ABSTRACT

BACKGROUND

A total of 415 million people have diabetes mellitus and an estimated 193 million people have undiagnosed diabetes mellitus worldwide. About 1 in 11 adults have diabetes mellitus globally. Where, Type 2 Diabetes Mellitus (T2DM) accounts for around 90% of patients with diabetes mellitus. The Prevalence of T2DM is increasing rapidly in Asia, where India and China are the top two epicentres. The number of patients with diabetes mellitus in India increased to 65 million in 2016 from 26 million in 1990. The prevalence of diabetes mellitus in population aged 20 years or older in India increased to 7·7% in 2016 from 5·5% in 1990. The prevalence of diabetes mellitus was highest in Tamil Nadu followed by Kerala, Delhi, Punjab, Goa and Karnataka. No permanent cure has yet been discovered for T2DM in the mainstream medical system. Studies have demonstrated the effectiveness of yoga in the management of various lifestyle diseases, including T2DM. No study has been investigated the impact of 1 year Yoga intervention on biochemical levels along with thermal imaging and electro-photonic imaging parameters in T2DM.

AIMS AND OBJECTIVES

Aim of the current study is to assess the impact of 1 year Yoga based lifestyle intervention on biochemical levels, thermal imaging parameters, electro photonic imaging parameters, anthropometric measurements, blood pressure, T2DM medication scores and psychological variables in patients suffering from T2Dm.

The objectives are follows: to assess the effect of 1 year Yoga based lifestyle intervention on biochemical levels in patients suffering from T2DM, to assess the effect of 1 year Yoga based lifestyle intervention on Electro-photonic Imaging parameters in patients suffering from T2DM, to assess the effect of 1 year Yoga based lifestyle intervention on Thermal Imaging

parameters in patients suffering from T2DM, to assess the effect of 1 year Yoga based lifestyle intervention on anthropometric measurements, blood pressure and T2DM medication score in patients suffering from T2DM, to assess the effect of 1 year Yoga based lifestyle intervention on psychological variables in patients suffering from T2DM, and to see the correlation between HbA1c level and Thermal Imaging parameters as well as between HbA1c level and Electro-photonic Imaging parameters in patients suffering from T2DM.

METHODS

Participants: One hundred sixty participants with T2DM (n = 160, 84 males, 76 females, mean age = 53.34±8.97 years, suffering from T2DM for the average of 6.69±4.60 years)

Design: This is a prospective single-blind randomized controlled parallel group design. One hundred sixty subjects with T2DM were randomized into two instructor-led intervention groups; yoga-based lifestyle (YBL) group and Physical exercise and health education (PHE). They were followed up for 1 year with biochemical levels, thermal imaging parameters, electro photonic imaging parameters, anthropometric measurements, blood pressure, T2DM medication scores and psychological variables

Assessments: Biochemical levels (HbA1c, FBS, PPBS) thermal imaging parameters, electro photonic imaging parameters, anthropometric measurements (BMI, waist-hip ratio), blood pressures (systolic and diastolic), T2DM medication scores and psychological variables (Depression anxiety Stress Scale - 42)

Intervention: Yoga-based Lifestyle group practiced a supervised validated yoga programme for diabetes, one hour per day, five days a week for initial 4 weeks followed by supervised tele-yoga practice for next 11 months. Physical Exercise and Health Education Programme group followed a similar regimen as the yoga group with the intervention. The exercises included in

PHE group were those with matched metabolic equivalents to the yoga practices, and the health education programme.

RESULTS

Thirty eight subjects in the YBL group and thirty six subjects in the PHE group completed the 6 months follow-up. At the end of 1 year, 51 subjects (28 in YBL group and 23 in PHE group) completed the study. Results of the present study demonstrated a significant group*time interaction effect for HbA1c at 6 months ($p=0.001$) as well as at 1 year ($p<0.001$) favouring the YBL group. The estimated decrease in mean HbA1c in the YBL group was 0.80 at 6 months and 1.25 at 1 year as compared to the PHE group. There was also significant group*time interaction effects for PPBS ($p=0.04$) and DASS depression score ($p=0.04$) at 1 year favouring the YBL group. The estimated decrease in mean PPBS in the YBL group was 37.75 as compared to the PHE group. The estimated decrease in mean DASS depression score in the YBL group was 1.45 at 1 year as compared to the PHE group.

A total of 29 thermal imaging variables showed significant negative correlations with the HbA1c level ($r = -0.16$ to -0.32, $p<0.05$). Eight thermal imaging variables which have stronger correlation with HbA1c (Right Knee, Left Knee, Right Ankle, Left Ankle, Right Shin Average, Left Shin Average, Centre of Eyebrows, Right Eye) showed a significant increase in temperature in the YBL group compared to PHE group ($p<0.05$) at 1 year. A total of 11 EPI variables showed significant correlations with HbA1c. Out of 11 EPI variables showing correlation with HbA1c, 7 variables (EPI Stress, Balance, Organs Balance Right, Organs Balance Left, Digestive System Balance, Adrenals Balance, and Cerebral Zone Cortex) improved significantly at 1 year in the YBL group compared to PHE ($p<0.05$).

CONCLUSIONS

Current study demonstrated that regular practice of yoga based lifestyle for one year leads to significantly better outcomes as compared to the physical exercise and health education programme in T2DM patients in following variables: HbA1c levels, postprandial blood sugar levels, depression scores, thermal imaging variables and electro-photonic imaging variables. Certain thermal imaging variables (negative correlation: centre of eyebrows, eyes, ears, knees, ankles and shins) and electro-photonic imaging variables (positive correlation: stress; negative correlation: balance, organs balance right, organs balance left, energy balance of kidneys, digestive system, adrenals, cerebral zone, liver and lumber spine) showed significant correlations with HbA1c levels.

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