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A Physiological Study Of Horror Film Viewing And Its Effect On Serum Cortisol Level In Healthy Adults.

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ABSTRACT

When a person perceives a situation as being scary or threatening, the corticotropin releasing factor (CRF) is released by the anterior pituitary gland, which stimulates the adrenal glands. There in turn releases adrenaline and cortisol, needed to react appropriately to survive. The purpose of this study was to examine the effects of cortisol level, which increases in healthy young individuals due to stress. To study autonomic function and serum cortisol level before and after watching a horror movie. In this cross sectional study, 84 healthy medical students in their first year of MBBS, aged between 18 and 22 years were included. On 1st day base line blood samples were taken before watching horror movie. After this on next day subjects were allowed to watch horror movie of about one & half hour and took blood samples immediately after watching horror movie. The serum cortisol levels in males and females before and after watching horror movie show significant increase in serum cortisol levels and autonomic parameters. Horror movie watching induced alteration of serum cortisol levels and autonomic parameters in males and females will require further studies.

Keywords: Cortisol, Horror, Movie, Autonomic.

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INTRODUCTION

Emotions are momentary states induced by an external or internal Event [1]. It initiates changes in several body elements, including neurological, psychological, cognitive, and physiological responses. Further, they prepare the human body for action and to avoid threats.

Fear shows a strong reaction to danger and initiates a distinct physiological and psychological response. The endocrine system releases a series of hormones, namely epinephrine, norepinephrine, and cortisol, during this state. The release of these hormones stimulates the cardio- vascular and respiratory system [2]. Literature suggests that sudden exposure to horror sounds triggers an increased adrenaline and cortisol flow and rapid breathing, a physiological response to fear [3]. Increased adrenaline flow raises the heart rate and dilates blood vessels [4].

Several researchers have employed horror movies to understand their effect on human physiology. The most common physiological responses include increased heart rate, respiration rate, and muscle tension [5]. Fukumato et al. (2015) have tried to understand the effect of watching a horror movie on the physiological data in respiration and skin response. An increase in respiration and a decrease in the respiration cycle were observed during the horror feeling. Also, the participants' skin conductance increased significantly during the movie. In a similar study [6], the participant reported an increased breathing rate, pulse rate, and sweating while watching the horror movie

Fear is a protective mechanism that acts as "survival intelligence" in the brain, mind, and body. It has a strong and distinct evolutionary function as a response to acute threats to physical and psychological well-being. Fear is often equated with the subjective experience or feeling of dread. However, fear is a complex phenomenon that prepares the individual to meet the survival challenges by automatically adjusting cardiovascular, skeletomuscular and endocrine functions alongside actual behaviour and psychological processes including attention and memory [7, 8]. Fear is a biological universal, and practically everyone will respond with a broadly similar fashion in a life-threatening situation. This response is fast: the neural cascade leading to the fear response takes less than half a second to be completed in the brain [9].

The human body is continually responding to internal and external stressors. Walton (1978) once stated that it is not fear when people view a movie, due to the fact that they consciously know that they cannot be harmed. The body processes the stressful information and elicits a response depending on the degree of threat [10]. The body's autonomic nervous system is broken down into the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). In times of stress, the SNS gets activated. The SNS is responsible for the fight or flight response, which causes a cascade of hormonal and physiological responses. The amygdala is responsible for processing fear, arousal, and emotional stimuli to determine the appropriate response. If necessary, the amygdala sends a stress signal to the hypothalamus [11]. Hamann, Ely, Hoffman Co Kilts, (2002) has surfaced to exemplify the importance of the amygdala and its role in fear [12].

The hypothalamus subsequently activates the SNS, and the adrenal glands release a surge of catecholamines, such as epinephrine. This results in effects such as increased heart rate and respiratory rate. As the body continues to perceive the stimuli as a threat, the hypothalamus activates the HPA axis. When a person is faced with a stressor that he cannot control with existing cope mechanisms, HPA axis is activated through the association cortex, amygdala, and hippocampus, which causes the cortisol blood level to rise and brain functions to be affected through the neurons in the brain and glucocorticoid receptors in glial cells [13].

Cortisol is released from the adrenal cortex and allows the body to continue to stay on high alert. Acutely, cortisol's catabolic mechanisms provide energy to the body [14]. Cortisol is the primary glucocorticoid of the HPA axis and is implemental in the fear process [15]. Horror movie is a fiction, but the emotions we feel and the reactions they trigger are real. Undoubtedly, it is a very powerful effect that is now being studied in the context of a newborn science called neurocinema, dedicated to study the influence of movies on our brains. Cuthbert et al. (2003) examined the psychophysiology of fear memory imagery, specifically in phobias, social-anxiety disorder [16].

The purpose of conducting this research is to know the physiological effects of horror movies on the youngsters. A person, who has recently watched a scary movie, might be unable to sleep for a night and then forget about it or this situation remains for weeks and months. The effect of horror movies on autonomic activity is not yet sufficiently explored. Detecting the impact of these stimuli is a complex task. The current study intends to automatically detect the horror- movies induced changes in cortisol level and autonomic parameters in healthy young individuals as a result of stress. However, no study has evaluated the effect of watching a horror clip on changes in cortisol level and autonomic parameters in healthy young individuals as a result of stress.

MATERIAL AND METHODS

Study Population

The present Cross Sectional study was conducted in healthy medical students of first professional M.B.B.S. (n=82) with 41 males and 41 females of 18 to 22 years age group in the Department of Physiology, G.S.V.M. Medical College, Kanpur. The subjects were selected by simple random sampling. The subjects were briefed about the study and informed consent was taken as well as Approval from the ethical committee was taken. They were divided in two groups randomly and two successive dates were allotted to each group when they had to assemble in the department. On the first of the allotted dates the baseline values of the parameters (Systolic and Diastolic Blood Pressure, Pulse Rate and Respiratory Rate) were recorded and venous blood sample was drawn in the morning in between 10.30 AM and 12 PM. After this on next day subjects were allowed to watch horror movie of about one & half hour. Horror movie " EVIL DEAD" was played on large screen in dark sound proof hall and took blood samples immediately after watching horror movie.

Inclusion Criteria

- Females and males between the age of 18 and 22 years.

Exclusion Criteria

- Subjects with any hearing disorder and middle ear disease.
- Subjects with history of any psychiatric disorder.
- Subjects with history of any drug addiction.
- Subject with history of cardiovascular episode /disease

Detailed history regarding the following was recorded

- Dietary habits
- Physical exercise
- Smoking
- Alcohol consumption
- Any known h/o auditory disorder
- History of any drug addiction/ regular drug intake
- Personal history: History of any chronic disease like Diabetes, Hypertension, Heart disease, Psychiatric disorder, Neurologic disorder etc.
- Family history: History of any chronic disease like Diabetes, Hypertension, Heart disease, Psychiatric disorder, Neurologic disorder etc., in the family of the subject
- History of any drug intake that affects emotional status.
- Any endocrinal disorder

Cortisol level estimation

Principle of Cortisol Elisa

The Cortisol kit that we used for the test is a solid phase competitive ELISA. The samples working cortisol-HRP conjugate and anti-cortisol-biotin solution are added to the wells coated with streptavidin. Cortisol in the patient's sample competes with a Cortisol enzyme conjugate for binding sites.

Unbound Cortisol and Cortisol enzyme conjugate is washed off by washing buffer. Upon the addition of the substrate, the intensity of color is inversely proportional to the concentration of Cortisol in the samples. A standard curve is prepared relating color intensity to the concentration of the Cortisol.

Assay Procedure

Prior to assay, the reagents are allowed to stand at room temperature and all the reagents are mixed gently before use.

1. The desired number of coated strips are placed in the holder.
2. 25µl of Cortisol standards is pipetted in control and subject's sera.
3. 50 µl of Biotin reagent is added to all the wells.
4. 100 µl of cortisol enzyme conjugate is added to all wells and mixed thoroughly for 10 seconds and then incubated for 60 minutes at room temperature.
5. The liquid is removed from all the wells and the wells washed three time with 300 µl of 1x wash buffer. Blot on absorbent paper towels.
6. 100 µl of TMB substrate is added to the wells and incubated for 15 minutes at room temperature.
7. 50 µl of stop solution is added to all the wells and the plate is shaken gently to mix the solution.
8. The absorbance is read on a ELISA reader at 450 nm within 20 minutes after adding the stop solution.

Calculation of Results

The standard curve is constructed as follows

1. Cortisol standard value is checked on each standard vial.
2. To construct the standard curve the absorbance for cortisol standards (vertical axis) versus cortisol standard concentrations (horizontal axis) are dotted on a linear graph paper. The best curve is drawn through the points.
3. The absorbance for controls and each unknown sample is read from the curve, and the values recorded.

Statistical Analysis

The data were collected, presented and analysed using Student Paired t- test using "SPSS Statistical Package for Windows version 16".

RESULTS

The following observations and results were made from our study. The mean values of age recorded are as follows

Table 1: Sex-wise Age Distribution

Sex	Mean Age (years)
Males (41)	19.26 ± 1.06
Females (41)	19.33 ± 0.68

Table 2: Changes in cortisol level and autonomic functions in females

Parameters Mean ± SD	Before watching Horror movie	After watching horror movie	t value	p value	inference
Serum cortisol	238.73 ± 85.96	290.65 ± 93.73	2.78	<0.05	Significant
Systolic Blood pressure	109.26 ± 6.98	132.24 ± 8.61	13.39	<0.001	Highly significant
Diastolic Blood pressure	72.29 ± 6.04	89.80 ± 7.16	9.51	<0.001	Highly significant
Pulse rate	76.51 ± 6.5	90.07 ± 9.36	8.07	<0.001	Highly significant
Respiratory rate	19.85 ± 15.77	19.68 ± 1.34	8.41	<0.001	Highly significant

(Paired 't' test)

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Table 3: Changes in cortisol level and autonomic functions in males

Parameters Mean ± SD	Before watching Horror movie	After watching horror movie	t value	p value	inference
Serum cortisol	245.39 ± 83.04	294.41 ± 76.34	2.47	<0.05	Significant
Systolic Blood pressure	114.48 ± 6.59	132.43 ± 10.91	2.28	<0.05	Significant
Diastolic Blood pressure	74.39 ± 6.34	89.46 ± 10.78	10.44	<0.001	Highly significant
Pulse rate	75.85 ± 6.71	89.09 ± 7.77	9.10	<0.001	Highly significant
Respiratory rate	17.26 ± 1.26	19.51 ± 1.34	10.75	<0.001	Highly significant

(Paired 't' test)

Table 4: Comparison of Changes in cortisol level and autonomic functions in males and females

Male vs Female	S. Cortisol	Systolic BP	Diastolic BP	Pulse Rate	Respiratory Rate
Male	49.02± 128.10	17.75± 10.62	14.87± 9.23	13.34± 9.50	2.24± 1.35
Female	55.80± 129.98	22.48± 10.88	18.58± 12.65	13.10± 10.52	2.26± 1.74
t test	0.240771	-1.53	1.5354	0.10973	0.0588544
p value	0.81 (>0.05)	0.12 (>0.05)	0.12 (>0.05)	0.91 (>0.05)	0.95 (>0.05)
Inference	Non significant	Non significant	Non significant	Non significant	Non significant

DISCUSSION

Fear is a complex phenomenon that consists of emotional, psychological, neurological, and cardiovascular fluctuations with a change in breathing behavior. Several studies have indicated that fear significantly affects heart rate, breathing, and skin conductance. However, contradictory findings have been revealed over time regarding the physiological effects of the fear stimulus. The irregularity in the response has been ascribed to the difference in response of the autonomic nervous system. All the subjects were comparable as all the 84 subjects belonged to same race and were of comparable age group. In our study, we compared the cortisol concentration and autonomic functions of individuals in their relaxed and stressed periods. The levels of mood parameters as well as cortisol levels both were significantly raised during horror movie watching.

Mood parameters and cortisol levels were compared between males and females (Table-4). Males exhibited significantly higher baseline levels of anxiety as compared to females. Both males and females showed an increase in the level of stress, anxiety but the difference does not reach statistical significance.

Moreover, variations in cortisol response probably reflect differences in the ways male and female perceive or cope with specific psychosocial situations. Stressors such as watching horror movies provoke greater cortisol changes in males than in females. Similar results were found in study conducted by "Ruchi et al" [17]. They found the levels of mood parameters and salivary cortisol were significantly raised during examination stress.

While in "Cay M et al study showed the mean cortisol level was found to increase approximately 9 times in stressful periods compared with that in relaxed periods [18].

The serum cortisol levels in males before watching horror movie were 245.39 ± 83.04 (mean ± SD) and after watching horror movie were 294.41 ± 0.76 which show significant increase in serum cortisol levels.

The serum cortisol levels in females before watching horror movie were 238.73 + 85.96 (mean ± S.D) and after watching horror movie were 290.65 ± 93.75 (mean ± S.D) which shows significant increase in serum cortisol levels.

The autonomic parameters in subjects after watching horror movie Shows significant increase in Pulse rate, Systolic and Diastolic Blood Pressure, and Respiratory rate. Our results have enough similarities of previous researcher's results. Mian, Shelton, Rayner, Harkin & Williams (2002) examined pulse rate and blood pressure in response to viewing a horror film (Texas Chainsaw Massacre 1974) [19].

All these areas (PR, DBP, SBP) reported increased significantly in response to the horror film.

Problem and limitations with this study limit its generalizing. First was the sample size used in this study, therefore, there might not have been enough power to detect significant differences. Furthermore, there was a degree of subjectivity when it came to the development of the film stimulus. It is possible that the film was not effective at eliciting fear. Another problem with the study was in its demographic. All the participants were students at G.S.V.M. Medical College, Kanpur, therefore creating a generalizability problem.

This could be improved by using a much larger and diverse sample size. In addition, this would have permitted the examination of gender differences which may have mediated the results (S Park et al, 1993) [20]. Further research should examine the role of gender in the relationship between autonomic reactivity and psychopathy.

Finally, the physiological equipment could also have affected results, since it is unusual to watch a film wearing electrophysiological recording equipment.

In the future, research procedure could be adapted to look at fear processing in a clinical psychopathic population (Both criminal and non-criminal).

CONCLUSION

Thus, exact contribution of horror movie watching induced alteration of serum cortisol levels and autonomic parameters in males and females will require further studies.

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