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Review

A narrative review on role of Yoga as an adjuvant in the management of risk factor, disease progression and the complications of type 2 diabetes mellitus

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is one of the major health problems in the world as well as in India that greatly affects the health care sector and economy. Use of drugs has its own drawbacks and in recent days the use of non-medical measures were reported not only to manage T2DM, but also to prevent its complications. Through there are various review articles that are dealing with the effect of Yoga on risk profiles, management along with the mechanisms of action of yoga in T2DM separately, there is a lack of comprehensive review on the effect of Yoga in combination with all the above mentioned including the effect of Yoga in the management of T2DM complications. Hence, we performed a narrative review in Medline/PubMed using keyword “Yoga and diabetes”. All the relevant articles published till 08th November 2016 were included. Based on the available literature, it could be concluded that Yoga plays a vital role as an adjuvant in the management of risk factors, disease progression and the complications of the T2DM. Further studies are warranted using standard research designs and variables to find out the various mechanisms of effects of Yoga in detail.

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1. Background

Diabetes mellitus is a group of metabolic disorders characterized by chronic hyperglycemia due to relative insulin deficiency or

resistance or both [1]. Type 2 diabetes mellitus (T2DM) is a major global health problem with a prevalence of 366 million in 2011 and that is projected to increase by 51%, reaching 552 million by 2030 [2]. India follows this global trend with a prevalence of 31 million diabetics in 2000 [1], 60 million in 2011 and that is projected to increase by 63%, reaching 98 million by 2030 [2]. Both in urban and

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rural India, prevalence of diabetes are increasing rapidly with a rough urban/rural divide of 2:1 to 3:1 being maintained through the past 2 to 3 decades. The rising burden of diabetes has greatly affected the health care sector and economy in India [3].

Genetic predisposition and environmental factors like physical inactivity, excessive calorie intake and obesity, low birth weight play an important role in the evolution of diabetes [4]. Use of drugs has its own drawbacks, such as drug dependency, drug resistance and adverse effects, if used for a long time. Hence, in recent years there has been an intense search for non-medical measures not only to manage the T2DM, but also to prevent its complications [1].

Though there are various review articles that are dealing with the effect of Yoga on risk profiles [5], management [6] along with the mechanisms of action of yoga [7] in T2DM [5–7], there is a lack of comprehensive review on the effect of Yoga in combination with all the above mentioned including the effect of Yoga in the management of T2DM complications. Hence, in order to provide a general overview, we performed a narrative review with the aim and objective to provide scientific evidence based effect of Yoga in the management of risk factors, disease progression and the complications of T2DM with the possible underlying mechanisms.

2. Methods

This narrative review was performed using Medline/PubMed electronic database with the use of keyword “Yoga and diabetes”. All the relevant articles published till 08th November 2016 were included and the article that are not relevant to the topic; articles with no abstract and full text; comments were excluded in this review.

3. Role of Yoga in the management of T2DM risk factors

Hypertension, dyslipidemia and diabetes are all lifestyle-related conditions and are therefore, modifiable [8]. The incidence of T2DM is increasing with increase in age, abnormal food habits, physical inactivity and sedentary life style [1]. Practice of Yoga was shown to improve the awareness about food consumption and adherence to diet [9], improved physical activity even in geriatrics, where vigorous exercise may not be acceptable [10] and thus, play a vital role in the management of risk factors and the prevention of T2DM [11]. At the same time Yoga was shown to have little effect on physical activity over time [12].

In previous studies, chronic stress [1,8,13] (physical, emotional and mental) and negative affective states have considered as a risk factors and reported to significantly contribute to the pathogenesis and progression of insulin resistance, glucose intolerance, hypertension, dyslipidemia and other metabolic syndrome-related conditions [8]. Similarly, other psychological factors such as depression and/or anxiety were also reported as risk factors for the development of diabetes and vice versa [1,13]. Whereas, regular practice of yoga was shown to produce significant improvement in stress (by reducing the perception of stress), depression [13] (reduction in the frequency of depressive symptoms and intensity of depression) [9], anxiety [13,14], mood [9], self-care behaviors [15] and subjective wellbeing [9,14]. It also shown to reduces the other risk factors such as body weight, blood pressure, glucose level, and abnormal cholesterol levels [13]. Similarly, in geriatric diabetes, practice of yoga was shown to produce improvement in risk profiles induced by stress and hence, reported to be effective in the prevention or delay in diabetes complications [16]. Interleukin-6 (IL-6) is associated with insulin resistance. Vitamin D deficiency has found to be more common among those with pre-diabetes and diabetes and is associated with the severity of insulin resistance [4]. But, a Yoga based lifestyle intervention programme was shown to be efficacious in modifying IL-6, vitamin D and other diabetes

risk factors including waist/hip ratio, fasting blood glucose (FBG) and insulin resistance [17].

4. Role of Yoga in the management of T2DM

Practice of Yoga has shown to be effective in reducing FBG [1,18], post prandial blood glucose (PPBG) [1], glycosylated hemoglobin (Hb A1C) levels [19], heart rate, diastolic blood pressure in patient with T2DM [18]. Overall, Yoga practices were associated with 5.4%–33.4% reduction in FBG, 24.5%–27% reduction in PPBG and 13.3%–27.3% reduction in HbA1C levels [8]. In contrast, a previous study reported no such significant changes in glucose control or physiological stress [15]. In the other studies, Yoga practices have shown to be associated with reduction in waist circumference, body weight [13,20], BMI [13,14,20,21], body fat [21], body composition, lipid levels, oxidative stress [6], serum insulin level and increase in insulin sensitivity in patient with T2DM [20]. A recent Meta analysis also reported as “yoga benefits adult patients with T2DM” [22].

4.1. Possible mechanism of Yoga in the management of T2DM

Yoga's mechanisms of action in T2DM are integrated and their effect is multi-systemic. The psycho-neuro-endocrine and immune mechanisms of action of Yoga in T2DM represent a possible approach to understanding its holistic effects on disease modulation of T2DM [7].

Increased sympathetic activity, enhanced cardiovascular reactivity and reduced parasympathetic tone have been strongly implicated in the pathogenesis of insulin resistance, atherosclerosis and cardiovascular diseases. Practice of Yoga has reported to reduces this risk profile by decreasing activation of the sympatho-adrenal system and the hypothalamic-pituitary-adrenal axis; promoting a feeling of wellbeing; producing direct enhancement of parasympathetic activity via vagus nerve [13]; and optimizing the secretion of sympathetic hormones such as cortisol and catecholamine thereby improving parasympathetic activity and reducing metabolic rate [7].

Oxidative stress is implicated in a number of diseases including T2DM. Enhanced oxidative stress along with decreased anti-oxidative status causes progression of the disease [23]. It accelerates the degenerative changes in diabetes and produces various complications like atherosclerosis, nephropathy and other micro-vascular complications [19]. Whereas, practice of Yoga has reported to reduces oxidative stress [19,23,24] and enhance the antioxidant defense mechanism [19,24] in T2DM [19,23,24].

Systemic inflammation plays a vital role in the development of atherosclerosis, T2DM, and a number of age-related diseases. Leptin is known to increases C-reactive protein (CRP), and inflammatory cytokines like interleukin (IL) 6 (IL-6) and tumor necrosis factor alpha (TNF- α); enhance vascular inflammation and oxidative stress that contribute to the pathogenesis of T2DM, hypertension and coronary heart disease. In contrast, adiponectin is known to decreases CRP, and inflammatory cytokines like IL-6 & TNF- α ; enhances production of anti-inflammatory cytokines (IL-10 and IL-1 receptor antagonist) and play an anti-inflammatory role. Hence, higher adiponectin levels have been associated with a lower risk for T2DM. In a study, 36% lesser leptin, 28% higher adiponectin level and a significantly higher adiponectin to leptin ratios (associated with lower insulin resistance) were revealed in Yoga experts compared to novice. Moreover, the duration of Yoga practices were positively associated with adiponectin level and adiponectin to leptin ratio, while it is negatively associated with leptin level. [25]

The beneficial effect of Yoga in T2DM has been attributed to increased insulin sensitivity at target tissues which decreases

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