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Oxidative Stress State in Men with Irritable Bowel Syndrome

Mahmood Abudlqader Hamad[1*]
Wajeeh Younis Mohammed Al-Ani[2*]
Hazim Ismael Ghazzay[3*]
mah22s3003@uoanbar.edu.iq[1]
wajeehalshaaban@uoanbar.edu.iq[2]
drhazimghazzay@uoanbar.edu.iq[3]
Department of Chemistry, College of Science, University of Anbar, Ramadi City, al-Anbar, Iraq.

Abstract
Oxidative stress, characterized by an imbalance between reactive oxygen species and antioxidant defences, is linked to irritable bowel syndrome (IBS). IBS contributes to intestinal irritation and adjusted intestine motility in IBS sufferers. Markers of oxidative strain are elevated, even as antioxidant enzymes display decreased interest. Addressing oxidative stress via antioxidant treatment options or lifestyle adjustments may also alleviate IBS signs and symptoms and improve the affected person's effects. Researchers at Falluja General Hospital carried out an examination on patients with irritable bowel syndrome to determine their blood oxidative strain degrees. They have a look at blanketed 90 grownup males without certain clinical conditions, and 40 individuals served as the manipulation organization. Blood tests were performed to measure various factors related to oxidative pressure. This precis compares patient and management companies across various parameters. Age analysis shows good-sized variations between patient agencies over and under 35; however, there is no broader association among age categories. BMI comparisons display no statistically great distribution variations between groups. Biochemical parameters (SOD, CAT, MDA, TAOC) all display enormously giant variations between patient and control groups. Correlation evaluation indicates robust relationships between those parameters, with CAT negatively correlated to MDA and positively to TAOC, even as SOD indicates moderate positive correlations with CAT and TAOC and negative correlation with MDA. In diagnostic overall performance analysis, the use of ROC curves demonstrates extraordinary accuracy for all four biochemical parameters (SOD, CAT, MDA, TAOC), with AUC values near one and minimum popular errors. These parameters exhibit varying tiers of specificity and sensitivity; however, they all show considerable ability as dependable biomarkers. Overall, whilst age and BMI analyses yield mixed outcomes, the biochemical parameters consistently exhibit great differences among groups and strong diagnostic capability.

Key words
Total Antioxidant Capacity, Irritable Bowel Syndrome, Antioxidant, Oxidative Stress, Catalase, Super oxide dismutase, Malondialdehyde,

INTRODUCTION

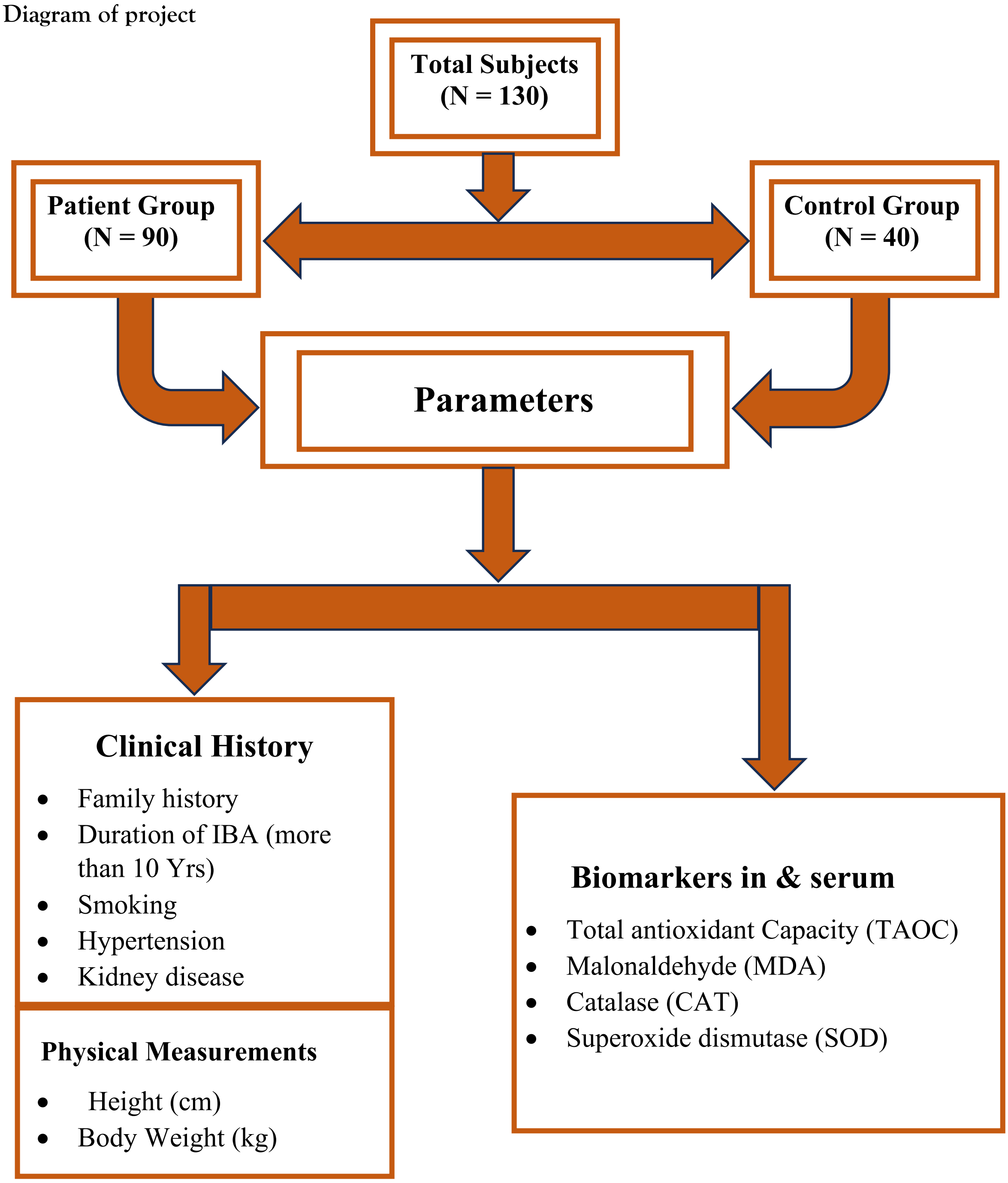
Oxidative stress in men with irritable bowel syndrome (IBS) indicates that oxidative stress can contribute significantly to the pathophysiology of the state. Oxidative stress occurs when there is an imbalance between reactive oxygen species (ROS), and the body has the ability to detox or repair, resulting in these reactive intermediate products. When it comes to IBS, oxidative stress is believed to increase intestinal inflammation and contribute to the symptoms that patients experience. A study published in early 2023 explored the neurobiological aspects of IBS, suggesting that oxidative stress might be linked to the autonomic nervous system's dysregulation, which is a common feature in IBS patients [1,2]. Another study from 2022 examined the impact of oxidative stress on postprandial (after eating) states in IBS patients, demonstrating that interventions aimed at reducing oxidative stress could potentially alleviate some symptoms of IBS [3, 4, 5]. In addition, oxidative stress is involved in a wide range of gastrointestinal disorders, including inflammatory bowel diseases, which share some pathophysiological properties with IBS [6]. These findings outline the importance of addressing oxidative stress in medical strategies for IBS, especially in male patients who can demonstrate different oxidative stress profiles than women.This is necessary to detect the mechanisms of oxidative stress and its effect on gastrointestinal health and understand the relationship between irritable bowel syndrome (IBS) and oxidative stress. Oxidative stress is characterized by an imbalance between reactive oxygen species (ROS) and the production of the antioxidant defense of the body, causing cell damage. When it comes to IBS, oxidative stress is believed to contribute significantly to pathophysiology for dissolution, increase the symptoms and the affect the quality of life [7, 8]. Recent studies have highlighted the role of oxidative stress in gastrointestinal disorders, including IBS. The gastrointestinal tract is exposed to oxidative damage due to exclusive contact with microbial antigens. This exposure can lead to the overproduction of ROS, which may damage, in turn, the intestinal epithelium, interfere with the mucosa, and promote inflammation. In IBS, oxidative damage, abdominal pain, deformity, and converted intestinal habits are believed to contribute to the symptoms [9, 10]. IBS -Pathogenesis includes several factors, including genetic instincts, environmental effects, and changes in intestinal microbiota. It is believed that oxidative stress interacts with these factors, which is a further complaint for the clinical presentation of IBS. For example, a regular feature of IBS is increased oxidative stress, which can promote pathogenic bacterial growth and reduce the abundance of favorable microbes, and intestinal dysbiosis increases. This dysbiosis can increase intestinal permeability, often called "leaky gut," which enables and further stimulates the transfer of luminal antigens, immune response, and oxidative stress [11].Medical strategies targeted to oxidative stress in IBS patients attract attention as possible treatment options. Antioxidants, which neutralize ROS and reduce oxidative damage, are investigated for their effectiveness in reducing IBS symptoms. Antioxidants in the diet, such as vitamins C and E, polyphenols, and flavonoids, have shown the promise of reducing oxidative stress and improving gastrointestinal health. In addition, lifestyle changes, including stress management and regular physical activity, can help reduce oxidative stress and improve the general welfare of IBS patients [12].In addition, the ratio of oxidative stress and IBS is bisexual. While oxidative stress can increase IBS symptoms, chronic stress associated with IBS can also increase ROS production, which can create a vicious cycle. Psychological stress is known to affect intestinal motility and barrier function, and it can also increase the production of pro-inflammatory cytokines and ROS. Therefore, addressing psychological stress through cognitive behavioral therapy, mindfulness, and other stress-free techniques can also help reduce oxidative stress and improve IBS results [13, 14].

Oxidative stress plays an important role in IBSS pathophysiology, which contributes to symptom severity and progression of the disease. Understanding mechanisms as oxidative stress affects the gastrointestinal tract informs the development of targeted agents aimed at reducing oxidative damage and improving the patient's results. Future research should focus on identifying specific oxidative stress biomarkers in IBS patients and evaluating the effect of antioxidant treatments in clinical studies. By addressing oxidative stress with other contributor factors, a more comprehensive approach to handling IBS can be achieved, eventually strengthening the quality of life for those affected by this challenging disorder [15].

Material and methods

Researchers at the Falluja General Hospital examined blood oxidative stress levels in patients diagnosed with irritable bowel syndrome between October 20, 2023, and July 8, 2024. Nighty adult males without a history of hematologic or oncologic disorders, malnutrition, or inflammatory disorders (acute or chronic) were identified in the first screening. We examined the hospital library to get the patients' ages, genders, treatment groups, and long-term conditions, such as cardiovascular disease, hypertension, congestive heart failure, arterial disease, and chronic obstructive pulmonary disease. Forty participants served as the control group for this study. They underwent a number of blood tests, including monitoring and recording of serum superoxide dismutase, Catalase, malonaldehyde and total antioxidant capacity. On the other hand, we examined forty control samples with age ranges from 20-65 Yrs and body mass index.

Diagram of project



STATISTICAL ANALYSIS

Statistical analysis was conducted to assess data homogeneity, normal distribution, and normality. The data was displayed as the mean ± standard deviation, and the probability was evaluated using an independent samples t-test in IBM SPSS version 27.0. A probability < 0.05 was deemed significant by t-test analysis.

RESULTS

Table 1 provides an analysis of age-related differences among two patient groups and a control group. The patient groups are divided into those over 35 years of age (>35) and those under 35 years (<35). The >35 group comprises 55 individuals, accounting for 61.11% of the patient cohort, with a mean age of 39.564 years and a standard deviation of 7.346. The <35 group includes 35 individuals, making up 38.89% of the patients, with a mean age of 30.560 years and a standard deviation of 3.977. The control group, consisting entirely of individuals under 35, includes 40 participants with a mean age of 29.26 years and a standard deviation of 4.681. Statistical analysis reveals a significant difference in mean ages between the >35 and <35 patient groups, as indicated by a t-test with a statistic of 8.55 and a p-value less than 0.0001, suggesting the difference is highly unlikely to be due to chance. However, a chi-square test examining the distribution of age groups yields a non-significant result (chi-square = 3.18, p-value = 0.33), indicating no significant association between the age groups in the context analyzed. Overall, while the patient groups show a significant age difference, the chi-square test suggests no broader association between the age categories considered.

Table (1): Average age and frequency of Irritable bowel syndrome with control groups

Groups		No. (%)	mean ± SD	Significant value
Patients	>35	55(61.11%)	39.564 ± 7.346	**Test Static t=8.55** **Degrees of Freedom (DF) = 78** **Two-tailed probability P<0.0001**
	<35	35 (38.89 %)	30.560 ± 3.977	
	Total	90 (100%)	34.3375±10.0	
control group	Age <35	40(100%)	29.26±4.681	
Chi-square	'Chi-square= 3.18 -value 0.33 (NON-Significant)			

Table 2 presents a comparison of Body Mass Index (BMI) categories between a control group and a patient group. The control group consists of 40 individuals, while the patient group includes 90 individuals. The BMI is categorized into three ranges: ≤24.9, 25-29.9, and ≥30. In the ≤24.9 BMI category, the control group has a mean BMI of 22.43 with a standard deviation of 0.28, and 10 individuals (25%) fall into this category. The patient group has a mean BMI of 23.0 with a standard deviation of 0.72, with 16 individuals (20%) in this range. In the 25-29.9 BMI category, the control group has a mean BMI of 28.63 with a standard deviation of 1.4, with 14 individuals (35%) in this range, whereas the patient group has a mean BMI of 29.33 with a standard deviation of 1.7, with 23 individuals (29%) falling in this category. For the ≥30 BMI category, the control group has a mean BMI of 33.6 with a standard deviation of 1.77, with 16 individuals (40%) in this category. The patient group shows a higher mean BMI of 35.0 with a standard deviation of 2.0, with 51 individuals (51%) in this category. A chi-square test was conducted to assess the distribution of BMI categories between the two groups, resulting in a chi-square value of 8.33 and a p-value of 0.439, indicating no statistically significant difference in the distribution of BMI categories between the control and patient groups.

Table (2): BMI (Kilograms per square meter) for control and patient groups.

Parameters			Control N=40	Patients N=90
	≤24.9	Mean & SD	22.43±0.28	23.0±0.72
		No.	10 (25%)	16 (20%)
	25-29.9	Mean & SD	28.63±1.4	29.33±1.7
		No.	14 (35%)	23 (29%)
BMI(Kg/m^2)		Mean & SD	33.6 ± 1.77	35.0 ± 2.0

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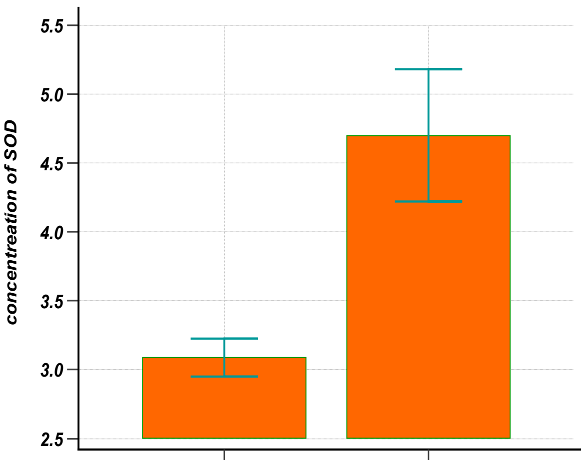
	≥30	No.	16 (40%)	51 (51%)
Chi-square		**8.33, p-value 0.439**		

Table 3 summarizes the comparison of four biochemical parameters between patient and control groups, using mean values and standard deviations, along with the results of t-tests to determine the statistical significance of four parameters as shown in Figures (1, 2, 3, and 4). The parameters measured include Superoxide Dismutase (SOD), Catalase (CAT), Malondialdehyde (MDA), and Total antioxidant capacity (TAOC). For SOD, the patient group has a mean value of 3.0862 with a standard deviation of 0.5734, while the control group has a higher mean of 4.6997 with a standard deviation of 1.1646. The t-test value for SOD is 8.985, with a p-value of less than 0.0001, indicating a highly significant difference between the two groups. For CAT, the patient group shows a mean of 2.3123 and a standard deviation of 0.7934, compared to the control group's mean of 7.7754 and standard deviation of 1.8489. The t-test value is 19.499, with a p-value of less than 0.0001, again showing a significant difference. MDA levels are higher in the patient group, with a mean of 279.5056 and a standard deviation of 52.1869, compared to the control's mean of 105.4189 and standard deviation of 18.6035. The t-test value is -14.238, with a p-value of less than 0.0001, indicating a significant difference. Lastly, for TAOC, the patient group has a mean of 3.5608 and a standard deviation of 1.6002, while the control group has a mean of 9.7301 and a standard deviation of 1.2718. The t-test value is 15.946, with a p-value of less than 0.0001, indicating a significant difference between the groups. Overall, all biochemical parameters show statistically significant differences between the patient and control groups, as indicated by the p-values being less than 0.0001.

Table (3): Mean and SD of oxidative stress (SOD, CAT, MDA, TAOC) in studied groups.

Parameters	Patients	Control	t-test	p-value
SOD	3.0862±**0.5734**	4.6997±**1.1646**	**8.985**	**P < 0.0001**
CAT	2.3123±0.7934	7.7754±1.8489	**19.499**	**P < 0.0001**
MDA	279.5056±**52.1869**	105.4189±**18.6035**	**-14.238**	**P < 0.0001**
TAOC	3.5608±1.6002	9.7301±1.2718	**15.946**	**P < 0.0001**

The data and visual representation both demonstrate a significant difference in SOD concentrations between patient and control groups, with controls exhibiting higher levels. This suggests a potential link between SOD levels and the health status of the individuals in these groups.



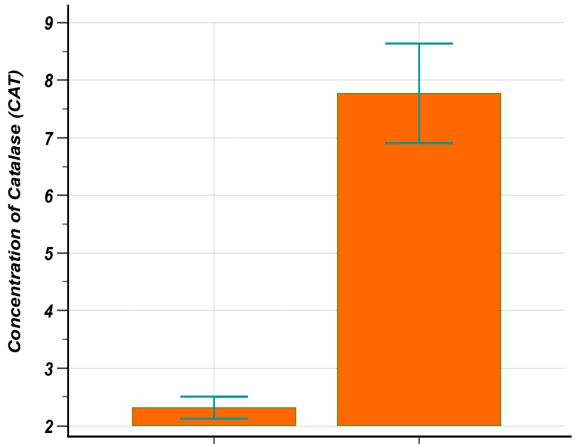


Table 4 below presents the correlation coefficients and the significance levels for the relationships between four biochemical parameters: Catalase (CAT), Malondialdehyde (MDA), Superoxide Dismutase (SOD), and Total Antioxidant Capacity (TAOC). Each correlation coefficient is accompanied by a significance level ($P < 0.0001$) and a sample size of 90. A strong negative correlation exists between CAT and MDA (-0.764), indicating that as CAT levels increase, MDA levels tend to decrease significantly. CAT also shows a strong positive correlation with TAOC (0.788), suggesting that higher CAT levels are associated with increased TAOC. SOD has a moderate positive correlation with CAT (0.530) and TAOC (0.513), while it is negatively correlated with MDA (-0.541). Lastly, MDA is negatively correlated with TAOC (-0.707), indicating that higher levels of MDA are associated with lower TAOC. All correlations are statistically significant, highlighting important relationships between these biochemical markers as shown in Figures (5, 6, 7,8, 9, and 10) below.

Table (4): Correlation coefficient of oxidative stress (SOD, CAT, MDA, TAOC) in studied groups

		CAT	MDA	SOD	TAOC
CAT	Correlation coefficient Significance Level P n	1	-0.764 <0.0001 90	0.530 <0.0001 90	0.788 <0.0001 90
MDA	Correlation coefficient Significance Level P n	-0.764 <0.0001 90	1	-0.541 <0.0001 90	-0.707 <0.0001 90
SOD	Correlation coefficient Significance Level P n	0.530 <0.0001 90	-0.541 <0.0001 90	1	0.513 <0.0001 90
TAOC	Correlation coefficient Significance Level P n	0.788 <0.0001 90	-0.707 <0.0001 90	0.513 <0.0001 90	1

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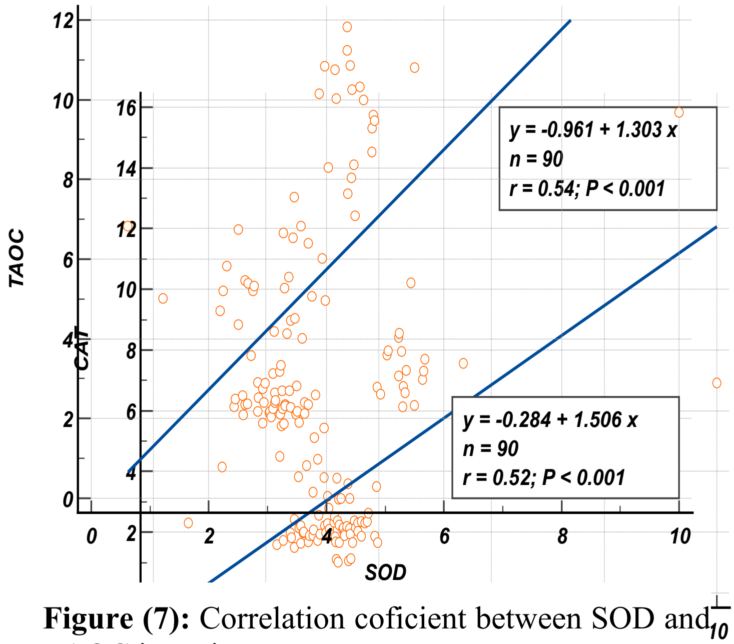

Figure (7): Correlation coficient between SOD and TAOC in patients group

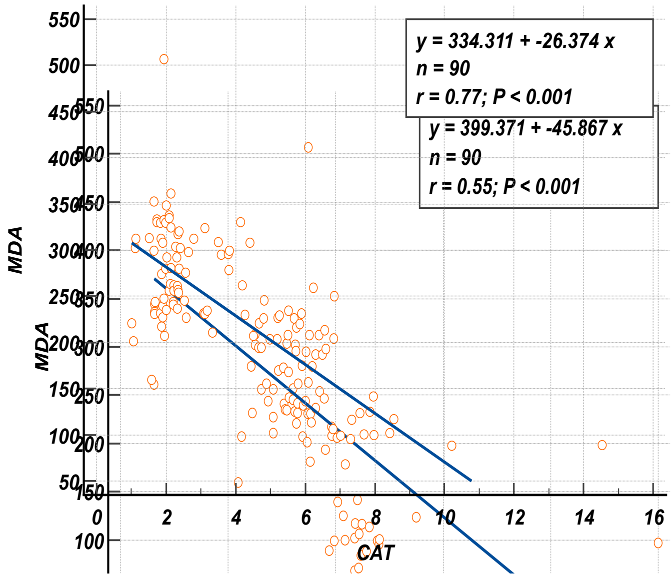

Figure (8): Correlation coficient between CAT and MDA in patients group

Figure (5): Correlation coficient between SOD and CAT in patients group

Figure (6): Correlation coficient between SOD and MDA in patients group

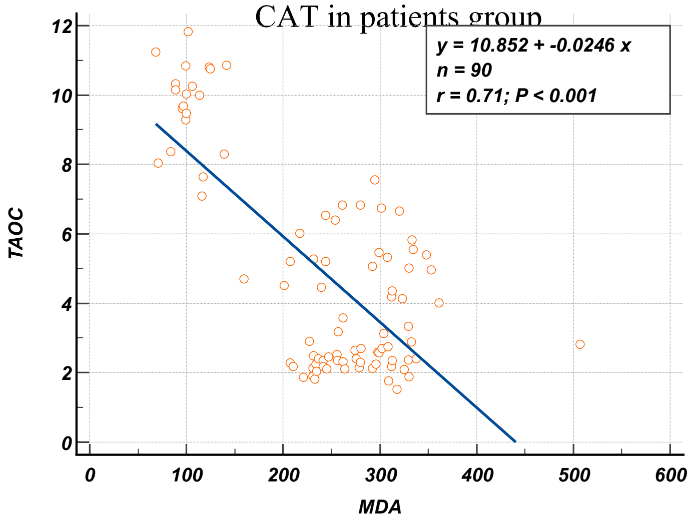

Figure (9): Correlation coficient between MDA and TAOC in patients group

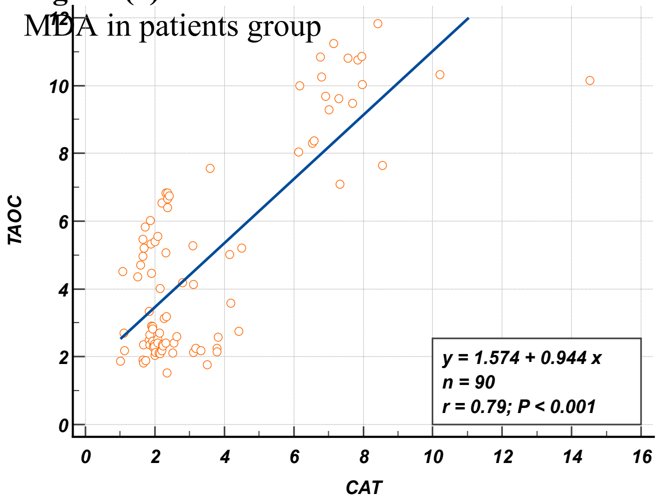

Figure (10): Correlation coficient between CAT and TAOC in patients group

Table 5 presents the diagnostic performance of four biochemical parameters—SOD, CAT, MDA, and TAOC—using the area under the ROC curve (AUC) as a measure Aas shown in Figures (11, 12, 13, and 14). All parameters exhibit exceptionally high AUC values, close to 1, indicating excellent diagnostic accuracy: SOD and CAT both have an AUC of 0.997, while MDA and TAOC have an AUC of 0.999. The standard error for each parameter is minimal (around 0.001), and the 95% confidence intervals range from 0.959 to 1.000, reflecting high reliability. The z statistic values are notably high, supporting the significance of these findings. Specificity and sensitivity values vary, with SOD and TAOC showing high specificity (100%) and sensitivity (95.7% and 97.1%, respectively). CAT has a lower specificity (10%) but perfect sensitivity (100%), while MDA shows a balance with 82.4% specificity and 100% sensitivity. All parameters have significant p-values (<0.0001), underscoring their potential as reliable biomarkers. Table 5 below shows the Roc curve for oxidative stress in study groups.

Table (5): Roc curve for oxidative stress in studied groups

Parameters	Area under the ROC curve (AUC)	Standard Error	95% Confidence interval	z statistic	Specify	sensitivity	Significant value
SOD	0.997	0.0010	0.959 to 1.000	919.887	100.00	95.7	<0.0001
CAT	0.997	0.0010	0.959 to 1.000	119.887	10.00	100.00	<0.0001
MDA	0.999	0.00106	0.958 to 1.000	169.519	82.4	100.0	<0.0001
TAOC	0.999	0.0010	0.958 to 1.000	169.519	100.00	97.1	<0.0001

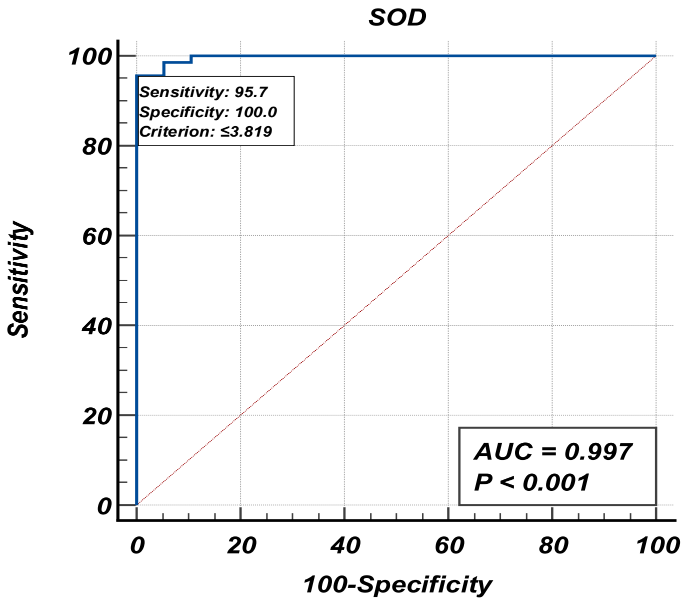

Figure (11): ROC-Curve for superoxide dismutase in studied groups

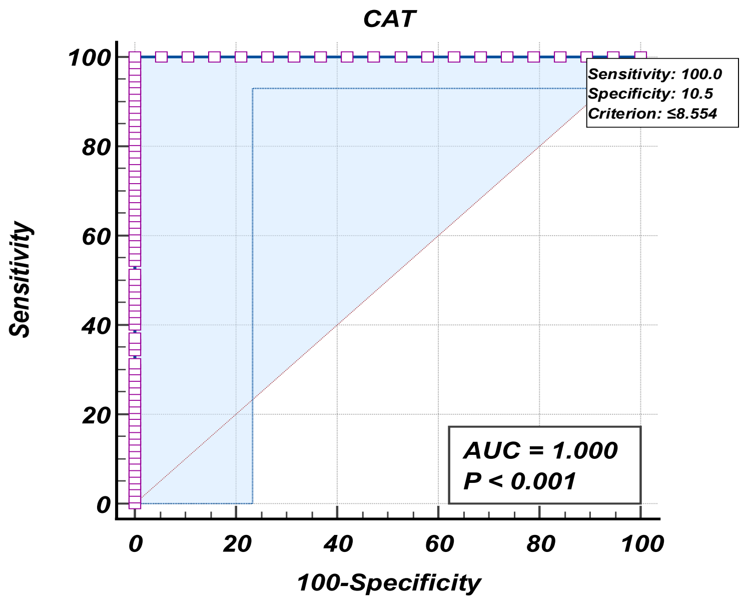

Figure (12): ROC-Curve for Catalase in studied groups

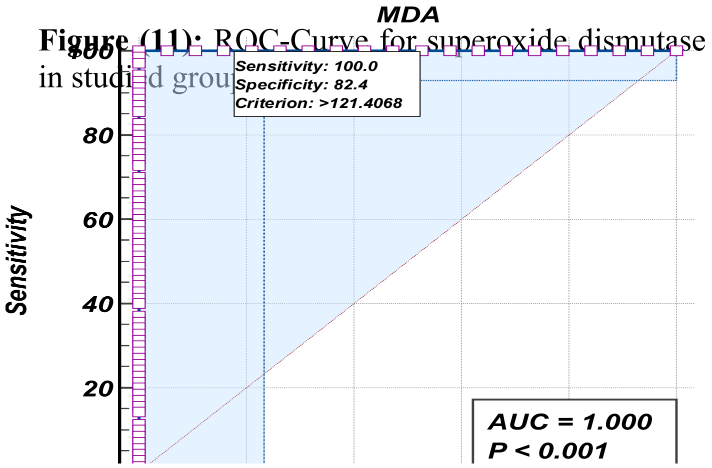

Figure (13): ROC-Curve for Malondialdehyde in studied groups

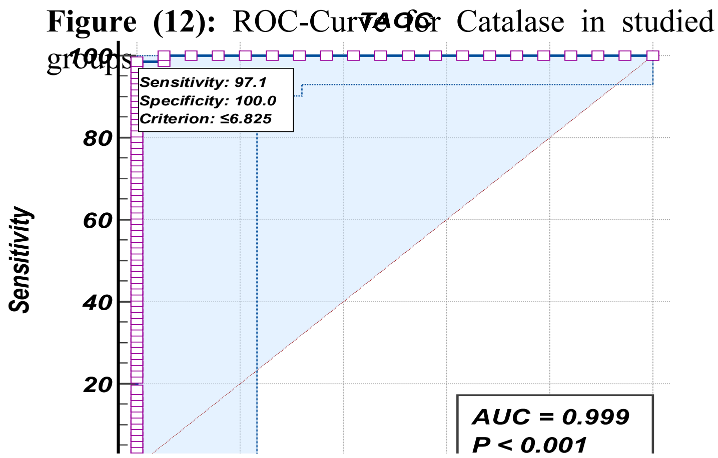

Figure (14): ROC-Curve for the total antioxidant capcity in studied groups

Discussion

Irritable Bowel Syndrome is a common gastrointestinal disorder characterized by symptoms such as abdominal pain, bloating, and altered bowel habits. It is a functional disorder, which means that it is diagnosed based on symptoms rather than identified structural or biochemical abnormalities [16].The prevalence of IBS varies globally, with estimates that it affects about 10-15% of the population in developed countries. However, real spreading may be more due to underreporting and incorrect diagnosis. The average age of the beginning for IBS is usually in late adolescence to early adulthood, where most cases are diagnosed before the age of 50 [17]. This condition is more common in women than men, where the relationship between women and men is about 2:1. This can be caused by hormonal differences in gender, as well as a possible difference in health-seeking behavior between men and women. Recent studies have focused on epidemiology, comorbidity, and management of IBS [18]. A study that uses regular health insurance data emphasized the incidence of IBS and comorbidity, indicating that individuals with IBS often have other overlapping functional disorders such as fibromyalgia and chronic fatigue syndrome. This study also emphasized financial IBS -burdens due to indirect costs and reduced productivity related to direct healthcare costs and absence [19, 20].Recent studies have focused on understanding the underlying mechanisms connecting BMI and IBS. For example, researchers have found a strong correlation between gut microbiota composition and weight growth. The gut microbiome's composition changes with weight growth, and this directly affects IBS symptoms. Changes in overweight intestinal microbiota composition may cause an increase in intestinal permeability and inflammation, which is believed to play a role in IBS pathophysiology. In addition, studies have investigated potential genetic and environmental factors that can contribute to both overweight and IBS. The purpose of these studies is to identify ordinary routes that can be targeted for medical intervention [21, 22]. The relationship between BMI and IBS is multidimensional and influenced by various factors, including diet, lifestyle, and genetic tendencies. Although evidence indicates that high BMI can increase IBS symptoms, the exact nature of this ratio is complicated, and it requires further examination. Understanding the conversation between BMI and IBS can lead to more effective management strategies for individuals affected by both situations [23].The findings from our study are consistent with numerous prior investigations that have documented changed oxidative stress indicators in individuals with IBS. A study conducted by Choghakory, R., Abbasnezhad, A., Hasanvand, A., & Amani, R. (2020) [24] found higher levels of oxidative stress indicators and considerably lower levels of antioxidant enzymes in IBS patients compared to healthy controls, where this indicates that oxidative stress has a vital role in the of IBS. In IBS pathogenesis. ROS accumulation may result from a deficiency of antioxidant enzymes such as SOD and CAT, which can damage cellular components, including lipids, proteins, and DNA. This oxidative damage may exacerbate the inflammation and disrupted intestinal motility observed in IBS. In addition, Breitirim, A. O. et al. 2021 [25] and Carcas, S. C. et al., IBS show the level of elevated MDA in patients, which increase lipids peroxidation, which may interfere with the integrity and function of the cell membrane, which can increase gastrointestinal symptoms. The lower level of TAOC in IBS patients supports the importance of lipid-soluble antioxidants to maintain intestinal health, where TAOC maintains polyunsaturated fatty acids in the cell membrane from the peroxidation of the cell membrane, and its deficiency can cause vulnerability to oxidative damage. Many studies confirm your research results where; a study by Ghoshal, U. C., Shukla, R., and Ghoshal, U. (2021) [27] showed that oxidative stress is a substantial factor in the pathogenesis of IBS, with IBS patients exhibiting increased oxidative damage and diminishing antioxidant capability, and another study with a similar information finding was presented by Mahrashkha, N. et al. 2022 [28] focused the function of oxidative stress in aggravating symptoms of irritable bowel syndrome (IBS) and suggested that antioxidant therapy may be effective in managing the condition, as well as, research by Choghakor et al. (2020) [24] found that antioxidants improved IBS symptoms and further supported the link between oxidative stress and IBS. Medical literature indicates that increasing antioxidant levels might serve to reduce IBS symptomology. The most extreme onset of irritable bowel syndrome symptoms results from oxidative stress together with insufficient antioxidant defence mechanisms. Medical professionals study irritable bowel syndrome through patient evaluations which display reduced measurements of SOD, CAT, MDA and TAOC levels. Successful prevention of oxidative stress represents the necessary condition to manage IBS syndrome. Additional research should analyze both life changes and supplementary antioxidant effects on oxidative stress damage and IBS symptoms. The 2017 paper by Mete [29] defines irritable bowel syndrome ("IBS") as a digestive system disorder affecting numerous patients through abdominal pain alongside altered intestinal functions and unusual bowel patterns as well as form and frequency abnormalities. Research suggests oxidative stress functions significantly in irritable bowel syndrome development, yet scientists lack comprehensive evidence for the complete explanation of pathophysiology at present. Oxidative stress occurs through ROS generation imbalances with antioxidant mechanisms in the body. Recent years have seen a major research interest in determining the relationships between oxidative stress measurements such as SOD, CAT, MDA and TAOC and irritable bowel syndrome.

Some scientific studies have demonstrated that enzyme superoxide dismutase (SOD) levels show a direct correlation to irritable bowel syndrome (IBS) severity. SOD works as an essential enzyme that decomposes superoxide radicals into hydrogen peroxide (H2O2) and molecular oxygen (O2) while protecting cells from damage caused by free radicals. The researchers from Zhang et al. [30] revealed in 2019 that people with irritable bowel syndrome (IBS) showed lower enzyme superoxide dismutase (SOD) activity compared to healthy individuals through their recent meta-analysis. This refers to a weakening of the defense systems against oxidative stress that appears in IBS patients. The results of Lee et al. [31] in 2023 revealed a connection between lower superoxide dismutase levels and higher IBS symptoms severity. The research findings indicate a straight connection exists between the decrease in the levels of the enzyme superoxide dismutase and worsening IBS symptom expressions.

Similar to the superoxide dismutase (SOD) enzyme, and other enzymes, it has also been shown that the activity of the catalase enzyme CAT is changed in patients with irritable bowel syndrome, where the catalase enzyme is an important enzyme in catalyzing the decomposition of hydrogen peroxide into water and oxygen. After reviewing a scientific study conducted in 2024 by Lee and others [32], it was noted that there is a strong negative correlation between the levels of the catalase enzyme and the severity of irritable bowel syndrome symptoms, with a decrease in the activity of the catalase enzyme in patients with irritable bowel syndrome compared to the healthy control group. This means that a decrease in the activity of the catalase enzyme (CAT) may lead at the same time to an increase in oxidative stress in patients with irritable bowel syndrome, which leads to an exacerbation of symptoms in those afflicted.Malondialdehyde (MDA) is a widely used marker for lipid peroxidation and oxidative stress. The elevated MDA level indicates an increase in oxidative damage to the cell membrane. Several studies have shown a positive correlation between MDA levels and IBS severity. For example, in a recent study by Chen et al. (2021) [33], With a strong positive correlation between MDA concentrations and IBS symptom score, much higher MDA levels were found in IBS patients than in healthy control. This discovery suggests that increased lipid peroxidation can play a role in the pathogenesis of IBS and contribute to symptom severity.

TAOC represents a medical measurement that measures the complete antioxidant state to protect individuals against potential oxidative damage. Irritable bowel syndrome patients demonstrate reduced total antioxidant capacity, which is a weak antioxidant defense system. Liu et al. (2017) [34] discovered that patients with higher IBS severity showed lower total antioxidant capacity and this explains the negative correlation between TAOC and IBS degree. Zhang et al. (2019) [30] conducted a latest meta-analysis to demonstrate patients with IBS have considerably reduced TAOC levels below healthy control subjects.

Balmus, I. M. et al. (2020) [35] highlight the importance of oxidative stress in the treatment of IBS through the understanding of a close relationship between IBS symptoms and these parameters. Tao E. et al. (2022) [36] conducted a random controlled test which evaluated the effects of anti-oxidative supplement treatment on IBS symptoms and oxidative stress markers. Antioxidant supplements served to improve symptoms of IBS while they increased activities of SOD and CAT through the reduction of MDA levels. Research indicates that antioxidant treatments demonstrate potential as an effective method to manage IBS symptoms through stress oxidative management.

The complex interplay between oxidative stress and other pathophysiological mechanisms involved in IBS can be understood by understanding the correlation between these parameters and IBS. Researchers studied the connection between oxidative stress markers and intestinal microbiota structure through the work by Zhou et al. (2018) [37]. Research results demonstrated that SOD, CAT and MDA levels found a direct correlation with different bacterial taxa abundance, thus indicating an influence relationship between oxidative stress and microbiota structure. The research findings show that oxidative stress could influence how the brain-gut axis works, which experts identify as an essential factor for IBS development.

This research has evaluated oxidative stress markers in relation to IBS for their prospective use as diagnostic or prognostic tools. The clinical usefulness of using SOD, CAT, MDA and TAOC as diagnostic markers for IBS was studied by Zhang et al. (2021) [38]. A study confirmed the use of these markers together as a diagnostic tool that shows effective clinical performance for spotting and tracking IBS conditions.

Conclusions

The significance of SOD, Cat, MDA, and TAOC as indicators of oxidative stress in IBS. It makes it clear:

1. The correlation between these indicators shows that oxidative stress plays a role in the pathogenesis of IBS.
2. Patients with IBS exhibit decreased total antioxidant capacity, elevated lipid peroxidation, and altered antioxidant enzyme activity.
3. Because of their strong correlation with the intensity of symptoms, these markers imply clinical importance.
4. One promising medicinal strategy for IBS is to target oxidative stress.
5. Future studies should concentrate on figuring out how oxidative stress and IBS are related, creating tailored treatments, and determining whether these markers may be used as clinical or immunological tools.

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