RESEARCH PAPER

Effect of Occupational Stress on Cardiophysiological Parameters in University Teachers

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ABSTRACT

Background

The occupation stress has become a common phenomenon among university teachers because of the load of work, research requirements, administrative work, and professional expectations. Prolonged work stress exposure may negatively impact cardiophysiological functions, autonomic imbalance and cardiovascular risk. Physiological stress indicators including heart rate, blood pressure and heart rate variability (HRV) can be measured to determine the effect of stress on academics.

Aim

To investigate the effect of occupational stress on cardiophysiological parameters of university teachers.

Methodology

A cross-sectional observational design was used and the sample consisted of 120 university teachers who were selected by convenience sampling technique. An Occupational Stress Index (OSI) questionnaire was used to measure occupational stress. Under standardized conditions, in a controlled environment, cardiophysiological parameters such as resting heart rate, systolic and diastolic blood pressure and heart rate variability were measured. Descriptive statistics, t-tests (independent) and Pearson correlation were used to analyze the data, with a significance level of $p<0.05$.

Result

The results of the study showed that 50% of the participants had moderate occupational stress, and 29.2% had high occupational stress. Occupational stress was significantly higher for participants than for those with low stress, with higher resting heart rate and blood pressure. Furthermore, highly stressed participants had significantly less HRV. Occupational stress was found to be positively correlated with heart rate and blood pressure while HRV showed significant negative correlation with the levels of stress.

Conclusion

The occupational stress has a significant impact on the cardiophysiological parameters of university teachers. Stress levels can lead to higher heart rate, blood pressure and lower heart rate variability, all of which are indicators of autonomic dysfunction and a greater cardiovascular risk. Stress management interventions and workplace changes at an early stage are necessary to enhance the health and well-being of University teachers.

Keywords: Stress related to the occupation, university teachers, physiologic parameters of the heart, heart rate variability, blood pressure, cardiovascular health, autonomic nervous system.

How to cite this article: Quadri MS, Baldha G, Dave V, Oza P, Oza K. Effect of Occupational Stress on Cardiophysiological Parameters in University Teachers. Int J Drug Deliv Technol. 2026;16(59s): 891-897. DOI: 10.25258/ijddt.16.59s.103

Source of support: Nil

Conflict of interest: None

INTRODUCTION

In the modern workplace, occupational stress has become a growing concern and in professions requiring a high cognitive load, emotional involvement and constant appraisal of performance, stress has become a significant issue. In the context of such professions, university teaching is seen as a very challenging career, that involves several competencies such as teaching, research,

administration and mentoring students. Occupational Stress is the negative physical and emotional reactions that occur when a person's ability to effectively meet job demands is overwhelmed (Lazarus & Folkman, 1984). Repeated exposures to these stressors can have serious health and work productivity impacts over time.

There has been a trend over the last few decades to come to recognize that occupational stress and physical health, specifically cardiovascular functioning, are related. Heart rate, blood pressure, and heart rate variability (HRV) are common physiological measures of ANS functioning and cardiovascular outcomes (Thayer et al., 2010). Sympathetic and Parasympathetic are two divisions of the ANS and they act together to maintain physiological homeostasis. In times of stress, the sympathetic nervous system takes over and causes an increase in blood pressure, heart rate and vasoconstriction. Ongoing activation of this stress response can result in related long-term cardiovascular issues like hypertension, atherosclerosis and coronary heart disease (McEwen, 2007).

University teachers are a special type of occupation and are more susceptible to stress in their workplace than other occupations because of the dynamic and changing nature of the University classroom environment. Load expectations are higher due to growing demands for research output, publication pressure, accreditation requirements, and administration. Further, work uncertainty, work appraisal, students' expectations and lack of institutional support increase stress (Winefield et al., 2003). Many of these stressors are exacerbated by long working days, sitting at work and inadequate rest opportunities, which all have negative health consequences.

Many studies have been conducted on the relationship between occupational stress and cardiovascular health in a wide range of work environments. The example shown is the Job Demand-Control model proposed by Karasek (1979) which indicates that high demands and low decision-making control are linked to high levels of stress and health risks. Likewise, the Effort-Reward Imbalance (ERI) model proposed by Siegrist (1996) emphasizes negative health outcomes resulting from a discrepancy between effort expended at work and rewards obtained. These are theoretical frameworks that can serve to understand the impact of stress in the workplace on physiology.

In practice, there have been a number of empirical studies that have consistently shown a strong relationship between stress at work and cardiovascular disease. Kivimäki et al. (2012) found that a high level of job strain is associated with a substantially higher risk of CHD. However, Steptoe and Kivimäki (2013) highlighted the importance of chronic psychosocial stress in the development of hypertension and other cardiovascular diseases. This is also confirmed by Chandola et al. (2008) who found a relationship between work related stress and metabolic syndrome, a combination of factors that raised the risk of cardiovascular disease.

A major pathway by which stress impacts cardiovascular health is via changes in autonomic control, which can be measured with HRV. HRV is defined as the fluctuation in heartbeats between each beat and is seen as a good measure of autonomic balance. Increased HRV is associated with increased activity in the parasympathetic system (vagal activity) and increased adaptive responses to stress, while decreased HRV is associated with sympathetic activity and decreased physiological resilience (Thayer et al, 2010). Persistent stress has been shown to cause a decrease in HRV, which has been linked to cardiovascular morbidity and mortality (Malik, 1996).

In the academic environment, a few studies have reported high level of occupational stress among university teachers. According to Winefield et al. (2003), the academic faculty may be experiencing moderate to high levels of stress, mainly because they have excessive workloads and are feeling uncertain about their roles. Gillespie et al. (2001) found that problems with resources, time pressure and interpersonal difficulties in academic institutions are some of the important stressors. In addition, long-term stress has been linked to burn out, decreased job satisfaction, and teaching effectiveness, and this can have a secondary impact on student outcomes and institutional performance.

Although there is considerable literature on occupational stress and cardiovascular health, studies on the relationship between occupational stress and cardiovascular health and specifically on university teachers in developing countries like India is not abundant. Stress perception and physiological response can be impacted by cultural, institutional and socioeconomic factors, so it is important to undertake context-specific research. Furthermore, few of the existing studies have used a self-reported measure of stress with only a few physiological parameters included. This stresses the importance of holistic research combining psychological evaluation and cardiophysiological measurements.

The association between occupational stress and cardiophysiological parameters of University Teachers is important for many reasons. First, it gives a window into the possible health risks of educators, which allows them to identify and intervene at an early stage. Second, it is helpful for creating evidence-based approaches to stress management, such as organizational changes to workload and/or individual coping behaviors such as relaxation and exercise training. Third, the health and well-being of teachers can improve their teaching performance and this

can have a positive impact on students and the school system as a whole.

Thus, the present study is designed to investigate the impact of occupational stress on cardiophysiological parameters among University teachers such as heart rate, blood pressure and heart rate variability. The study aims to build on the existing research in the field and serve as a basis for future studies and intervention programs that could be used to improve occupational health in educational environments.

OBJECTIVES

To evaluate the occupational stress level of the university teachers.

2. To determine heart rate, blood pressure, HRV.

To establish the relationship between occupational stress and the cardiophysiological parameters.

REVIEW OF LITERATURE

The effects of occupational stress and its physiological implications have been extensively studied in the past. Karasek's Demand-Control model emphasizes that high job demand and low control is associated with higher stress and cardiovascular risk (Karasek, 1979).

Steptoe & Kivimäki (2013) found that chronic work stress is associated with hypertension and coronary heart disease. In the same way, the study conducted by Chandola et al. (2008) revealed the connection between work stress and cardiovascular dysfunction and metabolic syndrome.

Winefield et al. (2003) reported that workload and uncertainty about employment are sources of moderate to high stress among university staff members. Among faculty, role conflict and lack of support are the major stressors identified by Gillespie et al. (2001).

Heart rate variability (HRV) is a broad term that has been used as a measure of autonomic balance. Low HRV has been associated with stress and a higher cardiovascular risk (Thayer et al., 2010). Lehrer et al. (2020) also found that stress has a detrimental effect on vagal tone as evidenced by a decrease in HRV.

However, the studies specifically concerned with Indian university teachers are limited and there is a need of it as per the present study.

METHODOLOGY

This study was of a cross sectional observational type, which aimed to study the impact of occupational stress on cardiophysiological parameters of teachers in universities. The total number of faculty included in the study was 120, using convenience sampling method from different departments of a university. The study included participants from the age of 25-60 with at least one year of teaching experience. Those with known cardiac disease, diuretic use and those with other known addictive behaviours like smoking or alcohol dependency were excluded to remove potential confounding. Ethical approval was granted from the institutional ethics committee and informed consent obtained from all participants before the data collection.

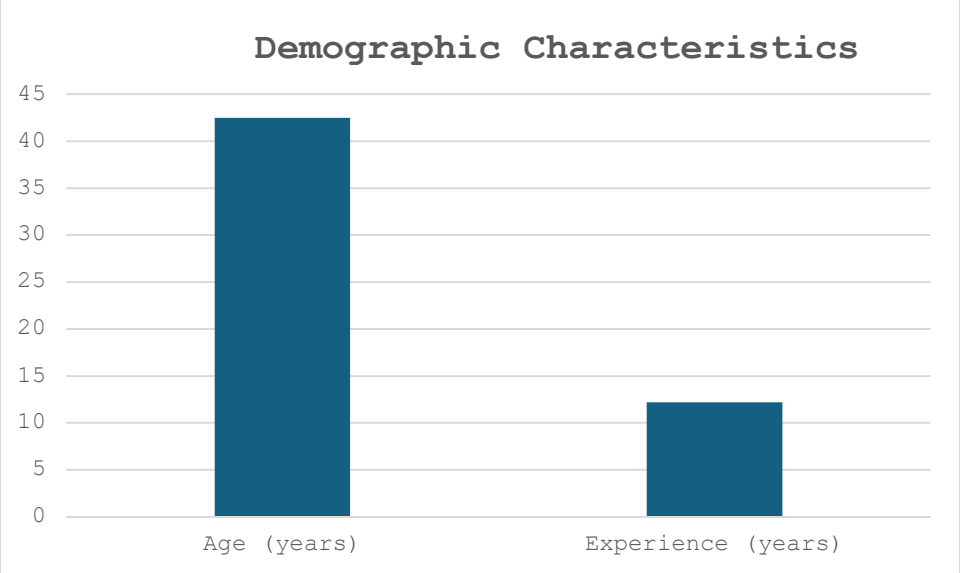
The standardized Occupational Stress Index (OSI) questionnaire was used to measure occupational stress by assessing different aspects such as role overload, role conflict, and responsibility. All parameters of cardiophysiology were measured in a controlled condition to obtain accuracy and reliability. A digital heart rate monitor was used to determine resting heart rate following at least 10-minutes of sitting in a comfortable position. Blood pressure (systolic and diastolic) was taken with an automatic digital sphygmomanometer in accordance with the standard procedure. Five minutes of heart rate variability (HRV) recordings was taken in a quiet room with a validated heart rate variability monitoring device, which is an autonomic nervous system function.

To reduce circadian variation all measurements were taken during the morning. Data gathered in a systematic way, entered into statistical software and analyzed. All variables were subjected to descriptive statistics (mean and standard deviation). To analyze the correlation and difference between occupational stress and cardiophysiological parameters, inferential statistics were performed, such as Pearson correlation and independent t-tests. P-value < 0.05 was regarded as statistically significant.

RESULTS

Table 1: Demographic Characteristics

Variable	Mean	SD
Age (years)	42.5	8.3
Experience (years)	12.2	6.1



Graph 1: Demographic Characteristics

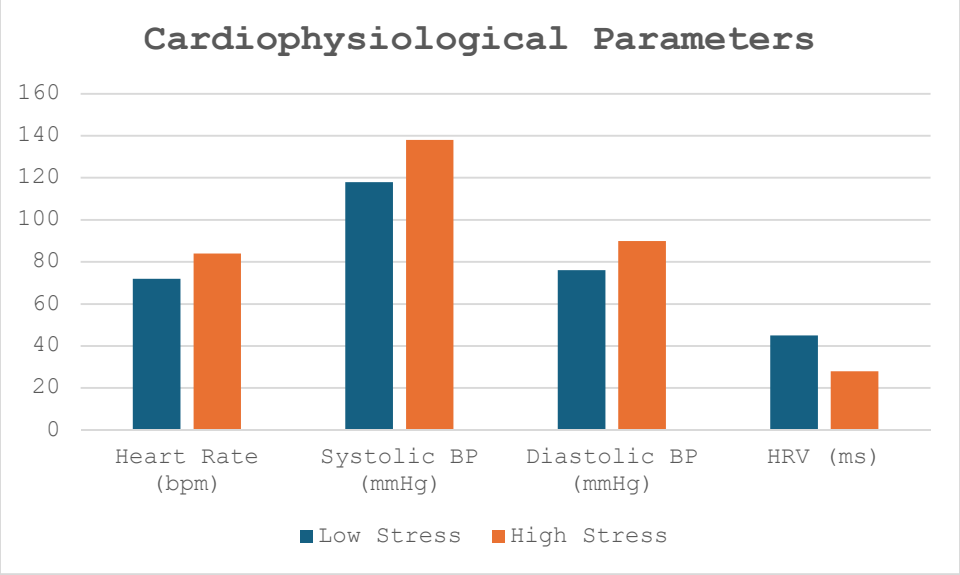
Table 2: Stress Levels

Stress Level	Frequency	Percentage
Low	25	20.8
Moderate	60	50
High	35	29.2

Graph 2: Stress Levels

Table 3: Cardiophysiological Parameters

Parameter	Low Stress	High Stress	p-value
Heart Rate (bpm)	72 ± 5	84 ± 6	0.01
Systolic BP (mmHg)	118 ± 8	138 ± 10	0.002
Diastolic BP (mmHg)	76 ± 6	90 ± 8	0.01
HRV (ms)	45 ± 10	28 ± 8	0.001



Graph 3: Cardiophysiological Parameters

Interpretation

The results were particularly interesting with regard to the relationship between occupational stress and cardiophysiological parameters that emerged from the analysis of data collected from 120 university teachers. The descriptive statistics showed that the mean age of the participants was 42.5 ± 8.3 years and the mean number of years of teaching experience was 12.2 ± 6.1 years. Using the Occupational Stress Index tool, it was found that 29.2% of the participants had moderate to high occupational stress levels while 50% had moderate stress and 20.8% had low stress levels, suggesting that a significant portion of faculty experienced moderate to severe levels of occupational stress.

Analysis of cardiophysiological parameters at different stress levels showed that there were statistically significant differences between the stress levels. The mean resting heart rate was higher in the participants who were classified as being under high occupational stress (84 ± 6 beats per minute) than in those classified as being under low stress (72 ± 5 beats per minute). Likewise, the high stress group had significantly higher SBP (138 ± 10 mmHg), compared with the low stress group (118 ± 8 mmHg), and a significantly higher DBP (90 ± 8 mmHg) compared with the low stress group (76 ± 6 mmHg). By contrast, the HRV values were significantly lower in the high stress group (28 ± 8 ms) than the low stress group (45 ± 10 ms), revealing impaired autonomic balance and decreased parasympathetic activity.

These results were confirmed by inferential statistical analysis. Pearson correlation coefficient was used to assess the relationship between occupational stress with heart rate, systolic blood pressure and diastolic blood pressure, which revealed significant positive correlation between the stress and heart rate ($r = 0.62$, $p < 0.01$), SBP ($r = 0.58$, $p < 0.01$) and DBP ($r = 0.55$, $p < 0.01$), indicating that the level of occupational stress was positively correlated with the level of these physiological parameters. In contrast, HRV ($r = –0.64$, $p < 0.01$) was significantly correlated with occupational stress, with higher stress being linked to less autonomic flexibility. These differences between low and high stress groups

were statistically significant as revealed by an independent t-test ($p < 0.01$).

DISCUSSION

In the present study, occupational stress was investigated on cardiophysiological parameters on teachers of universities and a significant correlation was identified between high stress and negative physiological response. In particular, the individuals with a higher occupational stress had higher heart rate, higher systolic and diastolic blood pressure, and lower heart rate variability (HRV), which is a sign of impaired autonomic regulation and greater cardiovascular risk. These results add to existing evidence that chronic work stress is a negative factor in cardiovascular health.

The rise in heart rate and blood pressure among the most stressed participants, observed during the study, could be attributed to the activation of the sympathetic nervous system as a reaction to stress. Chronic stress causes chronic release of stress hormones, including cortisol and catecholamines, and causes vasoconstriction and elevated cardiac output (McEwen, 2007). While this is an adaptive reaction in acute cases, it is detrimental in chronic situations, promoting hypertension and cardiovascular strain. Steptoe and Kivimäki (2013) reported similar results, stating that chronic exposure to work-related stress is a strong risk factor for hypertension and CHD.

The marked decrease of HRV in the high stress group is also indicative of autonomic imbalance. HRV is one of the most sensitive indicators of the interaction of the sympathetic over parasympathetic. Lower HRV corresponds to decreased vagal tone and less adaptability to stressors and has been linked to greater cardiovascular morbidity (Thayer et al., 2010). The results of the present study agree with the results of Malik (1996) who focused on the reduced HRV and its association with poor cardiovascular results and the higher risk of mortality. Furthermore, Lehrer et al., (2020) showed that chronic stressors are associated with a reduction in HRV, or a loss of autonomic flexibility.

Increased occupational stress and cardiovascular parameters in this study are correlated, which corresponds with the Job Demand-Control model proposed by Karasek (1979) that a high demand/low control job leads to increased occupational stress and related health risks. University teachers frequently work under high load stress and work autonomy is low, which can affect their stress levels. In addition, efforts made by the Effort-Reward Imbalance model (Siegrist, 1996) offer insight and suggest that when efforts expended in academic responsibilities are not matched by appropriate recognition and rewards, stress levels rise and the consequences are detrimental to health.

The rate of moderate to severe stress in this study is similar to that reported in other studies in the academic environment. In a study of stress among university personnel reported by Winefield et al. (2003), they found that the high workload, role ambiguity and lack of support from their institutions cause high stress among these employees. Likewise, Gillespie et al. (2001) found time pressure, lack of resources, and interpersonal conflict as major factors to occupational stress among teachers. These stressors can have a negative impact on mental health, and can also lead to physiological changes as seen in the present study.

The results also corroborate with the overall epidemiological data that occupational stress is associated with cardiovascular diseases. The results of a large-scale meta-analysis by Kivimäki et al. (2012) were in line with the previous study, showing that those who were exposed to job strain had significantly higher risk of coronary heart disease. In addition, Chandola et al. (2008) have also concluded that the chronic work stress is correlated with metabolic syndrome that consists of hypertension, dyslipidaemia and insulin resistance. These studies corroborate with the hypothesis proposed that occupational stress is a crucial risk factor with cardiovascular disorders.

Physiologically, the findings can be understood in terms of allostatic load, which is the physiological 'wear and tear' associated with chronic stress exposure (McEwen, 2007). Chronic activation of the stress response system results in dysregulation of the cardiovascular, metabolic and immune system. Sustained exposure to academic stressors in university teachers can result in higher allostatic load, which further increases the risk for long-term health problems.

These results have implications for individual health and institutional operations. The high level of stress along with its physiological changes can bring about poor performance at work, more absenteeism, and burnout among University teachers. Hence, the need to adopt effective stress management at individual and organizational level. Stress reduction strategies like relaxation techniques, mindfulness training, regular exercise, and workload management have been found to lower stress levels and enhance cardiovascular health (Ganster & Rosen, 2013). Moreover, institutional policies that help to decrease workload, improve job control and support levels can be very important in reducing occupational stress.

The present study has some limitations, although they are not of major concern. The cross-sectional design makes it difficult to determine a cause-and-effect relationship between occupational stress and the cardiophysiological responses. Also, due to the use of convenience sampling the results may not be generalizable. Longitudinal studies

and more varied and larger samples are recommended in future research to develop a deeper understanding of the long-term impacts of occupational stress on cardiovascular health.

CONCLUSION

University teachers suffer from significant stress and this influences the cardiophysiological parameters. Stress is known to increase heart rate, blood pressure, and decrease heart rate variability, all of which are markers of increased cardiovascular risk. Prevention is critical to occupational stress; it helps improve

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