

Obesity in western Iraqi patients: the involvement of glutathione peroxidase, catalase, superoxide dismutase, and malondialdehyde

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Abstract: The current study aims to investigate the levels of some antioxidants and oxidative stress in obese patients in Ramadi located in the center of Anbar province in western Iraq. Only 100 male samples were collected to investigate the levels of antioxidants and the effect of oxidative stress on obesity by measuring malonyldehyde MDA level and some antioxidants including superoxide dismutase SOD, catalase CAT and glutathione GSH in one hundred Iraqi obese men in addition to fifty aged matched normal weight young men. The results showed that the MDA level was significantly higher in obese men 9730.1 ng/ml than in normal weight 368 ng/ml. The mean SOD concentration in obese men was 1285 ng/ml and it was significantly higher than in normal weight 554ng/ml. Serum Catalass levels in obese and normal weight were 1097.5 pg/ml and 18608.8 pg/ml respectively and it was significantly lower in obese group in comparison to normal weight group. The mean serum glutathione concentration was significantly lower in obese group 549.5 ug/ml in comparison to normal weight 1813ug/ml. The levels of measured antioxidants (Catalase, Glutathione) decreased, and there was a significant increase in the levels of MDA. The conclusion reached by the study mechanism is that higher oxidative stress occurred with respect to obesity, which led to a significant decrease in the measured antioxidants and an increase in oxidative stress levels. This may affect the human body Through infection with many diseases such as diabetes.

Keywords: Glutathione peroxidase, catalase, SOD, MDA, Obesity, antioxidants, oxidants.

Introduction

Obesity is a global public health concern that affects individuals of all ages and is associated with numerous health complications. It is primarily characterized by the excessive accumulation of body fat, usually resulting from an energy imbalance between calories consumed and calories expended (1). The prevalence of obesity has increased dramatically over the past few decades, with the World Health Organization (WHO) estimating that more than 650 million adults were classified as obese in 2016 (1). [This rapid growth has been attributed to various factors, including changes in dietary habits, sedentary lifestyles, and genetic predispositions] (2). Obesity is linked to an increased risk of developing chronic diseases such as type 2 diabetes, cardiovascular disease, and certain cancers (3). As a result, addressing the obesity epidemic has become a priority for public health organizations worldwide (4). Glutathione peroxidase (GPx), catalase (CAT), superoxide dismutase (SOD), and malondialdehyde (MDA) are essential molecules involved in the antioxidant defense system and oxidative stress within the human body. [These enzymes play a crucial role in neutralizing reactive oxygen species (ROS), which are produced as a result of normal cellular metabolism or under pathological conditions] (5). An imbalance between the production of ROS and the body's antioxidant capacity can lead to oxidative stress, which has been linked to several health issues, including obesity (6). GPx is a selenium-containing enzyme responsible for detoxifying hydrogen peroxide and lipid hydroperoxides by converting them into water and alcohols (7). CAT is another antioxidant enzyme that protects cells against oxidative damage by catalyzing the decomposition of hydrogen peroxide into water and molecular oxygen (8). SOD catalyzes the dismutation of superoxide anions into oxygen and hydrogen peroxide and is a vital part of cellular antioxidant defense (9). [MDA is an end-product of lipid peroxidation and serves as a biomarker for oxidative stress (10). Recent studies have indicated a correlation between these antioxidant enzymes and obesity. For instance, individuals with obesity have been reported to exhibit lower levels of GPx, CAT, and SOD activities and higher levels of MDA compared to non-obese individuals] (11,12). The imbalance in these molecules contributes to the development of obesity and its related complications, such as insulin resistance, type 2 diabetes, and cardiovascular diseases (13). The aim of this study is to Investigating the role of Glutathione peroxidase, catalase, SOD and MDA in Obesity incidence of western- Iraqi patients.

Material and methods

The samples were then centrifuged at 3,000 rpm for five minutes to separate the plasma from the blood. Subsequently, the samples were analyzed. They 150 samples were obtained from 50 control subjects and 100 patients. For each individual, 10 ml of blood was drawn and placed in a gel tube were collected from Al-Ramadi Hospital and Dr. Sobhi Abdul-Jabbar Shehan's Clinic (an obesity specialist), and were taken from young adults aged between 15 and 35 years. After fasting for ten to twelve hours, ten milliliters of blood were collected from each subject early in the morning. This volume of blood was then placed in a gel tube for one hour at temperatures ranging from 23 to 27 degrees Celsius. The serum was then separated by centrifuging the blood for five minutes at 3,000 x g. The serum was separated into two portions: the first, five milliliters in size, was used to analyze blood lipids. The remaining three milliliters of the second portion were transferred to Eppendorf tubes and stored in a freezer set to -20 degrees Celsius for future determinations of biochemical outcome measures. commercially available enzyme-linked immunosorbent assay (ELISA) methods to measure.

Statistical Analysis:

The statistics were loaded into a computerized database structure. The statistical analyses were done via the computer programmer SPSS version 20 (Statistical Package for Social Sciences). All studied parameters were stated as mean \pm standard deviation (SD). T test was used to determine the significance of differences among the sets. P value <0.05 was determined as significant.

Result and Discussion:

The results of antioxidants and oxidative stress were illustrated in table 1 (Table 1), The MDA level was significantly higher ($p < 0.001$) in obese men 9730.1 ± 20074.4 ng/ml than in normal

weight 368 ± 370.5 ng/ml (Fig.1). The mean SOD concentration in obese men was 1285 ± 461.3 ng/ml and it was significantly higher ($p < 0.001$) than in normal weight 554 ± 136 ng/ml (Fig.2). Serum Catalase levels in obese and normal weight were 1097.5 ± 690.9 pg/ml and 18608.8 ± 2883.3 pg/ml respectively and it was significantly ($p < 0.001$) lower in obese group in comparison to normal weight group (Fig.3). The mean serum glutathione concentration was significantly lower ($p < 0.001$) in obese group 549.5 ± 1129.7 ug/ml in comparison to normal weight 1813.1 ± 6427.2 ug/ml (Fig.4).

Table:1 Comparison of the antioxidants and oxidative stress between obese and normal weight young men.

Group		N	Mean	Std. Deviation	t	Sig. (2-tailed)
SOD	Patients	100	1285.1	461.3	10.954	0.000
	control	50	554.0	136.1		
Glutathione	Patients	100	549.5	1129.7	-1.914	0.058
	control	50	1813.1	6427.2		
CATALASE	Patients	100	1097.5	690.9	-57.690	0.000
	control	50	18608.8	2883.0		
MDA	Patients	100	9730.1	20074.4	3.292	0.001
	control	50	368.0	370.5		

Figure (1): The mean of MDA (ng/ml) in obese patients and normal weight control group.

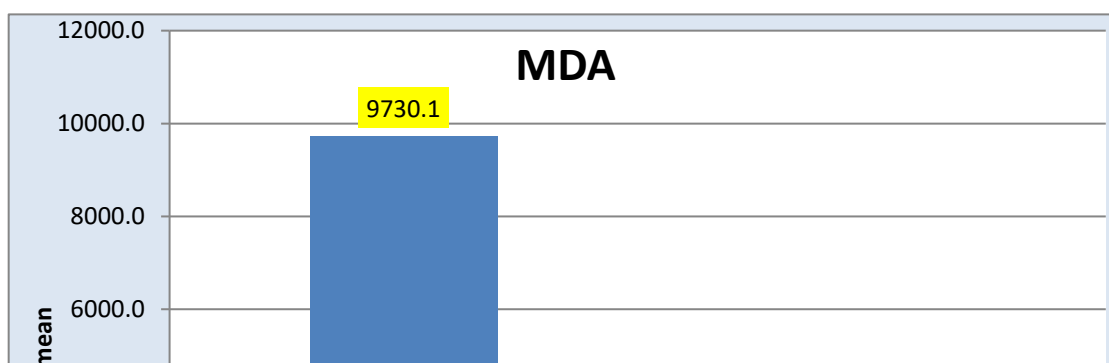


Figure (2): The mean of SOD (ng/ml) in obese patients and normal weight control group.

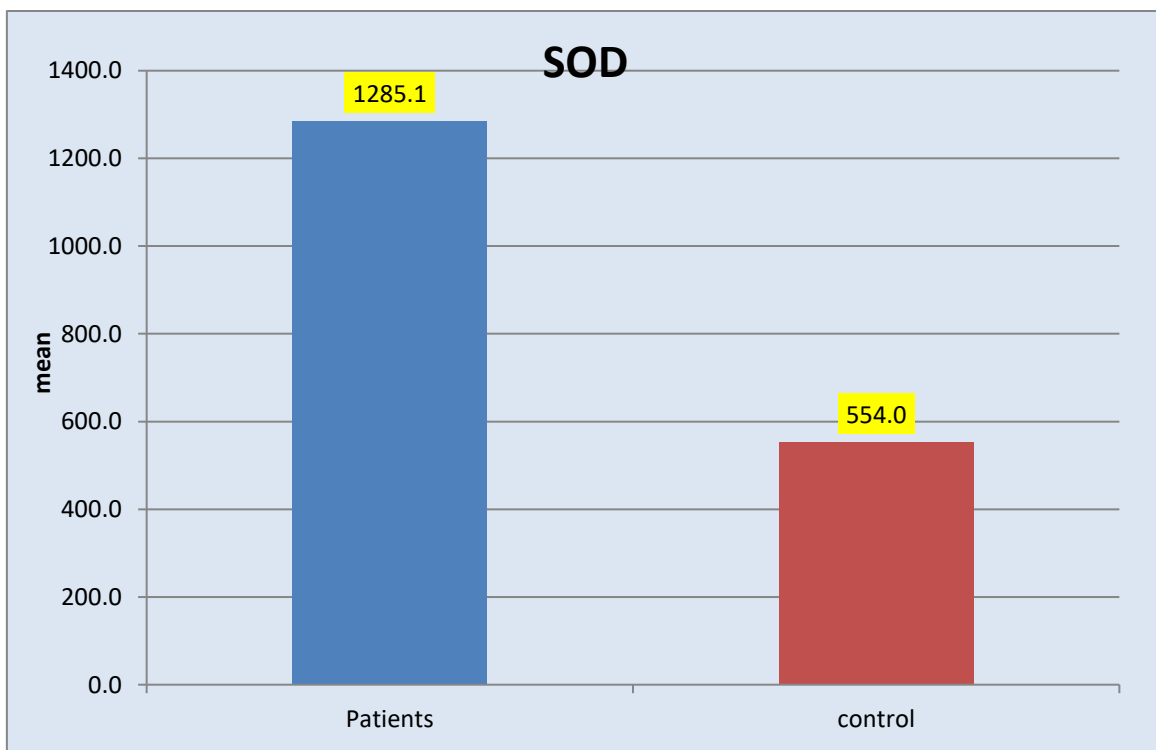


Figure (3): The mean of CAT (pg/ml) in obese patients and normal weight control group

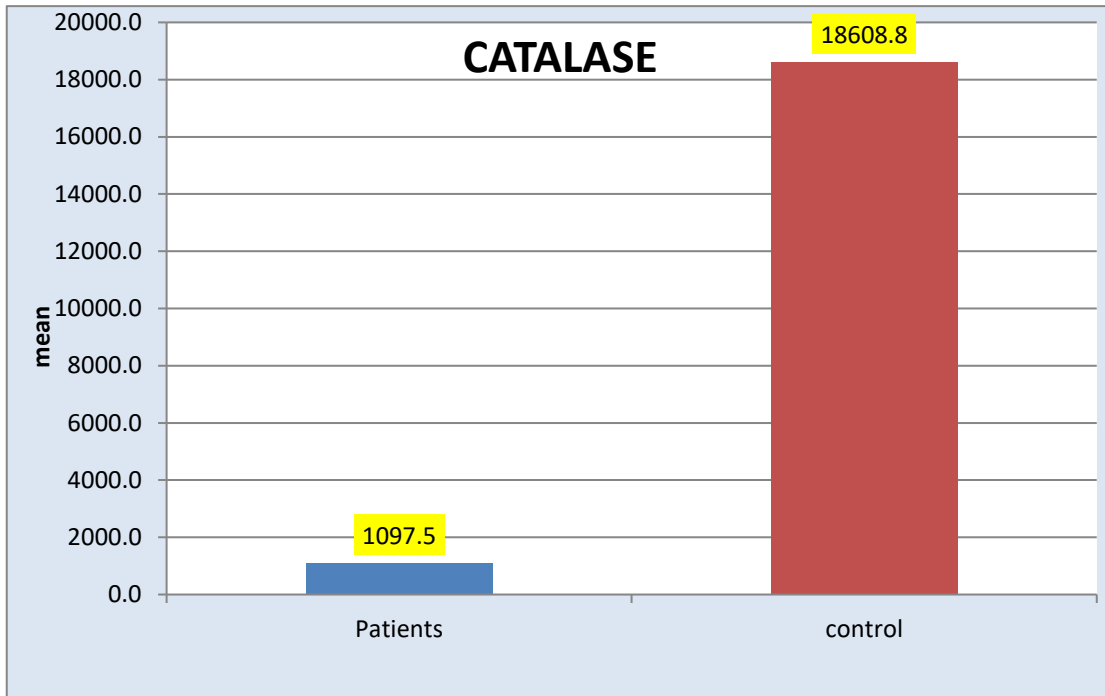
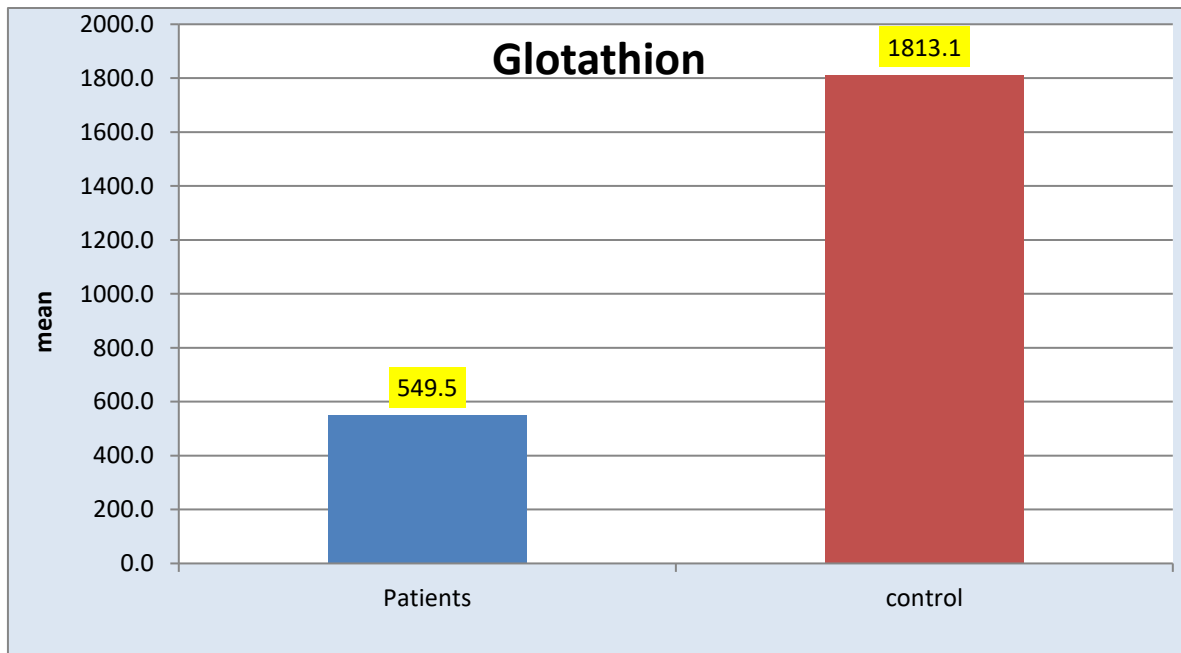


Figure (4): The mean of GSH (ug/ml) in obese patients and normal weight control group



In our study the levels of SOD serum levels were significantly in obese groups than in healthy. Superoxide dismutase (SOD) is an enzyme that plays a crucial role in the antioxidant defense system of the body by neutralizing reactive oxygen species (ROS). Obesity, which is characterized by excess adiposity, has been linked to increased ROS production and decreased antioxidant defenses. This has led to interest in studying the relationship between SOD and obesity (14). Several studies have investigated the association between SOD activity or expression levels and obesity in both animal and human models. In a study of rats fed a high-fat diet, SOD activity was found to be significantly lower in adipose tissue compared to control rats fed a normal diet (14). Another study in humans found that SOD activity was significantly lower in obese individuals compared to non-obese individuals (15). Similarly, studies have also examined the expression levels of SOD genes in adipose tissue in obese individuals. One study found that the expression levels of SOD were significantly higher in adipose tissue of obese individuals compared to non-obese individuals (16). Glutathione is a tripeptide composed of three amino acids, cysteine, glutamic acid, and glycine. It is an important antioxidant that helps to protect cells from oxidative damage and is involved in many cellular processes, including detoxification and immune function. Obesity, on the other hand, is a medical condition characterized by excessive body fat accumulation that can lead to adverse health effects. Recent research has suggested that there may be a correlation between glutathione levels and obesity. In our study Glutathione levels were significantly lower than in healthy groups. A study published in the *Journal of Clinical Endocrinology & Metabolism* in 2015 found that obese individuals had lower levels of glutathione than non-obese individuals, and that these lower levels were associated with insulin resistance and other metabolic abnormalities commonly seen in obesity (17). Another study published in the *Journal of Diabetes Research* in 2016 investigated the effect of glutathione supplementation on weight loss in obese individuals. The study found that individuals who received glutathione supplements along with a calorie-restricted diet lost significantly more weight than those who received a calorie-restricted diet alone (18). While these studies suggest a correlation between glutathione and obesity, it is important to note that correlation does not necessarily imply causation. More research is needed to establish the causal relationship between glutathione and obesity, as well as to determine whether glutathione supplementation can be an effective strategy for weight loss.

Catalase is a crucial antioxidant enzyme found in nearly all living organisms that catalyzes the breakdown of hydrogen peroxide into water and oxygen, protecting cells from oxidative damage. In our study catalase levels were significantly lower than in healthy groups. Several

studies have investigated the potential correlation between catalase levels and obesity. One study published in the Journal of Clinical Endocrinology and Metabolism in 2008 examined the relationship between obesity and catalase activity in both human adipose tissue and mice. The study found that catalase activity was significantly reduced in adipose tissue from obese individuals compared to lean individuals. Furthermore, when mice were fed a high-fat diet to induce obesity, their adipose tissue also showed reduced catalase activity. The authors suggested that this reduction in catalase activity could contribute to oxidative stress and inflammation in adipose tissue, potentially exacerbating the development of obesity-related health problems (19). Another study published in the International Journal of Obesity in 2014 investigated the relationship between catalase activity and obesity-related metabolic abnormalities in children. The study found that children with obesity had significantly lower catalase activity than children without obesity. Furthermore, lower catalase activity was associated with higher levels of insulin resistance, a key feature of metabolic abnormalities associated with obesity (20). There is a growing body of research investigating the potential correlation between MDA (malondialdehyde) and obesity. MDA is a marker of oxidative stress, which has been shown to be associated with various chronic diseases, including obesity. In current research there is significant correlation between MDA levels and Obesity. One study published in the Journal of Clinical Biochemistry and Nutrition investigated the correlation between MDA levels and obesity in Korean women. The study found that obese women had significantly higher MDA levels compared to non-obese women, suggesting that oxidative stress may play a role in the development of obesity (21). Another study published in the Journal of Obesity investigated the relationship between MDA levels and different measures of obesity, such as body mass index (BMI), waist circumference, and body fat percentage. The study found that MDA levels were positively correlated with all measures of obesity, suggesting that oxidative stress may be

involved in the pathogenesis of obesity (22). A more recent study published in the Journal of Diabetes and Metabolic Disorders investigated the association between MDA levels and insulin resistance, a key feature of obesity-related metabolic disorders. The study found that MDA levels were significantly higher in individuals with insulin resistance compared to those without, indicating that oxidative stress may contribute to the development of insulin resistance and related metabolic disorders in obese individuals (23). Overall, these studies suggest that there may be a positive correlation between MDA levels and obesity, and that oxidative stress may play a role in the development of obesity-related metabolic disorders. However, further research is needed to better understand the underlying mechanisms and to investigate potential interventions targeting oxidative stress in the prevention and management of obese.

Conclusion:

Obesity can associate with severe life-threatening effects which can occurs in all people and in different age categories, It was found that SOD MDA levels were higher in obese youth, while CAT and GSH levels were significantly lower in obese Iraqi young men. There is indisputable evidence that obesity increases oxidative stress. The increasing BMI enhanced lipid peroxidation as indicated by increasing MDA and SOD activity, oxidative status may be stimulated by low-grade systemic inflammation state which induced free radical formation and subsequent increase in lipid peroxidation.

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