



ORIGINAL RESEARCH PAPER

Biochemistry

INFLUENCE OF YOGA ON APO AI AND HDL-C LEVELS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

KEY WORDS: LCAT activity, HDL-C, T2DM.

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ABSTRACT

Background- The lecithin cholesterol acyl transferase (LCAT) activity is considered as the indicator of HDL-C function. Yoga practicing has shown the beneficial effects in T2DM by reducing the rate of mortality and morbidity. Yoga practicing increases the HDL-C levels and the mechanism by which it does is not yet clear.

Material And Methods- This is a case control study done in the Department of Biochemistry, BIMS, Belagavi. The study subjects were divided into 2 groups, Group 1: 100 T2DM on Yoga practicing (6months). Group 2: 100 T2DM not Yoga practicing. The blood samples collected from the subjects were analysed for Fasting plasma glucose (FPG), HbA1C, HDL-C and LCAT activity. SPSS Version 20 was used for statistical analysis. Paired t tests were employed to compare measures. A p value <0.05 was significant.

Results- LCAT activity and HDL-C levels were significantly increased and FPG, HbA1C levels were significantly decreased in T2DM patients practicing yoga regularly when compared to those not practicing yoga.

Conclusion- Hence the study concludes that raised LCAT activity might be responsible for increase in HDL-C levels in yoga practicing T2DM patients.

INTRODUCTION

Globally, the type 2 diabetes mellitus (T2DM) and its complications cause a major treat. T2DM could be prevented by lifestyle changes like consuming a healthy diet, maintaining a healthy body weight, staying physically active, no smoking and no drinking alcohol. Other management strategies include social support and ensuring adherence to medications¹. The search for better strategies for overcoming stress and maintaining healthy lifestyle in T2DM has led us to disciplines such as yoga².

Yoga, an ancient science is a rich heritage of our culture. Yoga includes certain aasanas and pranayama³. Many older books have mentioned the usefulness of yoga in the treatment and prevention of certain diseases. Now it has become the subject of modern scientific evaluation. Many studies have shown the effect of yoga on diabetes^{4,5,6}.

Lecithin cholesterol acyl transferase (LCAT) is produced by the liver. It plays a major role in the removal free cholesterol from tissues and assisting in HDL-C maturation. LCAT increases HDL-C size by transferring 2-acyl groups from lecithin or phosphatidylethanolamine to unesterified cholesterol⁵. LCAT activity is considered as the indicator of HDL-C function⁶. Further increased serum LCAT activity is associated with future risk of coronary heart disease and sudden death⁷.

Apolipoprotein AI (Apo AI) is the most abundant protein in HDL, whose concentration is known to be inversely correlated with cardiovascular risk. HDL associated Apo AI play a crucial role in cholesterol homeostasis by regulating RCT delivering it to the liver. Apo AI acts as an activator for the enzyme LCAT⁸. The further role of yoga on Lecithin cholesterol acyl transferase (LCAT) activity, Apolipoprotein AI (Apo- AI) and high density lipoprotein (HDL) concentration is unknown.

Aim Of The Study

To study the role of yoga practicing on LCAT activity and HDL-C levels in patients with T2DM.

Objectives

1. To study the activity of LCAT in T2DM patients with and

without yoga practicing.

2.To study the serum levels of HDL-C and lipid profile in T2DM patients with and without yoga practicing.

MATERIAL AND METHODS

Study Design- It is an interventional case control study.

Setting- Department of Biochemistry at BIMS, Belagavi from October 2017 to September 2018.

Selection Of Participants- The study subjects were selected from the medicine Out Patient Department (OPD), BIMS hospital, Belagavi. The American diabetic association (ADA) guidelines were used to recruit 200 patients with T2DM.

The study subjects were divided into 2 groups,

Group 1: **100 T2DM on Yoga practicing** (6months).

Group 2: **100 T2DM not Yoga practicing.**

Inclusion Criteria-

T2DM patients included in the study were diabetic ≤ 10 years and without microvascular and macrovascular complications. All these patients were in the age group 45-60 years.

Exclusion Criteria-

T2DM patients who were smokers, alcoholics, known neuropathy, retinopathy, nephropathy, hypothyroidism, cerebrovascular disease and coronary vascular disease were excluded. The study was approved from the institutional ethical committee and informed consent was taken from all participants.

The detailed history was taken from all patients including age, gender, duration of T2DM, complications of diabetes, treatment and BMI was measured.

The yoga class was conducted by Mr. Nagaraj Hosamani, a certified yoga teacher at Shree jaya yoga center, Belagavi.

Biochemical Analysis-

5ml of blood samples collected in plain and EDTA vacutainers

from every patient under strict aseptic conditions. The EDTA sample was analysed for Glycated Haemoglobin (HbA1c) and plain sample for Fasting plasma glucose (FPG), HDL-C, LCAT activity, and Apo A-I. The FPG was estimated by GOD-POD method. HbA1c by HPLC method, HDL cholesterol was estimated by CHOD-POD method⁸. The LCAT activity was estimated by indirect method by measuring the difference between the esterified cholesterol and free cholesterol¹⁰. The Apo A-I estimation was done by measurement of antigen-antibody reaction by the end point method.⁹

Details Of Yoga Practicing In T2DM Patients

Each yoga session consisted of	
Bhastrika Pranayam	3 minutes per day
Anuloma viloma	3-5 minutes per day
Kapalbhati Pranayam	10-15 minutes per day
Brahmari Pranayam	5 times per day
Suryanamaskaram (sun salutation)	5 turns per day
Yoga Mudrasana (psychic union pose)	5 minutes per day
Vajrasana (thunderbolt pose)	Each aasana practiced for 2 times per day
Vakrasana (twisted pose)	
Paschimottasana (seated forward bend)	
Pavanamuktasana (wind relieving pose)	
Sashankasana (hare pose),	
Ushtrasana (camel pose)	
Bhujangasan (cobra pose)	
Dhanurasana (bow pose)	
Arthakatchakrasana (lateral arc pose)	
Parivatha trilokasana (revolved triangle pose)	
Shavasana (corpse pose)	5 minutes per day
Meditation (one-one meditation/ breath counting meditation)	10 minutes per day

Statistical Analysis

Data collected were entered in Microsoft Excel and SPSS Version 20 was used for analysis. Paired *t* tests were employed to compare measures. A *p* value of <0.05 was significant and *p* value of <0.01 was considered highly significant. The associations between LCAT activity and independent variables were examined using Pearson's correlation test.

RESULTS

Table 1: Demographic Profile Of T2DM Patients

Parameters (mean ±SD)	T2DM with yoga practicing GROUP I (n=100)		T2DM without yoga practicing GROUP II (n= 100)	
	Males (60)	Females(40)	Males (60)	Females(40)
Age (years)	41.42± 10.32	51.36±10.31	41.02± 9.4	53.78±11.09
BMI ((kg/m ²)	25.03 ±2.14	23.2 ±2.14	24.73 ± 1.87	22.9 ± 2.15

Table 2: Serum Parameters In T2DM Patients

Parameters	T2DM with yoga practicing Group I (n=100)	T2DM without yoga practicing Group II (n=100)	P value
LCAT activity (IU/L)	90.74±5.42	54.83±9.22	<0.001
Apolipoprotein A-I (mg/dl)	178.5± 18.4	130.24± 20.29	<0.001
HDL-C (mg/dl)	48.5± 6.85	30.25± 4.6	<0.01
LDL-C (mg/dl)	95.6± 37.41	149.57± 32.36	<0.001
VLDL-C (mg/dl)	28.4± 18.70	36.13± 13.24	<0.05
Total cholesterol (mg/dl)	170.10± 38.55	220.4± 30.12	<0.01

Triglycerides (mg/dl)	154.4± 106.4	207.2± 83.2	<0.001
Fasting Plasma Glucose (mg/dl)	74.5±15.07	162.5± 95.14	<0.001
HbA1C (%)	5.8±0.4	7.2± 1.2	<0.01

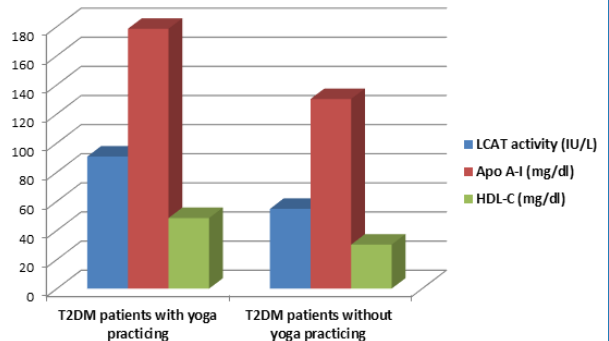


Figure 1: LCAT activity, Apo A-I, and HDL levels in T2DM patients with and without practicing yoga

Table 3: Correlation Of LCAT Activity With Apo A-I And HDL-C Levels In T2DM Patients

Parameters	r- value
LCAT activity v/s Apo A-I	0.85
LCAT activity v/s HDL-C	0.54

DISCUSSION

The main characteristic feature of T2DM is alteration in lipoprotein metabolism leading to cardiovascular diseases. In our present study we evaluated the lipid profile parameters in T2DM patients with and without yoga practicing. The LDL, VLDL, triglycerides and total cholesterol were significantly reduced and HDL levels were significantly increased in yoga practicing T2DM patients when compared to T2DM patients without yoga practicing. Our findings were in accordance with Arati et al¹² who found that pranayama and yogasana could be used as supportive therapy to improve lipid profile. Bijlani² showed that yoga could reduce the risk factors for cardiovascular complications in diabetic patients. Savita S³ found the significant reduction in lipid profile and glucose levels in yoga practicing diabetic patients. Yoga practicing improves lipid profile by increasing the availability of LDL receptors and increasing insulin sensitivity. Thus there is increased triglyceride uptake by adipose tissue.

Hyperglycemia in T2DM causes nonenzymatic glycation of LCAT or Apo A-I leading to decreased activity. The decreased Apo A-I levels in T2DM patients may be because of decreased insulin action, which in turn may reduce protein biosynthesis by altering the translational machinery leading to decreased biosynthesis of Apo A-I.

The LCAT enzyme activity and Apo A-I levels were significantly increased in yoga practicing T2DM patients than in T2DM not practicing yoga. This is because yogasana decreases insulin resistance and improve glycemic status leading to decreased glycation of LCAT or Apo A-I. Yogasanas may also increase the activity of LCAT by influencing the synthesis of Apo A-I thus responsible for increased HDL levels in T2DM patients practicing yoga.

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