IHJPAS. 37 (1) 2024
Ibn Al-Haitham Journal for Pure and Applied Sciences
Journal homepage: jih.uobaghdad.edu.iq
PISSN: 1609-4042, EISSN: 2521-3407

An Assessment of Glutathione-S-Transferase and Lipid Profile in Obese Iraqi Patients

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Received 30 January 2023, Received 8 March 2023, Accepted 14 March 2023, Published 20 January 2024

doi.org/10.30526/37.1.3252

Abstract

Obesity is a chronic disease that may have genetic, environmental, and other causes. Obesity is a shortcut to many diseases, such as hypertension, diabetes, atherosclerosis, and other chronic diseases. Oxidative stress increases obesity through free radicals. Glutathione S-transferase (GST) is a metabolic enzyme used to remove toxins. This study aimed to determine GST activity in obese patients as a predictor of oxidative stress and the effectiveness of lipid profiling in obese patients. The study included 139 samples of obese and healthy people (obese group 84 and healthy group 55). Both groups (obese and healthy groups) were divided into four groups based on body mass index. Blood samples were collected from obese males and females in Al-Yarmouk Hospital. Some biochemical parameters were measured for all study groups, including estimation of lipid profile, FSG, and GST activity. Results have shown a significant increase in low-density lipoprotein cholesterol (LDL-C) in obese groups and showed a rise in GST levels in healthy groups compared with obese groups ($p < 0.05$). These studies show that being overweight or obese makes you more likely to get heart disease and other illnesses. It has been demonstrated that the slightly lower levels of GST in the overweight and obese groups compared to other groups demonstrate the precise role of GST in its decrease with weight gain, along with an increase in LDL-C level.

Keywords: Body mass index, Glutathione-S-transferase, Lipid profile, Obesity, Oxidative stress.

1. Introduction

A complex combination of genetic, behavioral, and environmental variables leads to obesity, which is a complicated and diverse disorder. But none of these provides a precise explanation of the process that underlies obesity. The significance of genetics in obesity has been clearly shown by research on ethnic prevalence, family aggregation, twins, and adoption [1,2]. The etiopathology of obesity has been linked to several risk factors, including both genetic and environmental ones [3,4]. The term for oxidative stress is one of these factors. Promoting the accumulation of white adipose tissue and altering food intake can contribute to obesity and its associated comorbidities [5]. A significant direct correlation exists between oxidative stress indicators and body mass index (BMI). Numerous in vitro studies have demonstrated that elevated oxidative stress and reactive

oxygen species stimulate adipocyte proliferation, differentiation, and growth and control hunger and satiety responses [6,7].

Obesity and oxidative stress are linked because too much fat accumulation can lead to an inflammatory and oxidative state via several cellular and metabolic pathways [8-10]. Only white adipose tissue showed a lower glutathione-S-transferase (GST) expression, which detoxifies endogenously produced electrophilic compounds, including those caused by lipid peroxidation [11]. Additionally, antioxidants can reduce oxidative stress. Superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and GST are natural antioxidant enzymes that contribute to oxidative stress defense [12-14]. By conjugating with reduced glutathione, the xenobiotic metabolizing enzymes known as GSTs play a crucial role in cellular defense against reactive electrophiles and fatty acid hydroperoxides generated by oxidative stress. Therefore, GSTs help detoxify cells by reducing tissue damage from free radical assaults [15-18].

This study aimed to determine GST activity in obese patients as a predictor of oxidative stress and the effectiveness of lipid profiling in obese patients.

2. Materials and Methods

After fasting for approximately 12 hours, subjects collected 5 milliliters of blood from each participant via vein puncture. The blood was placed in a gel tube, separated from other blood components by centrifugation for less than 15 minutes at 3000 cycles per minute, and then kept in Eppendorf tubes at -20°C until the required tests, including fasting serum glucose (FSG) levels and lipid profile GST levels, were performed. The WHR= WC/HC formula determines the BMI and waist-to-hip ratio (WHR).

The WHO pathogenic threshold for WHR has been proposed to designate a considerably elevated risk of metabolic disorders as ≥ 0.90 in males and ≥ 0.85 in females [19–22].

All participated in the current study from the National Diabetes Center and AL-Yarmouk Teaching Hospital. It involved 139 participants divided into two groups according to their BMI: G1= A control group of 55 healthy individuals, male and female, aged 35 to 65. G2 consists of 84 obese patients, ages 35 to 65, both male and female. A 5 mL disposable syringe drew 5 mL of venous blood from each participant (patient and control). The serum was extracted from the blood by centrifuging it at 3000 rpm for ten minutes at room temperature; the serum was then split into aliquots and stored in Eppendorf tubes at -20 °C until testing.

2.1 Inclusion and exclusion criteria

Obese male and female subjects aged 35 to 65 years old who didn't have any chronic disease were included in this study. Patients with metabolic, diabetes mellitus, or chronic diseases were excluded from this study.

2.2 Data analysis

The data was examined using Statistical Packages for Social Sciences (SPSS), version 26. The information was shown as (mean ± SE). The statistical test included the ANOVA test for differences between three independent variables, the Tukey test, the ROC curve, and estimation

by analyzing for linear regression. The probability value, recognized as significant at $p \leq 0.05$ and non-significant at $p > 0.05$, determines the statistical significance.

3. Results

Table 1 shows the levels of BMI and WHR between these groups (mean ± SE). The median was [(23.10 ± 0.28 ^{c}) (26.40 ± 0.22 ^{d}) (32.03 ± 0.26 ^{a}) (38.83± 0.44 ^{b})]and [(0.88 ± 0.01^{a}) (0.93 ± 0.01 ^{ab}) (0.92 ± 0.02^{ab}) (1.01 ± 0.03 ^{b}), respectively.

Table 1. Factors distribution of sample study according to patients and control groups

Parameters	Mean ± SE				*p*-value
	Normal weight G1 (n=32)	Overweight G2 (n=23)	Obesity class I G3 (n=43)	Obesity class II G4 (n=41)	
Age (year)	46.68 ± 1.58 ^{a} (46.5)	48.13± 2.13 ^{a} (46)	46.65 ± 1.32 ^{a} (45)	46.66± 1.30 ^{a} (46)	0.915
BMI (kg/m^2)	23.10±0.28^{c} (23.4)	26.40 ± 0.22 ^{d} (26)	32.03 ± 0.26 ^{a} (31.9)	38.83± 0.44 ^{b} (38)	0.0001**
WHR	0.88 ± 0.01^{a} (0.89)	0.93 ± 0.01 ^{ab} (0.94)	0.92 ± 0.02^{ab} (0.90)	1.01 ± 0.03 ^{b} (0.96)	0.008**

Data were presented as Mean ± SE(Median), ** Significant different between means using ANOVA test difference between means at 0.01 level. Significant variants are denoted by different small letters. Non-significant variations are denoted by identical small letters

The mean ± SE values of GST (u/mL) for all the current study groups were recorded in **Table 2**. The table showed a significant difference between the G1, G2, G3, and G4 groups, with a ($p \leq 0.05$) difference in GST activity between groups. The GST activity was deficient in the Obesity Class I (G3) group compared with the G1, G2, and G4 groups. The Tukey test between groups G2 and G3 showed (p=0.05) while between the G1 and G4 groups ($p > 0.05$).

Table 2. Serum GST levels in the study group

Parameters	Mean ± SE				*p*-value
	Normal weight G1 (n=32)	Overweight G2 (n=23)	Obesity class I G3 (n=43)	Obesity class II G4 (n=41)	
GST activity (U/mL)	6.10 ± 0.57^{c} (5.46)	4.120 ± 0.69^{b} (3.12)	2.44 ± 0.21^{a} (2.08)	2.71± 0.30^{ab} (2.08)	0.0001 **

-Data were presented as Mean ± SE (Median), * Using the ANOVA test, there is a significant difference between the means at the 0.05 level, ** ANOVA-test results showing a significant difference between means at the 0.01 level. Significant variants are denoted by different small letters. Non-significant variations are denoted by identical small letters

Table 3: Serum lipid profile in the study groups

Parameters	Mean ± SE				*p*-value
	Normal weight G1 (n=32)	Overweight G2 (n=23)	Obesity class I G3 (n=43)	Obesity class II G4 (n=41)	
FSG (mg/dL)	99.11 ± 2.69 [a] (97.85)	98.45 ± 3.04 [a] (96)	98.29 ± 3.13 [a] (94)	94.36 ± 2.85 [a] (90.5)	0.644
TC (mg/dL)	160.2 ± 10.34 [a] (153)	186.62 ± 10.5 [a] (178.7)	178.84 ± 41.10 [a] (184)	160.35 ± 7.04 [a] (162)	0.073
TG (mg/dL)	174.61 ± 16.89 [a] (156)	151.90 ± 15.15 [a] (156)	173.98 ± 16.22 [a] (153)	170.01± 14.98 [a] (151)	0.811
HDL-C (mg/dL)	42.70 ± 1.47[a] (43.8)	43.30 ± 1.82 [a] (43.1)	44.30 ± 1.184 [a] (44.5)	45.92 ± 1.72 [a] (45.6)	0.449
LDL-C (mg/dL)	83.94 ± 8.95[ab] (89.4)	112.93 ± 10.12 [b] (110.7)	99.74 ± 6.63 [ab] (103)	80.42 ± 7.47 [a] (75.4)	0.033*
VLDL-C (mg/dL)	34.92 ± 3.37[a] (31.2)	30.38 ± 3.03 [a] (31.2)	34.79 ± 3.24 [a] (30.6)	34.0± 2.99 [a] (30.2)	0.811
Atherogenic index	0.55 ± 0.05[a] (0.56)	0.50 ± 0.04[a] (0.53)	0.51± 0.04 [a] (0.56)	0.50± 0.04[a] (0.55)	0.889

Data were presented as Mean ± SE (Median), *Significant difference between means using ANOVA -test at 0.05 level. Significant variants are denoted by different small letters. Non-significant variations are denoted by identical small letters.

According to the participant's anthropometric measurements, which are displayed in **Table 3**, the mean and standard deviation values of their lipid profiles for the study subjects demonstrated a significant difference ($p < 0.05$) in LDL-C but no significant differences ($p > 0.05$) among any of the groups.

The value of the area under the curve of the ROC curve for GST in obese person groups is 0.767. Also, the cut-off value for GST > 80.36. The higher sensitivity and specificity were estimated for GST (58.73% and 66.4%, respectively) in obese patients **Figure 1**.

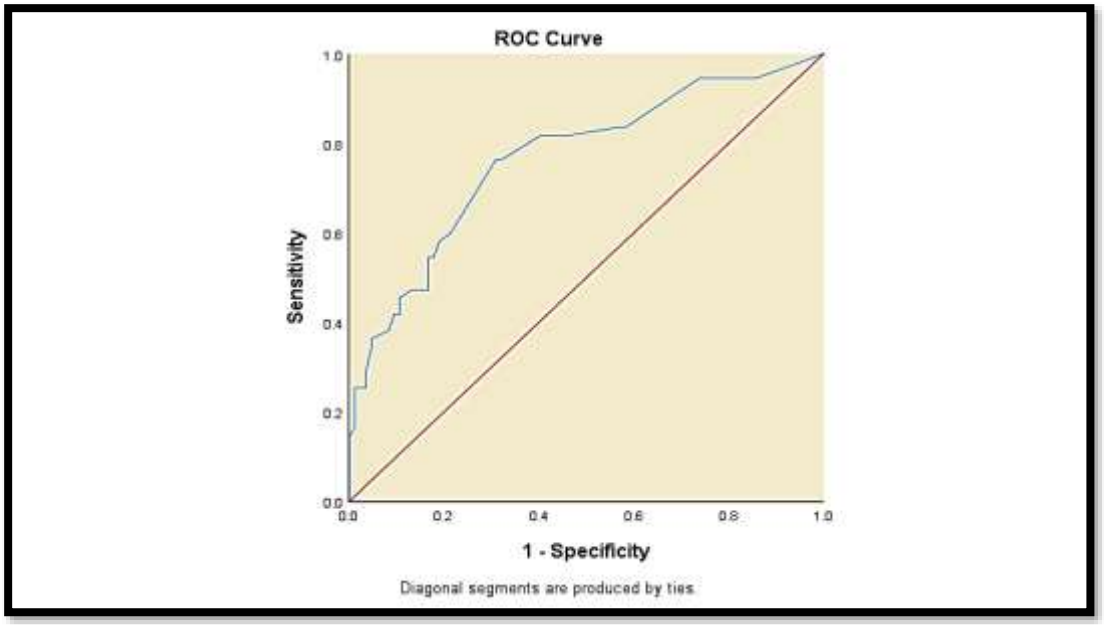

Figure 1. The ROC curve analysis of GST for patients and control groups

4. Discussion

Obesity results from environmental, genetic, aging, gut microbiome, and other factors that cause an energy imbalance and encourage excessive fat deposition. The significant increase in obesity over the past 20 years is primarily due to behavioral and environmental factors, according to the WHO consultation on obesity (sedentary lifestyles and excessive energy intake) [23, 24].

The present study showed that BMI and WHR were highly significant in all groups of these studies ($p \leq 0.05$). These results agree with those of the previous study [15]. Two anthropometric measurements (WHR and BMI) in the context of obesity show that rising BMI is independently associated with decreasing vascular compliance. This link highlights the possible advantages of weight loss for heart health in obese individuals. Measurements of central obesity are more important than measurements of body weight and height alone in causing metabolic syndrome resulting from WHR and BMI [25].

Also, previous studies found a statistically significant relationship between BMI and WHR, which may be used to assess obesity [26].

Another study [27] showed a highly significant BMI with obesity. According to the GST results, there is a substantial difference in GST between these groups and obesity; these findings are consistent with earlier studies [28].

It has been demonstrated that GSH activity was 1.71 times, $p < 0.0001$. In these studies, the findings of the lipid profile, FSG, and atherogenic analysis are presented in Table 3. The current study showed significant differences ($p \leq 0.05$) between patients and controls, while other parameters showed non-significant differences between study groups. Low-density lipoprotein gave a high significance. Results showed the highest level in these groups ($p \leq 0.005$), as shown in **Table 3**, which showed the levels. VLDL is 0.811, not significant in these groups, as shown in Table 3; the result is in agreement with another study [29], which found there was no meaningful relationship between lipid profile and obesity, and also in agreement with earlier data [6], which showed a non-significant relationship between obesity and lipid profiling in obese and non-obese people. Another study [30] showed non-significant differences with HDL-C, TG, TC, and VLDL.

5. Conclusion

It could be concluded that slightly lower levels of GSH in the overweight and obese groups compared to other groups accurately show the role of GST in its decrease in weight gain and an increase in LDL. Indicate their primary role in detoxification, protection against oxidative stress, and prevention of the development of metabolic diseases.

Acknowledgment

The authors thank the staff of the AL-Yarmouk Teaching Hospital and the National Diabetes Center for their assistance in collecting obese patients and healthy samples and for the facilities that helped complete this study.

Conflict of Interest: None.

Funding: None.

Ethical Clearance

This study was approved by the Scientific Committee in the College of Sciences for Women/ University of Baghdad, and verbal consent was obtained from each participant enrolled in the study.

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