order to specify the effect of these games on children. Most of the research studies in this context are related to aggression. Many research studies have reported that violent video games will increase antisocial behavior such as aggression [2, 7, 11, 16].

Regarding the effect of these games on aggression, many studies have reported physiological arousal during playing video and computer games. The reported effects include the increase in cardiovascular reactivity, blood pressure (usually systolic blood pressure), and oxygen consumption in children and adolescents [19] and to the same extent in adults of all age groups [21], especially in individuals with a family history of hypertension and those with Type A personality [12]. The response of the cardiovascular system to video games in young males has been considered as a reliable predictor of the future occurrence of hypertension [17]. In addition, discovering dopamine release during playing video games suggests that this neurotransmitter can play a role in the motivated behavior of humans [15]. Based on these findings, video games are used in research as a stressor for measuring cardiovascular reactivity [19]. Skosnik et al. (2000) reported no change in the level of cortisol secretion which is regarded as a stress hormone. Hubert and Jong-Meyer (1992) and Denot-Ledunois et al. (1998) reported a decrease in the level of cortisol secretion in children during video games. Comparing the changes in testosterone and cortisol changes in winners vs. losers of a Ping-Pong video game, Mazur et al. (1997) found that the level of cortisol decreased insignificantly in both groups.

This evident inconsistency of results may be due to the lack of comparability between different types of video games. For instance, dissection of the results reported on cortisol reveals that recent studies have used unexciting and unsophisticated games (including Ping-Pong and Tetris).Thus, research studies examining cortisol secretion can hardly be compared to the ones that use other games (such as Ms. Pacman, Atari breakout, or other irrelevant games). The present research aims to study the effect of violent and non-violent computer games on the level of salivary cortisol secretion in the adolescent age group.

MATERIALS AND METHODS

The present research is semi-empirical which was carried out as a field-survey study. The design of this research includes two experimental groups. The subjects were organized into the mentioned groups and participated in a design involving measurement before the game, during the game, immediately after the game, and 20 minutes after the game.

Population

The population of the present research consists of male adolescents at the high-school stage (16-19 years old) that had come to use the facilities of Cactus Game Net in Gorghan city, Iran.

Procedure

A. Saliva sampling method: saliva samples were collected before the game, 15 minutes into the game, immediately after the game, and 20 minutes after the game. The sampling method was as follows: subjects washed their mouth to remove oral cavity of previous saliva and other materials; then, they poured 4 milliliter of their saliva into specific sampling tubes without stimulation. At each stage, the collected samples were placed in an icebox. It must be noted that all the samples were frozen at a temperature of -30 centigrade degrees to be tested when opportune.

B. Hormone Measurement: The salivary cortisol concentration was measured using the radioimmunoassay (RIA) and by means of France-made Immune Tech Kit with 0.2 ng/ml accuracy. For the sake of uniformity of the method and hormone measurement stages, all the samples were taken by one experimenter.

Test Procedures
First the chosen subjects were organized into the groups of interest. Before taking the test, some information was individually provided for the subjects regarding the test procedures. Subjects filled out the questionnaires in the same introduction session. Saliva samples were taken from the subjects (before the game);then the subjects were exposed to 30 minutes of violent and non-violent games relative to their groups (Counterstrike for the violent game group and FIFA 2007 for the non-violent game group).Saliva samples were collected at 15 minutes into the game (while playing), immediately after the game, and 20 minutes after the game. Then, the samples were sent to a laboratory for analysis.

Statistical Analysis Procedures
2 × 4 analysis of variance with repeated measures, Tukey's post hoc test, and independent t-test were used in the research for comparing the means of the groups.

RESULTS

The results of analysis of variance revealed that there is a significant difference between the means of T1, T2, T3, and T4 in the violent game group, while the non-violent game group did not experience similar results (Figure 1). This result suggests the significant influence of violent computer games on the level of salivary cortisol.

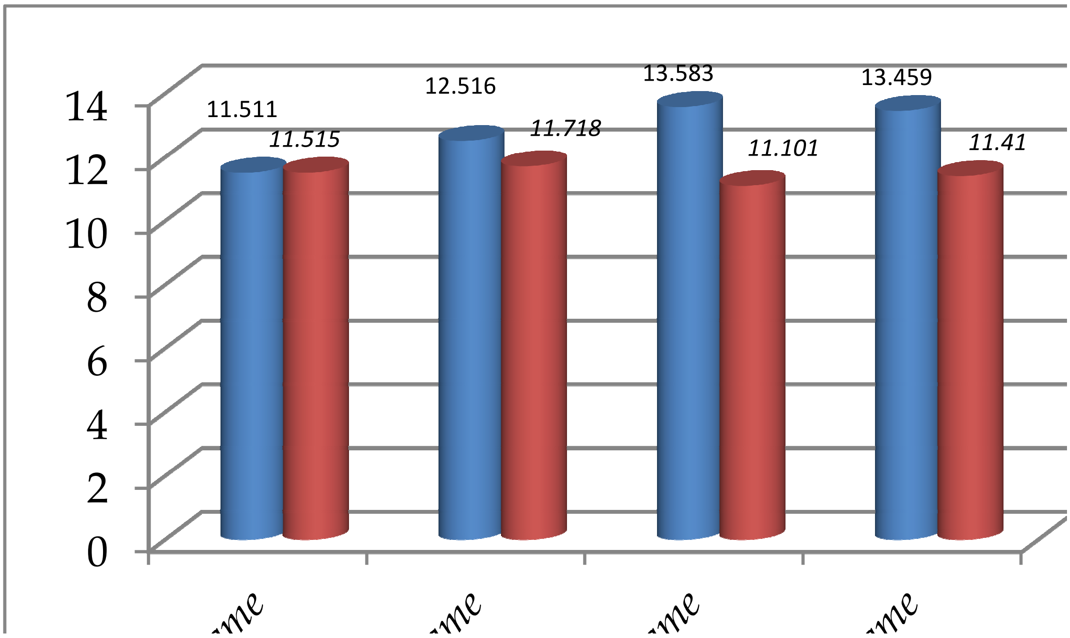

Figure 1. Mean scores of the level of salivary cortisol of research groups

DISCUSSION AND CONCLUSION

The purpose of the present research was to study the effect of violent and non-violent computer games on salivary cortisol changes in male adolescents. The results revealed that violent computer games lead to a significant increase in the level of salivary cortisol, while playing non-violent computer games does not result in such an increase. These findings are consistent with the results of Gawain et al (1983), Segal et al. (1991), Murphy, Albert and Walker (1992), Musante et al. (1994), Modesti et al. (1994), Griffiths and Dancaster (1995), Ballard et al. (1996), Anderson and Buchman (2001), and Anderson (2003) who reported physiological changes in subjects as a result of playing video and computer games.

Many researchers have measured the effect of video and computer games on arousal, but they have done these measurements only during the game and not after it. The results of this research shows that the added arousal during a violent computer game is still at a high level immediately after the game and 20 minutes after the game and that it is significantly different from its normal condition. According to the General Aggression Model of Anderson and Bushman (2002), one of the causes of aggressive behavior in children and adolescents is the increase in their physiological arousal [12]. Moreover, the results of many research studies suggest physiological changes as a result of playing a violent video and computer game [21, 3, 4]. Based on the General Aggression Model, the results of previous research, and the present findings we can conclude that the display of aggressive behavior in children as a result of playing a violent video game can be due to an increase in the level of physiological arousal involving an increase in blood pressure, heart rate, respiratory rate, the level of cortisol, epinephrine, and norepinephrine, and considering the result of the present research which showed that the increase in the level of arousal remains in the individual for a relatively long time, we can expect children and adolescents to display aggressive behavior after playing violent computer games. Finally, as the result of the present research and other studies have shown, violent computer games have a significant effect on aggression and arousal and lead to an increase in these two behaviors, but it has not so far been clarified whether these changes have detrimental effects on children in long-term, and this is an issue that requires long-term research in this context.

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