

## Commentary

### Yoga- a potential solution for diabetes & metabolic syndrome

India accounts for almost 70 million people with diabetes and the number is expected to increase to 90 million by the year 2030<sup>1</sup>. Over the last few decades, the mean age of onset of diabetes has been on the decline, the disorder thereby affects a relatively younger segment of the population<sup>2</sup>. Genetic predisposition and environmental factors like physical inactivity, excessive calorie intake and obesity, low birth weight and genetic factors play an important role in the evolution of diabetes<sup>3,4</sup>. Visceral adiposity produces several inflammatory cytokines like tumour necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin-6 (IL-6), resistin and vistafin which are associated with insulin resistance and the metabolic syndrome<sup>5</sup>.

Vitamin D deficiency has been found to be more common among those with prediabetes, diabetes and obesity. The lowered serum circulating vitamin D levels are inversely associated with severity of insulin resistance<sup>6</sup>. Vitamin D supplementation has shown to prevent the development of new onset diabetes thereby improving the insulin sensitivity and glycaemic control<sup>7</sup>.

Large clinical studies like the United Kingdom Prospective Diabetes Study (UKPDS)<sup>8</sup>, Diabetes Control and Complications Trial Research Group (DCCT)<sup>9</sup> and the Kumamoto study<sup>10</sup> have demonstrated that intensive glycaemic control can significantly reduce microvascular complications, however, may fail to have an impact on reduction of macrovascular complications. The rapid increase in incidence of diabetes and the challenges faced by healthcare givers to provide high quality care to all persons with diabetes related complications and growing economic and personal cost of the treatment of disease are indeed compelling for the need of primary prevention in type 2 diabetes<sup>11</sup>.

A strategy of primary prevention may be focused on high risk individuals who are prone for the development of diabetes. Lifestyle modifications (LSM) include enhanced physical activity, dietary modification, weight loss and behavioural modifications. Several studies such as the Finnish diabetes prevention study (DPS)<sup>12</sup>, the Diabetes prevention program (DPP) in the United States of America<sup>13</sup>, the Indian Diabetes Prevention Programme (IDPP)<sup>11,14</sup> and the Chinese Da Qing study have demonstrated the efficacy and benefits of life style interventions<sup>15</sup>. Pharmacological interventions with drugs like metformin, rosiglitazone, acarbose and orlistat have been studied in high risk individuals and were also proven to be effective<sup>16-18</sup>.

Lifestyle modification (LSM) is from a pragmatic perspective, considered to be the primary line of intervention prior to any pharmacological therapy for preventing the development of diabetes in high risk individuals<sup>19</sup>. Moreover, cohort studies like the 7-year project that was involved in the Finnish DPS and the 20 year follow up that was accomplished in the Da Qing Study, had established that the beneficial effects of lifestyle intervention were sustainable<sup>20,21</sup>.

The modern form of yoga is primarily focused on simple physical exercises (*asanās*), breathing exercise (*prānāyāma*), followed by relaxation techniques (*shāvasāna*) or meditation. Yoga has been considered as a simple and potentially economical therapy that may be used alongside medical treatment of diabetes. The benefits of yoga have been studied based on various aspects of diabetes such as glycaemic control, quality of life and on several complications of diabetes. In a systemic review Innes *et al*<sup>22</sup> have analyzed 70 previous studies on the effect of yoga and suggested that yoga may reduce the insulin resistance related risks in relation to cardiovascular disease. Another study has prospectively evaluated the benefit of yoga

on glycaemic control and the quality of life of subjects with type 2 diabetes for a period of three months<sup>23</sup>. All participants in the study had previously been on lifestyle modification (diet and exercise) and on oral medications. There was a significant improvement in the quality of life in the yogic group and only a marginal impact on glycaemic control<sup>23</sup>. A study by Amita *et al*<sup>24</sup> assessed the effect of yoga *nidrā* for three months among middle aged patients with diabetes on oral medications. The study group was randomized into those on yoga group and a control group on simple lifestyle measures. There was an improvement in symptom score, reduction of fasting blood glucose (22.75 mg/dl) and postprandial blood glucose by 18 mg/dl, both of which were significant when compared with the control group<sup>24</sup>. The effect of yoga has also been studied in patients with gestational diabetes mellitus (GDM). The patients with GDM were randomized into those on yoga and mindful eating, and a control group for eight weeks. The difference in the mean fasting blood glucose, postprandial blood glucose and mean HbA1c levels between the two groups was significant, however, the clinical differences were rather small<sup>25</sup>. Singh *et al*<sup>26</sup> studied the 40 day effect of yoga on glycaemic control and autonomic function in patients with diabetes. There was a marked improvement in the glycaemic profile inclusive of fasting blood glucose, postprandial blood glucose and HbA1c levels when compared with the baseline status. A positive impact was also noticed on various autonomic indices such as the pulse, blood pressure and corrected QT interval<sup>26</sup>. Manjunatha *et al*<sup>27</sup> studied the beneficial effect of yogic postures on blood glucose control. In another study an improvement of glycaemic control and pulmonary function in type 2 diabetes patients was seen with yoga *asanas*<sup>28</sup>. Singh *et al*<sup>29</sup> in a preliminary study, validated the efficacy of yoga in glycaemic control and on reducing the markers of oxidative stress: serum malondialdehyde (MDA). Malhotra *et al*<sup>30</sup> conducted a randomized controlled study and demonstrated the beneficial effect on glycaemic control and nerve conduction after 40 days of yoga. A short study of 10 days showed the effect of yoga in improving lipid profile and glycaemic parameters<sup>31</sup>. Yoga practice has also been shown to reduce anxiety and may improve overall wellbeing along with reduction in BMI<sup>32</sup>.

In this issue Netam *et al*<sup>33</sup> have demonstrated beneficial effects of short-term yoga-based lifestyle intervention programme on diabetes risk factors in obese individuals. The study included supervised yoga

intervention for 10 days and a follow up at 30 days. At day 10 a significant reduction was observed in body weight, BMI, waist-hip ratio, blood glucose level and median fasting insulin and interleukin-6 (IL-6). This study also highlighted the challenges in sustainability of this intervention during the follow up period. McDermott *et al*<sup>34</sup> did a pilot study to look at the effect of yoga in individuals at a high risk for diabetes. Each yoga session lasted for 75 min. The study group showed a significant weight loss, reduction in waist circumference and an improvement in psychological well being.

Kanayan *et al*<sup>35</sup> in the PRYSMS study, randomized patients into a yoga group and stretching group for 48 wk. At six months of follow up, the yoga group had a reduction in the levels of fasting blood glucose, HbA1c, low density lipoprotein cholesterol and increase in HDL-C. However, at the end of 12 months, there was no sustained change except for a drop in fasting blood sugar. In a community based study, Hegde *et al*<sup>36</sup> evaluated the effect of yoga on oxidative stress in prediabetes patients. At the end of three months, yoga was associated with reduction in malondialdehyde, a marker of oxidative stress. A similar study showed that short-term yoga for 10 days reduced the IL-6 level and increased the adiponectin level<sup>37</sup>. Yoga was shown to be effective in reducing the waist circumference, blood pressure and improving the lipid and glycaemic profiles in metabolic syndrome<sup>38</sup>. A study from Korea was conducted on boys with obesity for a period of eight weeks. It was found that yoga could significantly reduce the body weight, BMI, fat mass (FM) and body fat percentage and improve fat free mass and the basal metabolic rate<sup>39</sup>.

In summary, short-term studies on yoga have been found to be moderately effective in reducing various risk factors of prediabetes, obesity and the metabolic syndrome. Studies have shown a beneficial impact on achieving glycaemic control in type 2 diabetes and gestational diabetes mellitus. However, there was heterogeneity in the methodology and the sample sizes across the various studies. In majority of these studies, the sample size was small and the duration of the studies was short. There was also a variability in the pattern of yoga, type of yoga and timing of individual sessions among all studies.

There is a need for proper randomized controlled interventions with adequate sample size and power with an appropriate duration. The effect of yoga also

has to be studied across various ethnic populations and risk categories to identify which pattern of yoga is more beneficial and which disorders benefit best from yogic interventions. It is also essential to have a trained expert yoga instructor, to design and individualize the yoga to maximize the benefit when yoga is advised for therapeutic purposes.

**Dukhabandhu Naik & Nihal Thomas\***

Department of Endocrinology  
Diabetes & Metabolism  
Christian Medical College  
Vellore 632 004, Tamil Nadu, India

\*For correspondence:

nihal\_thomas@yahoo.com

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