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ORIGINAL ARTICLE

Screening of Oxidative stress markers in Software professionals in Hyderabad – Possibility for the occurrence of Diabetes and Cardiovascular diseases

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ABSTRACT
The Oxidative stress and oxidative damage to tissues are common end points of chronic metabolic disorders such as diabetes and cardiovascular disease (CVD) wherein, abnormally
elevated free radical concentrations and concurrent reduction in antioxidant defence systems may result in harm to cellular organelles and enzymes, elevated lipid peroxidation, and the emergence of insulin resistance. These oxidative stress-related effects may accelerate the emergence of diabetes mellitus and cardiovascular diseases. The fasting blood sugar and biochemical markers such as total cholesterol, triglycerides, LDL, HDL, VLDL, Homocysteine, total protein, Phospholipids, glycolipids and enzymes like glutathione-S-transferase, Xanthine oxidase, SGOT, SGPT, SOD of 200 people in Hyderabad who are working in IT industries were assessed. Oxidative biomarkers were assessed using standard biochemical methods to know the possibility of occurrence of Diabetes and CVD. The data was subjected to statistical analysis for subsequent determination wherein, all the samples analyzed showed higher levels of lipid profile and enzyme markers. The mean cholesterol, triglycerides and LDL cholesterol was found to be higher as compared to those in the controls wherein, the pattern of lipid abnormalities was high triglyceride levels in 60 subjects, high LDL levels in 64 and high total cholesterol level in 76 subjects. Further a slight increased levels of proteins, phospholipids, glycolipids and oxidative enzymes were also noticed. These results clearly indicate that the software personnel are prone more to stress and dyslipidemia, which could cause diabetes and cardiovascular disorders in their future.

Keywords : *Oxidative stress, Biochemical markers, Diabetes mellitus, Cardiovascular disease, Software personnel*

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INTRODUCTION

Stress is one of the major problems being faced by human beings worldwide which has positive and negative impact as well. The positive stress at certain level help individuals to perform better in their work whereas the negative stress called distress restricts their performance by decreasing their potential [1]. The occupational stress is quite common and is inevitable every field of work [2]. If it is not controlled, it leads to physiological, biochemical, somatic and psychological changes in the body leading to oxidative stress and this was higher in software professionals as they interact more with computers. The Indian software industry has expanded at a growth rate of 28% annually and expected to 36% by 2030 [3]. The software services segment is one of the main contributors to the industry's exports; this sector is essential to the expansion of our nation's economy. The Indian economic policy has been more liberalized, which has contributed to the software industry's remarkable rise. The key factors driving the expansion of the Indian IT sector are the country's cost advantages, the availability of trained labour, and high-quality services. The uneven work schedules like day and night shifts in several multinational companies to provide cost effective and quality service worldwide is also responsible for the increase of

stress [4-5]. As a result, the young professionals are at risk and facing several health problems like back pain, arching in wrists, forearms, blurred vision etc. Therefore, there is a need to address this burning issue worldwide in general and India in particular, as there are large number of software companies located in India.

Oxidative stress is the disruption of the balance between oxidants and anti-oxidants physiologically leading to cellular damage [6-7]. The increased oxidative stress is clearly evidenced by the rise in the levels of oxidized molecules such as oxidized glutathione, malondialdehyde (MDA), Hydrogen peroxide (H_2O_2), protein carbonyls, isoprostanes, nitrate/nitrite (NOx) and various oxidative enzymes [8]. It is well recognized that these oxidative conditions act as mediators in the pathophysiology of several diseases including cardiovascular diseases, diabetes, Parkinson's, Alzheimer's etc. [9-10]. Therefore, Conscientious efforts have been put by many scientists throughout the world for identification of markers of oxidative stress as they have the potential to act as an "integrator" of a multitude of processes that drive cardiovascular pathobiology. This study aims at evaluating the oxidative stress levels in software professionals in Hyderabad by analysing various biochemical markers.

MATERIAL AND METHODS

Sample and Sample Size

A total of 200 men working various companies in Hyderabad were selected randomly for this study. The mean age of the selected subjects was 30±4.12. The control group consisted of 100 control subjects (other than software professionals) of the same age group. Prior to their involvement in the study, informed consent was obtained from every individual.

Inclusion Criteria

Age group of 26-35 years

Subjects often feel stress often every day

Exclusion Criteria

Age group less than 25 years and greater than 36 years; Subjects having a family history of Diabetes and cardiovascular diseases; Subjects who are receiving drugs for blood pressure and non-steroidal anti-inflammatory drugs.

Sample collection

Subjects were allowed for overnight fasting and 10 ml of blood was drawn into EDTA tubes. The plasma was prepared and stored at -80°C until further use for the determination of various biochemical markers.

Determination of Biochemical markers

Lipid profile was determined as per the method of Kumar and Das, 2018 [11]. HDL values are also used in the calculation of LDL levels (as shown below).

LDL level was calculated from measured values of cholesterol, triglycerides and HDL according to the formula LDL = TC-HDL-TG/5, where TG/5 is an estimate of very LDL (VLDL) and all levels were expressed as mg/dL. Th serum biomarkers were determined as follows, Homocysteine [12], total proteins [13], Phospholipids [14], enzymes like glutathione-S-transferase [15], Xanthine oxidase [16], SGOT & SGPT [17], SOD, Catalase and Glutathione peroxidase [18].

Statistical Analysis

The results were expressed as median (range) for variables having a skewed distribution and as mean±SE for variables with a regularly distributed distribution. The p-values <0.05 and <0.01 were considered as significant.

RESULTS AND DISCUSSION

The demographic and other characteristics were assessed and the results were presented in Table-1. Age, BMI and waist circumference were significantly higher in software professionals (study subjects) than the normal professionals (control subjects). Further, compared with the controls, study subjects showed a significant elevation in systolic and diastolic blood pressure values. The lipid profile and other biochemical markers were evaluated and presented in table-2. It was evident that the software professionals displayed increased level of cholesterol, triglycerides, HDL and LDL as compared to the control subjects. The total protein, phospholipids and homocysteine levels in software professionals were found be 8.89 g/dL, 4.14 mmol/L and 31.38 µmoles/L respectively which was elevated significantly as compared to the control subjects (Table-2). The enzymatic antioxidants in the serum between the study and control groups were compared and presented. The significant feature was that the study subjects exhibited elevated of Glutathione S-transferase, SOD, catalase, SGOT, SGPT, Xanthine oxidase and Glutathione peroxidase of 5.712 µg/L, 118.37 U/L, 0.32 mU/L, 48.32 units/L, 64.38 units/L, 3.42 µg/L and

6.82 U/L respectively as compared to the control group (3.11 µg/L, 78.39 U/L, 0.14 mU/L, 34.21 units/L, 41.29 units/L, 1.15 µg/L and 3.47 U/L).

Oxidative stress is the result of prooxidative and antioxidative components no longer being in balance, which negatively affects cells. Research demonstrates that oxidative stress contributes to the emergence of obesity-related complications [19]. Oxidative stress is characterized by increased reactive oxygen species (ROS) and decreased antioxidative enzyme activity [20]. Both the global epidemic of obesity and a high-fat diet are associated with oxidative stress and have numerous detrimental effects on health. An imbalance of antioxidants and oxidants can lead to a variety of inflammatory problems, from cancer to infections and immunologic diseases [21]. Free radicals cause peroxidation, which harms DNA, proteins, and fatty acids and interferes with normal biological processes. Antioxidants counteract these free radicals, and the degree of each antioxidant reaction has been utilized as a substitution for measuring the free radical activity [22-23].

The results obtained with regard to lipid profile revealed that the average levels of serum cholesterol and triglycerides were found to be higher in software professionals compared to the normal control. Further, the mean HDL and LDL levels were also significantly higher. These abnormalities in lipid profile clearly indicates the elevated oxidative stress in software professionals and are prone to cardiovascular diseases and diabetes. These results in oxidative stress people are in accordance with those of published reports [24]. Superoxide dismutase (SOD), glutathione peroxidase (GPX), and catalase (CAT) are antioxidant enzymes that are employed as indicators of oxidative stress. These are crucial for maintaining homeostasis and enabling regular cell activity. By reducing the amount of activation energy required to initiate a process, enzymes regulate the rate of metabolic reactions. Because they attach to certain substrates, enzymes display specificity. CAT converts hydrogen peroxide, a hazardous byproduct of metabolic processes, into water and free oxygen in the peroxisomes of the liver and kidney. Superoxide is extremely poisonous; SOD scavenges it and transforms it into hydrogen peroxide. The glutathione system keeps the hydrogen peroxide that SOD produces at a safe concentration. In the present work, elevated levels of all the enzymes was observed which is in agreement with those of published reports [9, 25].

Table-1: Demographic and other characteristics of normal and software employees

Particulars	Control subjects (Other than software professionals)	Study subjects Software Professionals
Sample size	100	200
Age	31±4.52	30±4.12
Gender	Male	Male
BMI (Kg/cm^2)	23.26±2.47**	26.73±3.11*
Waist Circumference (cm)	83.34±2.48*	87.92±2.16**
Systolic BP (mm Hg)	124.56±3.68**	137.21±4.37*
Diastolic BP (mm Hg)	78.63±2.84**	89.76±3.12*

Values presented as mean±SE; *p<0.05, **p<0.01

Table-2: Biochemical markers in of normal and software employees

Biochemical Markers	Reference Range	Control subjects (Other than software professionals)	Software employees
Lipid Profile			
Total Cholesterol (mg/dL)	<200	154.38±4.51*	221.87±4.89*
Triglycerides (mg/dL)	<150	138.19±3.72**	198.39±4.76*
HDL (mg/dL)	>60	63.78±2.34*	52.36±2.18**
LDL (mg/dL)	<100	92.11±3.04*	108.39±3.25*
Oxidative Stress Markers			
Total Protein (g/dL)	6.0 – 8.0	6.76±1.02*	8.89±0.98**
Phospholipids (mmol/L)	1.61 – 3.55	2.36±0.76**	4.14±0.89**
Homocysteine (µmoles/L)	5-15	10.23±1.32**	31.38±1.68*
Glutathione-S-transferase (µg/L)	1.0 – 4.0	3.11±0.88**	5.71±0.99**
SOD (U/L)	1.56 - 100	78.39±3.42**	118.37±4.67**
Catalase (mU/L)	0.11 – 0.19	0.14±0.03**	0.32±0.05*
SGOT (Units/L)	5 - 40	34.21±1.28*	48.32±2.34*
SGPT (Units/L)	7 - 56	41.29±2.04*	64.38±3.81**
Xanthine oxidase (µg/L)	0.5 – 2.0	1.15±0.07**	3.42±0.75**
Glutathione peroxidase (U/L)	2.65 – 4.80	3.47±1.01**	6.82±1.04*

Values presented as mean±SE; *p<0.05, **p<0.01

In the present study, software professionals' mean xanthine oxidase (XO) level was noticeably greater than that of the control group. A research study revealed that in Chinese, Malay, and Indian populations, elevated fasting blood glucose (FBG) was correlated with increased XO [26]. Serum XO levels have been linked to insulin resistance and hyperglycemia, according to another study [27]. Furthermore, the elevated XO levels is linked to cardiometabolic risk factors and affects the health of children and adults [28]. These conditions if persists for long time may lead to other complications like CVD and diabetes and there is a need for effective strategies to minimize the occupational stress among people working in software industry as a first line of defence and for a healthy and wealthy life.

CONCLUSION

The study on the assessment of various biochemical markers of software professionals indicate a significantly higher levels of lipid profile, total protein, homocysteine, phospholipids and all anti-oxidant enzymes. The results can be effectively correlated with the oxidative stress status of the people and if untreated may lead to the pathogenesis of CVD, diabetes, obesity, cancer, inflammation and other metabolic disorders. Further studies are underway to devise suitable strategies which help to combat the degree of risk of diseases associated with this oxidative stress.

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COMPETING INTERESTS

The authors declare that there are no competing interests

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