

ABSTRACT

BACKGROUND

Type-2 diabetes (T2D) is becoming one of the fastest-growing major non-communicable diseases (NCDs) adversely affecting human life and well-being globally, in a multitude of ways. The latest epidemiological data shows its worldwide prevalence as 463 million and is projected to reach 700 million by 2045. At the molecular level, T2D condition is associated with a higher level of oxidative stress (OS), reduced antioxidant capacity, increased oxidative DNA damage, and impaired DNA damage-repair capability, which may lead to a variety of micro and macrovascular diseases, endothelial dysfunction, atherosclerotic plaques, and subsequent development of cardiovascular diseases and stroke. Although yoga is found to be beneficial in the management of T2D, its mechanism of action is poorly understood. This study examines how yoga modulates OS induced DNA damage and the efficiency of DNA repair in T2D condition

AIMS AND OBJECTIVES

This study aims to elucidate how yoga influences oxidative DNA damage, its repair, and thereby overall DNA damage in T2D patients.

-)] To assess the effect of yoga practices on DNA damage & repair in patients with T2D
-)] To investigate the mechanism of action involved in the effect of yoga practices on DNA damage in patients with T2D

METHODS

Participants

Patients identified with T2D (fasting plasma glucose above 126 mg/dL, as per American Diabetic Association guidelines), age ranging from 35 to 60 from both genders (Male:33, Female:28) and having no prior yoga experience were enrolled using convenience sampling for this study.

Design

This study followed a randomized control trial design (RCT), where, T2D subjects ($n=61$), aged (Mean \pm SD, 50.3 ± 4.2) were randomly allocated into Yoga group (31) that received 10 weeks of yoga intervention and Control (30) with routine exercises.

Assessments:

Primary outcome measures;

TM: Tail Moment & OTM: Olive Tail Moment (indices of DNA damage)

8-OHdG: 8-hydroxy-2'-deoxyguanosine as Oxidative DNA damage marker,

OGG1: 8-Oxoguanine glycosylase - protein expression for DNA repair gene-activity,

TAC: Total Antioxidant Capacity

FBS: Fasting Blood Sugar

Secondary outcome measure;

BMI: Body Mass Index; WHR: Waist to hip ratio; SBP: Systolic Blood Pressure;

DBP: Diastolic Blood Pressure; FBS: Fasting Blood Sugar; LDL: Low Density Lipoprotein;

HDL: High Density Lipoprotein; TG: Triglycerides; TC: Total Cholesterol; Cr: Creatinine

Ur: Urea; UA: Uric Acid; Alb: Albumin; TP: Total Protein;

Intervention:

Yoga group underwent 10 weeks of yoga-practice sessions including *Asana* (specific postures) and *Pranayama* (specific breathing) practices as given in the intervention protocol 4 hours/week, by a certified and trained yoga professional. This study used an adapted version of the yoga module, developed, validated, and used by AYUSH, Ministry of Health, Govt. of India, for a national level programme for T2D management. Control group did physical exercises like walking, jogging, and stretching 4 hours/week for 10 weeks, though they were not instructor-led sessions.

RESULTS:

At the end of the 10th week, Yoga group showed significant reduction in DNA damage indicators like Tail Moment (-5.88[95%CI: -10.47 to -1.30]; $P=.013$) and Olive Tail Moment (-2.93[95%CI: -4.87 to -1.00]; $P< .01$), oxidative DNA damage marker 8-OHdG (-60.39[95%CI: -92.55 to -28.23]; $P< .001$) and Fasting Blood Sugar (-22.58[95%CI: -44.33 to -0.83]; $P=.042$) compared to Control. OGG1 protein expression indicating DNA repair, improved significantly (17.55[95%CI:1.37 to 33.73]; $P=.034$) whereas Total Antioxidant Capacity did not(5.80[95%CI: -0.86 to 12.47]; $P=0.086$). Mediation analysis indicated that improvements in oxidative DNA damage and DNA repair together played a major mediatory role (97.4%) in carrying the effect of yoga.

CONCLUSION:

The beneficial effect of yoga on DNA damage in T2D subjects was found to be mediated by mitigation of oxidative DNA damage and enhancement of DNA repair. Yoga was also found to be a potent adjunct therapy in the management of T2D.