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Original Research Article

HPA AXIS BIOMARKERS DYSREGULATION DUE TO PERCEIVED STRESS AMONG YOUNG STUDENTS

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ABSTRACT

Background: First year of college often generates psychological stress among youngsters due to sudden shift in environment. Stress often leads to biochemical changes. One of the consequences of psychological stress may be deviation in the levels of stress markers -sulphated Dehydroepiandrosterone (DHEA-S) and cortisol. Earlier studies investigated psychological stress and DHEA-S and cortisol levels and observed different findings. Studies showed high levels of cortisol and lower levels of DHEA-S in stress. Few studies demonstrated contradicting results. Further some studies do not show any clear association in any direction. The purpose of this study is to investigate whether levels of DHEA-S and cortisol fluctuates in students who reported perceived stress compared to individuals who report less perceived stress at college.

Material and Methods: There were 107 participants (53 cases and 54 controls) of age range 19-25 years, selected from the first-year nursing students of Subharti Medical College of Meerut district. Perceived stress scale (PSS 10) was used to measure perceived stress of respondents. Serum DHEA-S and cortisol were estimated by Vitros Fusion 5.1 by Ortho Clinical Diagnostics from Johnson & Johnson USA.

Results: In our study mean levels of DHEA-S in cases were 0.66 ± 0.31, Cortisol 103.8 ± 29.8 and PSS were 23.01 ± 2.1. PSS was positively correlated with DHEA-S (r = < 0.05) while there was no significant relation between PSS and Cortisol.

Conclusion: This study indicates that stressed individual has markedly higher levels of DHEA-S. No significant correlation was found between perceived stress and cortisol.

Keywords: Cortisol, DHEA-S, Perceived stress, PSS.

INTRODUCTION

Psychological stress (PS) is the equilibrium adjustment induced by psychological factors which may involve several general and emotional stressors. As per Lazarus and Folkman stress appraisal theory, stress is determined by individual's perception of changed environment more than being associated with environmental events and persons physiological response.[1] Although different individual experiences different problems, they respond with a conventional pattern of biochemical, functional and structure changes basically required in adjustment to new situation. Stress plays a significant part in the lives of young adults including college students. Stress can be induced by a variety of circumstances which can act as stressors. Few studies reported that, environment in first year of college is stressful due to sudden change of lifestyle. [2,3] Students confront different professional and personal stressors like changes in diet and sleeping patterns, social conflicts etc. This results in poor physical and mental health. The stress can be assessed subjectively by means of classical psychological questionnaires and objectively by biochemical parameters present in the biological specimens as urine/blood etc.

Stress primarily activates and stimulates Sympathetic adrenal medullary system (SAM) and hypothalamic pituitary axis (HPA) and release biomarkers like Adreno corticotrophic hormone (ACTH), Cortisol and Dehydroepiandrosterone. [4,5] Cortisol is referred to as the stress hormone and is also responsible for several stress related changes in the body. In general, most healthy adults have a raised cortisol in the morning and low level at night. Prolong activation of HPA under stressful situations leads to an overproduction of cortisol due to dysregulation of the negative feedback loop. DHEA and its sulphated form DHEA-S are anabolic hormones secreted primarily from the adrenal cortex in women and men as well as from the testes in men. It has a protective role & buffers the negative consequences of cortisol. It is released in response to ACTH stimulation as a part of HPA axis making it a potential moderator of the HPA Axis response to stress. DHEA-S levels are highest in the morning similar to cortisol and decline throughout the day. [6,7,8] Levels of DHEA-S are age dependent. Peak levels are reached in early adulthood and decline thereafter. Sustained homeostatic imbalance will interfere the functions of these hormones and significantly affects physical and mental health. Some studies have reported a link between DHEA-S levels and stress intensity. High cortisol has been associated with different disease states, such as depression while high DHEA-S levels have been associated with good health and well-being.

The relationship between prolonged psychological stress and DHEA-S or cortisol levels has been investigated in different ways, but the number of studies is relatively small and observations of these studies contradict each other. Reduced levels of DHEA-S and increased levels of cortisol have been reported in association with exposure to prolonged psychological stress, but elevated levels of DHEA-S have also been reported.

youngsters often do not identify or appreciate the existence of stress with in them. Negligence leads to health problems in a long run. It is important to recognize the existence of stress in early stage. If we can detect its alarming signals timely, it is possible to minimize the subsequent deleterious consequences. In view of the above facts and findings the present study designed to investigate whether perceived stress in first year of young college students affects HPA axis biomarkers – cortisol and DHEA-S and also to find out the association between these markers with perceived stress.

MATERIALS AND METHODS

A total of 107 participants (53 cases and 54 controls) of age range of 19-25 years were selected from the first-year nursing students of Subharti Medical College of Meerut District. Subjective stress was assessed using 10 item PSS which assess the extent to which circumstances in one's life are perceived as stressful. PSS includes 5-point scale ranging from 0 (never to 4 (very often). PSS total scores are broadly calculated by reversing the scores of the seven positive items and then adding the scores of all ten items[9].

Serum cortisol and DHEA-S were estimated on Vitros Fusion 5.1 fully automatic clinical chemistry analyser by Ortho Clinical diagnostics from Johnson & Johnson USA.

Statistical Analysis

The data was given as mean ± standard deviation. Statistical analysis was performed by SPSS version 20.

RESULTS

In our study mean levels of DHEA-S in cases were 0.66 ± 0.31, Cortisol 103.8 ± 29.8 and PSS were 23.01 ± 2.1 (Table 1). PSS was positively correlated with DHEA-S (r = < 0.05) (Table 2) while there was no significant relation between PSS and cortisol.

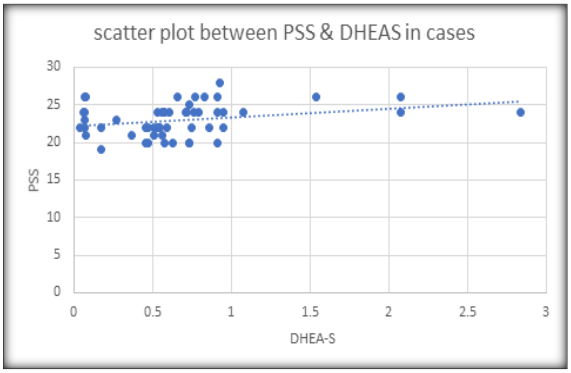

Figure 1: Scatter plot between PSS and DHEAS in cases

Table 1: Values of DHEA-S, Cortisol & PSS in cases and control

		Mean ± Std Dev
DHEA-S	Control	1.51 ± 0.7
	Case	0.66 ± 0.5
Cortisol	Control	56.8 ± 18.5
	Case	103.3 ± 29.8
PSS	Control	7.13 ± 1.5
	Case	23.02 ± 2.08

Table 2: Values and Correlation of DHEA-S with PSS in cases

	DHEA-S	PSS	p value	r value
Cases	0.66 ± 0.31	23.01 ± 2.1	< 0.001	< 0.05

DISCUSSION

In this study major HPA axis biomarkers- Cortisol & DHEA-S were compared between undergraduate students who perceived significant stress and students who did not perceived significant stress. We found no significant correlation between PSS and cortisol. The findings were contrary to the majority of studies which reflects positive correlation of cortisol with stress & related disorders signifying the dysregulation of HPA axis. Less conclusive results pertaining to cortisol and perceived stress likely to be attributed to the different factors for example quality of sleep, menstruation cycle which could possibly affect the levels and hence results. Young age could also be one of the factors which compensates HPA dysfunction due to stress. Further our study demonstrated positive correlation of PSS with DHEA-S. DHEA-S is good hormone and its levels in general decreases with stress.[10]

Few studies showed high DHEA-S in stress. Increased DHEA-S activity was noticed in response to acute and chronic stress possibly to buffer the effects of high cortisol.[11]

Studies demonstrated conflicting results about the use of DHEA-S as one of the biomarkers of stress were also found. [12,13] while other studies do not demonstrate any obvious association in any direction.[14]

The major finding was that DHEA-S is relevant biomarker of perceived stress. DHEA-S has beneficial & protective role during the psychological stress by opposing the cortisol effects. Our results showed that younger individuals displayed increase in DHEA-S levels with stress. DHEA levels are age dependent, levels decrease after early adulthood. [15,16,17]. Our results are backed by other studies which found higher DHEA-S levels in chronically stressed individuals. While there were no differences in any of the cortisol measures.[18]

Our study results are in contradiction with many other studies on DHEAS and stress. [19,20]

Limitations

The major limitation of our study was inclusion of more female participants so we had less data related to males. Another limitation was lack of information related to menstrual cycle and sleep disturbances. As cortisol follows circadian rhythm improper sleep and irregular cycle could contributed to less conclusive results pertaining to cortisol. Different confounding factors are also associated with the analysis of steroid hormones like lifestyle, age, socioeconomic status, meditations, gender, timing of sample collections etc. Unmeasured confounders (eg personality types, lifestyle factors and social factors) may also impact the result. However, we tried to compensate confounding by matching cases with controls. Another significant limitation of our study that the Stress is multifactorial and has many dimensions. Majority of the studies were based on few aspects of stress like depression and anxiety. In future, more comprehensive studies encompassing different biomarkers and multiple stress & stress related disorders in large sample size is warranted to have a broader view in addressing stress in youngsters.

CONCLUSION

In conclusion this study indicates that youngsters display significant positive association of DHEA-S with perceived stress.

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