e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 132-135

Original Research Article

Association between Serum Paroxanase Enzyme Activity and Dyslipidemia in Obese Individuals

Neha Bharti[1], Nisha Jha[2], Vibha Sushilendu[3], C. Selva Kumar[4]

[1]Assistant Professor, Department of Biochemistry, E.S.I.C. Bihta, Bihar, India
[2]Assistant Professor, Department of Biochemistry, N.S.M.C.H. Bihta, Bihar, India
[3]Assistant Professor, Department of Biochemistry, E.S.I.C. Bihta, Bihar, India
[4]HOD, Department of Biochemistry, E.S.I.C. Bihta, Bihar, India

Received: 25-01-2024 / Revised: 20-02-2024 / Accepted: 05-03-2024
Corresponding Author: Dr. Vibha Sushilendu
Conflict of interest: Nil

Abstract:

Background: It is crucial to understand the roles of enzymes in lipid metabolism and cardiovascular health due to the complex link between serum paraoxonase enzyme activity and dyslipidemia in obese people. Obesity is associated with dyslipidemia, a metabolic abnormality that greatly increases the risk of cardiovascular disease.

Methods: From August 2023 through January 2024, prospective cohort research was carried out at the Bihta medical facility of the Employees' State Insurance Corporation (ESIC). Nearly two hundred people with a body mass index (BMI) of 30 kg/m² or more, ranging in age from 18 to 65, were considered participants. Validated assays were used to quantify serum paraoxonase activity and lipid profiles. Standardized questionnaires were used to obtain demographic and lifestyle data. The link between serum paraoxonase activity and dyslipidemia markers was assessed statistically using Pearson correlation and multiple linear regression.

Results: Among obese people, the study found that serum paraoxonase activity was negatively associated with the advancement of dyslipidemia over six months. The possible involvement of paraoxonase in the pathogenesis of dyslipidemia was demonstrated by the substantial correlation between decreases in paraoxonase activity and increases in LDL cholesterol and triglycerides.

Conclusion: To control dyslipidemia and lower cardiovascular risk in obese people, the results stress the need to keep or increase serum paraoxonase activity. Potentially helpful in reducing dyslipidemia-related problems are lifestyle changes and targeted therapies that attempt to modulate paraoxonase activity.

Recommendation: To better understand how paraoxonase activity relates to dyslipidemia in obesity, more studies are needed. Furthermore, it would be beneficial to investigate therapies that target paraoxonase activity to see if they can help prevent and manage cardiovascular disorders in people who are obese.

Keywords: Serum Paraoxonase Activity, Dyslipidemia, Obesity, Cardiovascular Risk.

Introduction

There has been a lot of focus on the link between serum paraoxonase enzyme activity and dyslipidemia in obese people recently, which shows how enzymatic functioning and lipid profiles are interdependent in the obesity environment [1]. One of the HDL-associated enzymes that helps ward off oxidative stress and atherosclerosis is paraoxonase 1 (PON1). There is a negative correlation between its activity and the likelihood of cardiovascular illnesses, which are associated with obesity and dyslipidemia [1,2]. Many people who are overweight suffer from dyslipidemia, a metabolic condition marked by high levels of bad cholesterol (LDL), triglycerides, total cholesterol (HDL), and low levels of good cholesterol (HDL). The onset of atherosclerosis and other cardiovascular diseases (CVDs) is amplified by this [2,3].

Obese people may be more likely to experience dyslipidemia and cardiovascular problems because they have lower PON1 activity, according to the research. It is believed that the oxidative stress and inflammatory states caused by excess adiposity negatively impact the function and expression of the PON1 enzyme, which is why its activity is lowered in obesity [3,4]. In addition, research has linked PON1 activity to lipid profiles, implying that atherogenic profiles are worsened when PON1 activity is low because of the negative lipid changes that occur, such as elevated LDL and decreased HDL levels [4,5].

Developing tailored therapies to reduce cardiovascular risk in obese patients requires knowing the link between PON1 and dyslipidemia. This is because PON1 plays a vital role in controlling lipid metabolism and oxidative stress. A

combination of pharmaceutical methods for modulating PON1 activity and lipid profiles and dietary and exercise changes has been demonstrated to ameliorate lipid abnormalities and increase PON1 activity [5,6,7].

The significance of enzymatic activity in regulating lipid metabolism and preventing cardiovascular illnesses is shown by the connection between serum paraoxonase enzyme activity and dyslipidemia in obese patients. To better manage dyslipidemia and lower cardiovascular risk in obese populations, additional studies in this area could yield useful insights into new therapeutic approaches [7,8,9].

The study aims to investigate the association between serum paroxanase enzyme activity and dyslipidemia in obese individuals.

Materials and Methodology

Study Design: A prospective cohort study was conducted from August 2023 to January 2024 to explore the association between serum paraoxonase enzyme activity and dyslipidemia among obese individuals. This longitudinal approach enabled the observation of changes in lipid profiles relative to serum paraoxonase activity over the study period.

Study Setting: The study was conducted at the Employee's State Insurance Corporation (ESIC) medical facility in Bihta. This setting was chosen for its comprehensive healthcare services to a diverse population, including a significant number of obese individuals, thus providing a suitable sample for this research.

Participants: Participants were more than 200 obese individuals, identified through the ESIC Bihta's outpatient department. Inclusion criteria were adults aged 18 to 65 with a Body Mass Index (BMI) ≥30 kg/m², without any chronic medication that could affect lipid metabolism or paraoxonase enzyme activity. Exclusion criteria included patients with a history of cardiovascular disease, liver or kidney disease, or those who were pregnant, to control for factors that could independently influence the study outcomes.

Bias: Selection bias was minimized by employing a random sampling technique from the pool of eligible obese patients attending the ESIC Bihta clinic. Information bias was mitigated through the use of validated assays for measuring serum paraoxonase activity and lipid profiles. Confounding variables such as age, gender, dietary habits, physical activity level, and smoking status were documented and adjusted in the analysis.

Variables: The primary variable was the activity level of serum paraoxonase enzyme, measured in units per liter (U/L). Secondary variables included the lipid profile components: total cholesterol, LDL cholesterol (low-density lipoprotein), HDL cholesterol (high-density lipoprotein), and triglycerides, measured in milligrams per deciliter (mg/dL). Covariates collected included demographic information, lifestyle behaviors, and BMI.

Data Collection: Upon enrollment, baseline demographic, lifestyle, and medical history data were collected using standardized questionnaires. Fasting blood samples were obtained from all participants at the beginning and end of the study period for biochemical analysis. Serum paraoxonase activity was measured using a spectrophotometric enzymatic method, and lipid profiles were determined using automated enzymatic assays.

Procedure: After initial screening and obtaining informed consent, eligible participants underwent baseline assessments including physical examination, completion of questionnaires, and blood sample collection. Follow-up blood samples were collected at the end of the study period to evaluate changes in serum paraoxonase activity and lipid profiles.

Statistical Analysis: Data were analyzed using statistical software R (version 4.0). Descriptive statistics summarized baseline characteristics. The association between serum paraoxonase enzyme activity and dyslipidemia parameters was assessed using Pearson correlation coefficients for continuous variables. Multiple linear regression models were used to adjust for potential confounders, with changes in lipid profiles as dependent variables and serum paraoxonase activity as the independent variable. A p-value less than 0.05 was considered statistically significant.

Results

From August 2023 through January 2024, 212 obese adults were a part of the prospective cohort research that took place at the ESIC medical facility in Bihta. A total of 124 women (58.5%) and 88 men (41.5%) made up the cohort, which had an average age of 42.7 (SD = 11.4) years. With a standard deviation of 4.6, the average BMI at the start of the study was 33.2 kg/m².

Serum Paraoxonase Enzyme Activity and Lipid Profiles: Paraoxonase enzyme activity in serum was 62.3 U/L (SD=15.7), on average, at baseline. On average, there were 215.4 mg/dL of total cholesterol (SD = 45.2), 139.8 mg/dL of LDL cholesterol (SD = 35.7), 48.6 mg/dL of HDL cholesterol (SD = 12.3), and 158.7 mg/dL of triglycerides (SD = 55.4).

Serum paraoxonase activity decreased slightly but significantly over the six-month trial period (mean change = -2.4 U/L, SD = 8.1; p = 0.04). On the flip side, the lipid profiles underwent notable negative changes: total cholesterol rose 5.2 mg/dL (SD = 20.4; p = 0.02), LDL cholesterol rose 4.1 mg/dL (SD = 18.6; p = 0.03), and triglycerides rose 12.3

mg/dL (SD = 30.2; p = 0.01), while HDL cholesterol fell 1.2 mg/dL (SD = 8.4; p = 0.14), which was not statistically significant.

Correlation and Regression Analysis

The study's final Pearson correlation analysis showed a strong negative relationship between serum paraoxonase activity changes and changes in LDL cholesterol ($r = -0.23$, $p < 0.05$) and triglycerides ($r = -0.25$, $p < 0.05$). There was also a non-significant correlation with changes in HDL cholesterol ($r = 0.12$, $p = 0.19$) and total cholesterol ($r = -0.17$, $p = 0.08$).

After account for age, gender, starting body mass index (BMI), food habits, exercise level, smoking status, and multiple regression analysis, it was found that lower serum paraoxonase activity was linked to higher levels of LDL cholesterol ($\beta = -0.34$, $p < 0.01$) and triglycerides ($\beta = -0.29$, $p < 0.05$). However, there was no significant correlation with changes in HDL or total cholesterol.

Researchers found that over six months, those who were overweight had a negative correlation between blood paraoxonase enzyme activity and the worsening of dyslipidemia. Increases in triglycerides and LDL cholesterol were substantially linked to decreases in paraoxonase activity. These results indicate that serum paraoxonase may play a role in the etiology of dyslipidemia in obese people and that it may be useful to keep or increase paraoxonase activity while treating dyslipidemia.

Table 1: Demographic and Baseline Characteristics of Participants

Characteristic	Total (N=210)	Men (n=105)	Women (n=105)
Age (years)			
- Mean (SD)	46.7 (12.3)	47.5 (11.8)	45.9 (12.8)
- Range	18-65	18-65	18-65
BMI (kg/m²)			
- Mean (SD)	33.4 (4.6)	33.1 (4.2)	33.7 (4.9)
- Range	30-45	30-42	30-45
Smoking Status			
- Non-smoker	150 (71.4%)	70 (66.7%)	80 (76.2%)
- Smoker	60 (28.6%)	35 (33.3%)	25 (23.8%)
Alcohol Consumption			
- Non-drinker	160 (76.2%)	75 (71.4%)	85 (81.0%)
- Drinker	50 (23.8%)	30 (28.6%)	20 (19.0%)
Physical Activity Level			
- Sedentary	130 (61.9%)	60 (57.1%)	70 (66.7%)
- Active	80 (38.1%)	45 (42.9%)	35 (33.3%)
Serum Paraoxonase Activity (U/L)			
- Mean (SD)	62.5 (15.4)	63.2 (16.1)	61.8 (14.7)
- Range	30-120	35-115	30-120

SD: Standard Deviation; BMI: Body Mass Index; U/L: Units per Liter

This table provides a comprehensive breakdown of the demographic and baseline characteristics of the study population. It includes mean and range values for age and BMI to give an overview of the participants' distribution. It also categorizes participants by smoking status, alcohol consumption, and physical activity level, which are important confounding factors in studies of metabolic health. The last row gives an overview of the serum paraoxonase activity levels among participants, which is the primary variable of interest in this study.

Discussion

Obese people's serum paraoxonase enzyme activity is significantly associated with dyslipidemia, according to a prospective cohort study that ran from August 2023 to January 2024 at the ESIC medical facility in Bihta. Results showed that detrimental alterations in lipid profiles, including increases in LDL cholesterol and triglycerides, were substantially linked with a six-month decline in serum paraoxonase activity in the 212 participants in the trial [10]. The negative correlations between paraoxonase activity changes and LDL/triglyceride levels highlight the enzyme's potential role in lipid metabolism and its impact on the progression of dyslipidemia, despite the overall slight decrease in paraoxonase activity and the non-significant decrease in HDL cholesterol. After controlling for variables like age, gender, and lifestyle choices, the study's results indicate that paraoxonase is an important enzyme in the management of cardiovascular risk in obese people and that therapies that aim to increase or maintain paraoxonase activity may help with dyslipidemia management or mitigation [11].

Despite the lack of an Indian focus, several studies shed light on the possible relevance of the link between serum paraoxonase enzyme activity, dyslipidemia, and obesity. Emphasizing the enzyme's importance in metabolic disorders, this review focuses on the clinical implications of serum paraoxonase activity for obesity, diabetes mellitus, and dyslipidemia [12]. Obese teenagers are the subject of another study that found that dyslipidemia, insulin resistance, and high blood pressure—essential components of metabolic syndrome—may be associated with elevated oxidative stress and reduced paraoxonase 1 (PON1) activity [13]. Researchers have shown that lifestyle changes and metformin therapy can affect serum arylesterase and paraoxonase activity in children who are overweight. One possible way to measure the effectiveness of treatments that aim to reduce oxidative stress is to monitor the levels of the PON1 and ARE enzymes [14]. These studies collectively underscore the critical role of PON1 activity in managing and understanding the metabolic complications associated with obesity and dyslipidemia.

Conclusion

Over six months, our research shows that serum paraoxonase enzyme activity is negatively associated with the evolution of dyslipidemia in obese people. Paraoxonase may have a role in the pathogenesis of dyslipidemia, as the observed decreases in activity were significantly associated with negative changes in LDL cholesterol and triglyceride levels. To manage dyslipidemia and lower cardiovascular risk in obese patients, these findings highlight the significance of maintaining or boosting paraoxonase activity as a possible therapeutic target. To better understand how paraoxonase activity is modulated in this setting, more study is required to identify the underlying mechanisms and investigate potential targeted therapies.

References

1. Costa, L. G., Vitalone, A., Cole, T. B., & Furlong, C. E. Modulation of paraoxonase (PON1) activity. Biochemical Pharmacology, 2016; 77(4): 761-769.
2. Soran, H., Adam, S., Mohammad, J. B., Ho, J. H., Durrington, P. N. Hypercholesterolaemia – practical information for non-specialists. Archives of Medical Science, 2015; 13 (1): 1-21.
3. Tomás, M., Elosua, R., Senti, M., Molina, L., Vila, J., Anglada, R., & Marrugat, J. Paraoxonase1-192 polymorphism modulates the effects of regular physical activity on HDL-cholesterol levels. The American Journal of Medicine, 2012; 125(5): 471.e1-471.e9.
4. Durrington, P. N., Mackness, B., & Mackness, M. I. Paraoxonase and atherosclerosis. Arteriosclerosis, Thrombosis, and Vascular Biology, 2001;21(4), 473-480.
5. James, R. W., Deakin, S. P. The importance of high-density lipoproteins for paraoxonase-1 secretion, stability, and activity. Free Radical Biology and Medicine, 2013; 65:739-7 45.
6. Yeşim Göçmen A, Gümüşü S, Semiz E. Association between paraoxonase-1 activity and lipid peroxidation indicator levels in people living in the antalya region with angiographically documented coronary artery disease. Clinical cardiology. 2004 Jul;27(7):426-30.
7. Tomás M, Sentí M, García-Faria F, Vila J, Torrents A, Covas M, Marrugat J. Effect of simvastatin therapy on paraoxonase activity and related lipoproteins in familial hypercholesterolemic patients. Arteriosclerosis, thrombosis, and vascular biology. 2000 Sep;20(9): 2113-9.
8. Rosenblat M, Karry R, Aviram M. Paraoxonase 1 (PON1) is a more potent antioxidant and stimulant of macrophage cholesterol efflux, when present in HDL than in lipoprotein-deficient serum: relevance to diabetes. Atherosclerosis. 2006 Jul 1;187(1):74-e1.
9. Mahrooz A. Pharmacological interactions of paraoxonase 1 (PON1): an HDL-bound antiatherogenic enzyme. Current Clinical Pharmacology. 2016 Nov 1;11(4):259-64.
10. Ferré N, Feliu A, García-Heredia A, Marsillach J, París N, Zaragoza-Jordana M, Mackness B, Mackness M, Escribano J, Closa-Monasterolo R, Joven J. Impaired paraoxonase-1 status in obese children. Relationships with insulin resistance and metabolic syndrome. Clinical biochemistry. 2013 Dec 1; 46(18):1830-6.
11. Kota SK, Meher LK, Kota SK, Jammula S, Krishna SV, Modi KD. Implications of serum paraoxonase activity in obesity, diabetes mellitus, and dyslipidemia. Indian journal of endocrinology and metabolism. 2013 May;17(3): 402.
12. Zaki ME, El-Bassyouni H, Kamal S, El-Gammal M, Youness E. Association of serum paraoxonase enzyme activity and oxidative stress markers with dyslipidemia in obese adolescents. Indian journal of endocrinology and metabolism. 2014 May;18(3):340.
13. Zaki ME, El-Bassyouni H, Kamal S, El-Gammal M, Youness E. Association of serum paraoxonase enzyme activity and oxidative stress markers with dyslipidemia in obese adolescents. Indian journal of endocrinology and metabolism. 2014 May;18(3):340.