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Clinical Correlation Of Oxidative Stress Andantioxidant In Obese Individuals

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ABSTRACT
Introduction:Obesity is a health and dietary problem in both developed and developing countries, Obese people have a higher risk for type 2 diabetes mellitus, cardiovascular, hypertensive, dyslipidaemia and cancer. This would also increase the frequency of oxidative stress due to the difference in the number of oxidants and antioxidants, which contributes to unpaired mitochondria and β oxidation, resulting in increased reactive oxygen species.Antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase (GSH), and non- antioxidants such as vitamin C, E act as free scavengers, therebyreducing oxidative stress. Thus, we aimed to study Antioxidant levels in this study mainly, Superoxide dismutase, Glutathione peroxidase, Vitamin C, and Vitamin E.
Methods: This cross-sectional study was carried out on 100 Obese patients and 100 healthy controls and thelevels of Superoxide dismutase, Glutathione peroxidase, Vitamin C, and Vitamin E are measured before and after giving supplements.
Results:In obese patients Superoxide dismutase (SOD) levels were 142.15±21.31, Glutathione Peroxidase levels were 1.941±2.36, Vitamin C levels were 0.29±0.08 and Vitamin E levels were 3.906±1.31 which is lower than normal range.
Conclusion:Present study concludes that estimation of antioxidant capacity is used as one of the biological markers for monitoring oxidative stress in obese persons.

Keywords: Obesity, Oxidative stress, Antioxidant status

INTRODUCTION:

Obesity is a health and nutrition epidemic in developed as well as developing countries.[1] For the last several decades, obesity has become a growing issue of public health worldwide, and its predisposing factors differ according to region. For example, obesity is identified with hypertension, angina, diabetes and arthritis in China, Russia, and South Africa whereas it is identified with hypertension in India[2]. Obesity can also cause a broad range of other diseases[3,4]. Obesity is a disorder in which adipose tissue accumulates excess fat[5]. Usage of the Body Mass Index (BMI) to show this. Individuals with BMI < 25.0- < 27.0 kg / m2 are classified as overweight, while BMI < 27.0 kg / m2 is classified as obese. [2] Obese people have a higher risk of type 2 diabetes mellitus, cardiovascular, hypertensive, dyslipidemic and cancer[6].

It would also raise the occurrence of oxidative stress due to the difference in the amount of oxidants and antioxidants, which contributes to unpaired mitochondria and β oxidation, leading to increased reactive oxygen species.This would result in dysregulation of the adipose tissue, i.e. increased adipocytokine production and decreased adiponectin contributing to the development of metabolic syndrome [7].

An rise in lipid peroxidation such as malondialdehyde (MDA) is associated with obesity. MDA is one of the parameters used by the free radicals to calculate oxidative stress. The mean MDA was significantly higher in individuals with obesity than non-obese [8]. High concentrations of MDA indicate the existence of processes of oxidation in the cell membranes. In the case of oxidative stress, the ability to lower normal oxidation is compromised and causes oxidative damage to tissue[9].

Obesity is associated with a metabolic balance dysregulation which includes lipid metabolism, inflammatory or hormonal processes in response to insulin resistance [10]. The pathogenesis of obesity is diverse and involves, among other closely related pathways, metabolic and hormonal dysregulation, low-grade systemic inflammation, and endoplasmic reticular tension. The key factor in the development of associated comorbidities is increased oxidative stress due to increased use of oxygen and subsequent production of reactive oxygen species (ROS) by means of mitochondrial respiration, which results in excessive reduction of antioxidant protection in the body and cell harm.[11]

Oxidative stress is followed by inflammatory cells invasion of the adipose tissue, along with the further development of excess ROS by these cells as part of the immune response. Therefore, adipocyte dysfunction occurs with the subsequent derangement of many secretory factors derived from adipose tissue, refers asadipokines, which can lead to the development of various metabolic diseases via altered glucose and lipid homeostasis.[12]

However, ROS is typically developed in very low levels of the body, which is generally needed to preserve physiological functions as cell proliferation, host defense, signal transduction, and gene expression. Many groups around the globe, including ourselves [13,14], have based our work on the role of oxidative stress as a central mechanism that could improve the conditions described above. In this background, we have shown how the use of antioxidants in long-term obesity decreases inflammation, insulin resistance and tissue fibrosis associated with obesity. This article discusses the use of antioxidant therapy for ameliorating or avoiding undesired adverse effects.

AIM AND OBJECTIVE:

AIM:

To study the levels of Superoxide dismutase (SOD), Glutathione peroxidase, Vitamin C and Vitamin E in Obese Individuals.

To study the levels of Vitamin C and E before and after vitamin supplementations.

OBJECTIVE:

To correlate the levels of Superoxide dismutase (SOD), Glutathione peroxidase (GPx), Vitamin C (Vit-c) and Vitamin E (Vit-E) between Obese individuals and healthy controls (age matched) attending AVBRHWardha and SMHRC Nagpur.

MATERIAL AND METHOD:

The present Study was carried out in the Department of Biochemistry at DattaMeghe Medical College, ShalinitaiMeghe Hospital &Research Centre, Nagpur in collaboration with Jawaharlal Nehru Medical College and AVBRH (DattaMeghe Institute of Medical Sciences), Sawangi (Meghe) Wardha Maharashtra.

Total **200** subjects were selected for study. Out of which **100** patients are age and gender matched healthy control, **100**were suffered from psychiatric disorders. Informed consent was taken from all participants included in the study.

Sample Collection:

Blood sample were collected and all patients and controls (n=200) gave informed consent for participation to the study.

GSH-Px Measurement:

GSH-Px activity was measured by the method of Paglia and Valentine.[15]

SOD Measurement:

SOD activity was determined according to the method of Sun and colleagues.[16]

Estimation of vitamin C:

Vitamin C was estimated by high performance liquid chromatography (HPLC) with electrochemical or ultraviolet light detection.[17]

Estimation of vitamin E:

Vitamin E was estimated by Modified simple method by baker and frank method.[18]

INCLUSION CRITERIA:

Obese males and females

OBSERVATION AND RESULTS

Table 1: Anthropometric parameters in obese males:

PARAMETERS (N=50)	NORMAL WEIGHT MALE (N=50)	OBESE MALE (N=50)
Age (Years)	32.71±10.00	36.14±8.80
Weight (kg)	65.60±4.60	99.86±9.59
Height (cm)	169.30±6.60	169.57±4.40
BMI (kg/m^2)	21.62±0.99	35.12±3.10
Waist circumference (cm)	77.26±4.15	114.75±9.91
HIP (cm)	93.55±3.89	118.40±6.98

Table 2: Anthropometric parameters in obese females:

PARAMETERS (N=50)	NORMAL WEIGHT MALE (N=50)	OBESE MALE (N=50)
Age (Years)	32.67±6.92	35.40±8.20
Weight (kg)	52.72±2.73	84.08±9.12
Height (cm)	154.12±4.82	153.70±6.37
BMI (kg/m^2)	22.02±0.46	35.24±2.40
Waist circumference (cm)	74.60±5.02	102.53±9.30
HIP (cm)	92.30±5.00	118.64±8.90

Table 3:Levels of Antioxidants in Obese patients and Healthy control.

Antioxidants	Cases Mean±SD (n=100)	Controls Mean±SD (n=100)
Superoxide dismutase (SOD)	142.15±21.31	202.4±46.74
Glutathione Peroxidase	1.941±2.36	4.362±2.32

Vitamin C	0.29±0.08	0.84±0.64
Vitamin E	3.906±1.31	9.42±14.39

Table 4:Correlation of Antioxidant levels between cases and control.

Antioxidants	Cases Mean±SD(n=100)	Controls Mean±SD (n=100)	t-value	p-value
Superoxide dismutase (SOD)	142.15±21.31	202.4±46.74	11.729	< 0.0001
Glutathione Peroxidase	1.941±2.36	4.362±2.32	7.316	< 0.0001
Vitamin C	0.29±0.08	0.84±0.64	8.527	< 0.0001
Vitamin E	3.906±1.31	9.42±14.39	3.816	0.0002

P<0.05

Present table shows that the Antioxidant status in obese individuals is very low as compared to healthy adults. There is a significant correlation between obese persons and healthy controls with a p value of <.05

Table 5: Correlation of Antioxidant status before and after supplementation in Obese patients.

Antioxidant Status	Before Supplementation	After Supplementation	Vitamin Doses	t value	P value
Vitamin E	3.906±1.31	7.312±3.71	400IU/day	8.657	< 0.0001
Vitamin C	0.29±0.08	0.64±0.68	500mg/day	5.112	<0.0001

P<0.05

After the supplementation with different doses of vitamins there is a slight increase in the values of Vitamins**.** There is a significant correlation between vitamins in Obese patients before and after supplementation with a p value of <.05

DISCUSSION:

Free radicals and oxidants play dual roles both as toxic and beneficial compounds because they can be a hazard or a benefit to the body. When over-produced, free radicals and oxidants produce aphenomenon called oxidative stress that damages cell membranes and other structures such as proteins, lipids, lipoproteins, and deoxyribonucleic acids (DNA).Oxidative stress can arise when cells unable to destroy the excess free radicals that areformed. This reaction leads to the formation of MDA and cytotoxic and mutagenicconjugated diene compounds [11]. The high levels of free radicals in the body can be shown by low antioxidant enzyme activity and high levels of MDA in plasma [6].

Free radicals and oxidants perform multiple roles as both toxic and beneficial molecules, since they can be a threat to the body or a benefit. Oxidative stress is characterized as an imbalance between the generation of free oxygen radicals and the antioxidant protection mechanism, resulting from increased development of reactive oxygen species known to cause cytotoxic reactions that are harmful to membrane lipids, proteins, nucleic acids, and lipoprotein carbohydrates, and deoxyribonucleic acids. Oxidative stress occurs when the cells are unable to remove the excess freely formed radicals. This reaction leads to the formation of MDA and conjugated compounds that are cytotoxic and mutagenic[19].The high concentrations of free radicals in the body could be shown by low antioxidant enzyme activity and high levels of MDA

in plasma[20] Extreme free fatty acid release from adipose tissue induces lipotoxicity as it induces oxidative stress to the endoplasmic reticulum and mitochondria[21].

However, excessive accumulation of Triacylglycerol inside the adipose tissue eventually arouses the release of fatty acids as a result of increased lipolysis, which is enhanced by the increased sympathetic condition that normally prevails in obesity[22-23].In addition, dietary habits as lipid-rich diets, with high dietary saturated fatty acids (SFA) that stimulate intracellular mechanisms, resulting in oxidative stress through various biochemical pathways, such as superoxide generation from NADPH oxidases, glyceraldehyde autoxidation, protein kinase C (PKC) activation, and polyol pathway.[24]In addition, low dietary intake of fruits and vegetables; because fruits and vegetables contain antioxidants such as vitamin C and A that helps to protect the body from oxidative injury. [25,26]

The removal of ROS depends on the action of either enzymatic or non-enzymatic reactions to antioxidants; these antioxidants represent the cells' most significant protection mechanisms against oxidative stress[25,26,27].Tomato contains bioactive compounds in the form of lycopene, while tocopherol (vitamin E), tokotrienol, oryzanol and pangamic acid are found in rice bran[28].Many studies indicate that antioxidant compounds in tomatoes, namely lycopene, have been shown to increase blood plasma antioxidant levels.[29]

Based on the results obtained, it can be concluded that Obesity increases the risk factors, mainly increased BMI, waist circumference, lipids, and decreases the status of antioxidants. In present study, we studied the association between obesity and antioxidant status activity in obese adults and healthy adults, the levels of antioxidants mainly superoxide dismutase (SOD) is 142.15±21.31, glutathione peroxidase is 1.941±2.36, vitamin C is (0.29±0.08) and vitamin Eis 3.906±1.31 which is lower than healthy control with a p value of <0.05[30,31].

CONCLUSION:

The result of this study indicates that, the obesity increases the risk of oxidative stress and leads to metabolic syndrome, in present study Obese Individuals, have decrease in the serum levels of superoxide dismutase, glutathione peroxidase, vitamin C and Vitamin E, which is a major factor for concern. To decrease oxidative stress, obese persons should do physical activities, weight loss and they should eat antioxidant rich diet which help in decrease in Oxidative stress, increases antioxidant defences and improves cardiovascular and metabolic risk factors. Present study concludes that estimation of antioxidant status is used as one of the biological markers for monitoring oxidative stress in obese persons.

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