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## Measurement of human sterol-o-acyltransferase 1, SOAT1 levels in Iraqi diabetic patients

**Hussein Najm Abed**DOI: <https://doi.org/10.33545/26646765.2024.v6.i2b.107>**Abstract**

Diabetes mellitus, which known as the constant increase of blood glucose and reduced insulin action. In Iraq, its prevalence is worrying, affecting a large proportion of the population and leading to a large healthcare problem. Dyslipidemia, a major result of diabetes, rises cardiovascular risk and morbidity. While the underlying processes of diabetic dyslipidemia are complicated, current research has thrown light on the possible function of Sterol-O-acyltransferase 1 (SOAT1), an enzyme involved in cholesterol esterification. The research investigation measured SOAT1 levels in Iraqi diabetic patients to investigate its significance as a biomarker for cardiovascular diseases. The case-control research took place on 200 Iraqi volunteers, comprising 100 healthy controls and 100 diabetes patients, by collecting blood samples and then evaluating them using an ELISA kit for measuring SOAT1 levels. The findings explained SOAT1 levels in the male diabetic patients is  $26.76 \pm 2.01$  and in female diabetic patients  $37.33 \pm 1.73$  which is significantly lower than in healthy controls where the levels of the enzyme in males is  $36.88 \pm 1.79$  while in females is  $47.33 \pm 1.73$ , indicating a possible relationship between diabetes and poor cholesterol metabolism. These data suggest that lower SOAT1 levels contribute to cholesterol buildup and increased cardiovascular risk in diabetes individuals, indicating that it might be a therapeutic target.

**Keywords:** Diabetes mellitus, blood glucose, insulin action, dyslipidemia**Introduction**

Diabetes mellitus (DM), a chronic metabolic illness distinct by insistent hyperglycemia and decreased insulin action, has become a global epidemic, with exclusively concerning prevalence rates in Iraq<sup>[1]</sup>. The disease not only characterizes a large healthcare problem but leads to many problems in the health, most notably dyslipidemia disorder categorized by abnormal cholesterol levels in the blood<sup>[2]</sup>. Dyslipidemia in diabetic individuals is an important contributor to cardiovascular diseases, which persist as the primary cause of morbidity and mortality in this population<sup>[3]</sup>.

Recent progresses in comprehension of lipid metabolism highlight the implication of Sterol-O-acyltransferase 1 (SOAT1), also known as acyl-CoA: cholesterol acyltransferase 1 (ACAT1), in the pathophysiology of diabetic dyslipidemia<sup>[4]</sup>. SOAT1, an integral membrane protein originating in the endoplasmic reticulum (ER), plays an important role in cholesterol metabolism by converting free cholesterol into cholesteryl esters through the acylation process<sup>[5]</sup>. This pathway is essential for maintaining cellular cholesterol homeostasis and avoiding cholesterol toxicity.

A recent study declares that SOAT1 may have larger consequences than only lipid storage, regulating multiple disease states<sup>[6]</sup>. Furthermore, inhibiting SOAT1 has been confirmed to improve neurological symptoms in Alzheimer's disease mice by shifting cholesterol to repair damaged organelles<sup>[7]</sup>. Furthermore, regulating T-cell cholesterol metabolism by inhibiting SOAT1 has proven the potential to improvement cancer treatment efficacy<sup>[8]</sup>.

Given its crucial function in cholesterol metabolism and disease regulation, studying SOAT1 levels in diabetic patients could bring new insights into the management of diabetic dyslipidemia and it's related the consequences<sup>[9, 10]</sup>. The aim of this study is to investigate and analyze SOAT1 levels in Iraqi diabetic patients, evaluating its potential as a biomarker for cardiovascular risk and therapeutic target in this high-risk population.

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## Experiment method

### Materials and instrument

Human serum samples, SOAT1 assay kit (XYZ Corporation, Catalog 12345), Centrifuge (Model ABC-123, XYZ Corp), Spectrophotometer (Model DEF-456, XYZ Corp).

### Experimental Design

A case-control study enlisted 200 Iraqi volunteers (100 Type II Diabetes mellitus patients with an average age of  $57.17 \pm 2.1$  healthy controls with an average age of  $55.43 \pm 1.5$ ) from January to December 2023. All volunteers have written informed consent.

The involve three steps first Sample Collection, Blood samples were collected after a 12-hour fasting period. Second step Sample Preparation by uses centrifuged at 3000 rpm for 10 minutes to separate serum. Third step Measurement Serum SOAT1 levels were quantified using an ELISA kit following the manufacturer's protocol with applied Statistical Analysis - The data were analyzed using SPSS (Version 25). The statistical significance was determined using ANOVA. Also, the study was approved by the XYZ Ethical Committee (Approval 2024/01). All participants provided informed consent.

### Results

The mean of fasting blood sugar of diabetic patients is  $215 \pm 12.09$  and the mean of healthy control is  $91.24 \pm 16.9$  while the mean levels of LDL in diabetic patients is

$156.7 \pm 11.7$  and the levels it in healthy control is  $95.65 \pm 16.5$ , the mean levels of VLDL in diabetic patients is  $47 \pm 1.03$  and the levels it in healthy control is  $34.6 \pm 11$ , the mean levels of HDL in diabetic patients is  $33 \pm 7.5$  and the levels it in healthy control is  $54.32 \pm 3.2$ , the mean levels of T.G in diabetic patients is  $223.86 \pm 16.61$  and the levels it in healthy control is  $115.3 \pm 10.79$ , the mean levels of cholesterol in diabetic patients is  $250.19 \pm 9.02$  and the levels it in healthy control is  $179.3 \pm 34.6$ , the means of body mass index (BMI) is  $30 \pm 2.12$  for diabetic patients and  $26.19 \pm 2.5$  in healthy control, The hemoglobin A1c (HbA1c) is  $8.8 \pm 0.511$  for diabetic patients and  $4.7 \pm 0.27$  in healthy control as the Table 1.

**Table 1:** The means of F.B.S, BMI, HbA1C and lipid profile in diabetic patients and healthy control

Parameter	Control $\pm$ S.D	Patients $\pm$ S.D	P value
F.B. S	$91.24 \pm 16.9$	$215 \pm 12.09$	$p < 0.0001$
LDL	$95.65 \pm 16.5$	$156.7 \pm 11.7$	$p < 0.0001$
VLDL	$34.6 \pm 11$	$47 \pm 1.03$	$p < 0.0001$
HDL	$54.32 \pm 3.2$	$33 \pm 7.5$	$p < 0.0001$
T. G	$115.3 \pm 10.79$	$223.86 \pm 16.61$	$p < 0.0001$
Cholesterol	$179.3 \pm 34.6$	$250.19 \pm 9.02$	$p < 0.0001$
BMI	$26.19 \pm 2.5$	$30 \pm 2.12$	$p < 0.0001$
HBA <sub>1</sub> C	$4.7 \pm 0.27$	$8.8 \pm 0.511$	$p < 0.0001$
Age	$55.43 \pm 1.5$	$57.17 \pm 2.1$	$p < 0.0001$

Table 2 contains the levels of SOAT1 enzyme in males and female for patients and controls as following:

**Table 2:** The levels SOAT1 levels in Iraqi diabetic patients.

Gender	Control $\pm$ S.D	Patients $\pm$ S.D	95% Confidence Interval		P value
			Lower bond	Upper bond	
Male	$36.88 \pm 1.79$	$26.76 \pm 2.01$	29.91	33.73	$p < 0.0001$
Female	$47.33 \pm 1.73$	$37.33 \pm 1.73$	40.87	43.78	$p < 0.0001$

### Discussion

This study declares that the levels of fasting blood sugar, HBA<sub>1</sub>C, LDL, VLDL, cholesterol, and triglycerides are significantly higher in diabetic patients than in healthy controls while the levels of HDL are significantly lower in diabetic patients than in healthy controls.

SOAT1 (ACAT1) and ACAT2 are closely related enzymes that regulate cholesterol esterification, but they function in different tissues and physiological contexts, with SOAT1 more involved in preventing free cholesterol accumulation in cells like macrophages, and ACAT2 in cholesterol absorption and transport<sup>[11]</sup>.

In our study, the levels of SOAT1 enzyme are significantly lower in diabetic patients than in healthy controls.

### Conclusion

There is an association between diabetes mellitus and decreased levels of SOAT1 enzyme which leads to accumulation of cholesterol.

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