INFLUENCE OF PRANAYAMAS AND YOGA-ASANAS ON SERUM INSULIN, BLOOD GLUCOSE AND LIPID PROFILE IN TYPE 2 DIABETES

Savita Singh, Tenzin Kyizom, K P Singh*, O P Tandon and S V Madhu*

Departments of Physiology and *Medicine, University College of Medical Sciences & GTB Hospital, Dilshad Garden, Delhi

ABSTRACT

A distinguishable feature of type 2 diabetes besides hyperglycemia and deranged lipid profile is an impaired insulin secretion, peripheral insulin resistance and obesity which has become a major health concern worldwide. India with an estimated 31 million diabetics in 2000 and 79 millions by the yr 2030 has the highest number of type 2 diabetics in the world. In this study, we aimed to see if yoga-asanas and pranayamas have any influence in modifying certain biochemical parameters. Sixty patients of uncomplicated type 2 diabetes (age 35-60 yrs of 1-10 yrs duration) were divided into two groups: Group 1 (n=30): performed yoga along with the conventional hypoglycemic medicines and group 2 (n=30): patients who only received conventional medicines. Duration of the study was 45 days. Basal recordings of blood glucose (fasting and post-prandial), lipid profile and serum insulin were taken at the time of recruitment and the second reading after forty five days. Results showed a significant improvement in all the biochemical parameters in group 1 while group 2 showed significant improvement in only few parameters, thus suggesting a beneficial effect of yoga regimen on these parameters in diabetic patients.

KEY WORDS

Pranayama and yoga-asana, Diabetes mellitus, Insulin resistance, Lipid profile, Blood glucose.

INTRODUCTION

Diabetes mellitus (DM) comprises a group of metabolic disorders that share the common phenotype of hyperglycemia, polydipsia, polyuria and hyperphagia. Added metabolic dysregulation in the form of deranged lipid profile, impaired insulin secretion and insulin resistance is a feature of type 2 diabetes. Most patients are obese when they develop diabetes and the obesity is becoming a major health hazard worldwide. The incidence of type 2 diabetes is also increasing with the increase in age, physical inactivity and sedentary lifestyle (1). Its strong familial predisposition makes the situation even worse with the result that children and adolescents now present with juvenile diabetes (2,3).

Address for Correspondence :

Prof. Savita Singh, Department of Physiology, UCMS and GTB Hospital, Dilshad Garden, Delhi- 95 E-mail: tenkyiz5@yahoo.com

Yoga, a vedic science has been applied in the field of therapeutics in modern times. Yoga has given patients the hope to reduce medication besides slowing the progression of the disease. Yoga employs stable postures or asanas and breath control or pranayama (4). It has already proven its mettle in the improvement of oxidative stress as well as in improving the glycaemic status of diabetics through neuroendocrinal mechanism (5). The 45 days study was undertaken to see if yoga-asanas and pranayamas have any influence on the blood glucose, lipid profile and serum insulin level of patients of uncomplicated type 2 diabetes.

MATERIALS AND METHODS

The study was conducted in the departments of Physiology & Medicine, UCMS, Delhi. Sixty patients of type 2 DM in the age-group of 35-60 yrs with diabetes of 1-10 yrs duration were recruited from diabetic clinic of Guru Teg Bahadur Hospital, Delhi. Patients of nephropathy, retinopathy (proliferative) and coronary artery disease or any other complications of diabetes were excluded. The patients were divided into two groups of 30 patients each. Group 1 practised yoga along with the conventional medicines while group 2 continued with the

conventional medicines. The dose of the medicines remained constant throughout the study period. The clearance from the Ethical committee of the college was obtained and an informed written consent was taken from all the patients after the procedure was explained to them.

Group 1 patients were taught pranayama and yoga-asana by a yoga expert (Table 1). During this study period, the subjects were initially called continuously for five days and then once every week for follow up and compliance, total time for performing yoga being 45 minutes every day for forty five days. Fasting and post prandial blood glucose levels, lipid profile and serum insulin levels by Mercodia insulin ELISA (Enzyme Linked Immunosorbent Assay) kit were assessed before and

Table 1: Name and duration of various pranayamas & yogaasanas included in yogic exercises

| S.N | o. Name | Duration |
|-----|----------------------|--|
| 1. | Bhastrika- pranayama | 3-5 mins per day |
| 2. | Kapal- bhati | 5-10mins per day |
| 3. | Anulom-viloma | 5-10 mins per day |
| 4. | Bhramari | 5 times a day |
| 5. | Udgit-Om Uccharan | 5 times a day |
| 6. | Surya namakar | 3-7 turns of each, the pose being maintained for ten seconds adding each turn, every fortnight |
| 7. | Tadasana | 1⁄4 minute to one minute for adding1⁄4 minute per week. |
| 8. | Trikona-asana | $^{1\!\!4}$ minute to one minute for each side, adding $^{1\!\!4}$ minute per week |
| 9. | Pashimottanasana | 1/4 minute to one minute for each side, adding 1/4 minute per week |
| 10. | Bhujangasana | 3-7 turns of each, the pose being maintained for ten seconds adding one turn each, every fortnight |
| 11. | Shavasana | 2- 5 minutes, adding 1 minute per week |

after forty five days in both the groups. The data were statistically analysed using repeated measures analysis of variance (ANOVA) followed by Tukey's test at 5% level of significance.

RESULTS

The study showed a decrease in BMI (Body Mass Index) and a significant decrease in the weight in group 1 patients (Table 2). A significant decrease in blood sugar (Table 3) ,serum insulin level (Table 4) and an improvement in lipid profiles (Table 3) was also observed in group 1 while group 2 patients showed increase in the weight and non-significant improvement in other parameters.

Table 2 : Weight and BMI in both the groups before and after 45 days of study (Mean \pm SD)

| | | WT (kg) | BMI(Kg/m²) |
|----------------|--------|----------------------|------------------|
| GROUP 1 | Before | 63.20 ± 4.45 | 26.12 ± 1.54 |
| | After | $60.60 \pm 4.65^{*}$ | 24.59 ± 1.39 |
| GROUP 2 | Before | 63.17 ± 4.67 | 25.83 ± 1.77 |
| | After | $64.03 \pm 5.10^*$ | 26.05 ± 2.13 |

*p < 0.05

DISCUSSION

Following 45 days of yoga-asanas and pranayamas, significant reduction in the blood sugar was achieved in group 1 (Table 3) while group 2 although showing a reduction didn't show significant change. Various yoga-asanas may be directly rejuvenating cells of pancreas as a result of which there may be increase in utilization and metabolism of glucose in the peripheral tissues, liver and adipose tissues through enzymatic process (6). Sahay et al (7) reported a decrease in the drug requirements by some of the patients in his study. Singh S et al (8) also observed the similar findings in their study. Jain et al (9) found that there was significant reduction in

Table 3: Glucose & lipid profile (mg/dl) in both groups before and after 45 days (Mean±SD)

| | Glucose (fasting) | Glucose(PP) | TC | TG | HDL | LDL | VLDL |
|---------|-------------------|----------------|---------------|---------------|-------------|---------------|--------------|
| GROUP 1 | | | | | | | |
| Before | 172.87±45.55 | 260.50±78.60 | 185.60±45.86 | 162.93±79.21 | 36.23±8.05 | 118.90±41.70 | 32.20±16.56 |
| After | 133.77±38.77** | 198.90±63.68** | 169.37±37.14* | 137.37±58.78* | 39.23±6.23* | 104.30±40.25* | 27.03±13.03* |
| GROUP 2 | | | | | | | |
| Before | 174.40±36.91 | 260.27±51.43 | 187.40±45.44 | 163.77±41.44 | 36.57±4.82 | 120.0±53.37 | 29.80±11.98 |
| After | 167.40±37.32 | 250.23±48.57 | 182.90±47.66 | 157.93±38.44 | 37.27±5.49 | 116.37±46.30 | 27.13±9.39 |

*p < 0.05; **p <0.001

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| Table 4: S. Insulin levels | (mU/L) in both | groups (Mean±SD) |
|----------------------------|----------------|------------------|
|----------------------------|----------------|------------------|

| | | S. Insulin |
|---------|--------|--------------|
| GROUP 1 | Before | 31.47±17.28 |
| | After | 22.42±13.80* |
| GROUP 2 | Before | 32.20±16.18 |
| | After | 30.18±15.10 |
| | | |

*p < 0.05

hyperglycemia with decrease in oral hypoglycemic drugs for maintenance of normoglycemia in response to yoga therapy. These findings suggest improvement in the insulin sensitivity following yogic exercises.

The present study also shows a significant decrease in Total Cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) with a significant increase in high density lipoprotein (HDL) level from its initial value after forty five days of yoga-asanas and pranayamas in group 1 while showing insignificant decrease in group 2 (Table 3). The parameters were taken only twice -once at the time of recruitment and other at the end of 45 days, therefore the trend of reduction cannot be commented upon. At the same time, it is also difficult to exactly quantify how many patients have benefited by pranayama because it differed from parameter to parameter. For example, only 25 patients showed improvement in HDL by 13.66%, 20 patients had reduction in VLDL by 25.80%, 22 patients had reduction in LDL by 20.91%, 26 patients in TG by 18.18%, 29 patients in TC by 8.83% and reduction in blood glucose (fasting and post-prandial) by 22.61% and 23.64% respectively. The decrease in lipid profile seen in this study is in agreement with the earlier studies. Sahay et al (7) and Bijlani et al (10) reported a significant reduction in free fatty acids, LDL, VLDL and an increase in HDL. The improvement in the lipid profile after yoga could be due to increased hepatic lipase and lipoprotein lipase at cellular level, which affects the metabolism of lipoprotein and thus increase uptake of triglycerides by adipose tissues (11, 12). These changes suggest improvement in the insulin sensitivity following yogic exercises. The patients in both the groups belonged to the same socio-economic background. So it won't be wrong to assume their dietary habits were similar. Hypoglycemic drugs like glibenclamide and metformin were the drugs prescribed to most of these patients. We also encouraged patients to include vegetarian diet and stressed on the importance of regular meal timings since some studies suggest that plant protein may be hypocholesterolemic (13). Supplementation of vegetarian diets and dietary fibres is also known to augment the activity of these metabolic enzymes further.

Influence of Pranayamas and Yoga-Asanas

Type 2 diabetes in contrast to type 1 diabetes is associated with an increased plasma insulin concentration (hyperinsulinemia). This occurs as a compensatory response by the pancreatic β -cells for the decrease in carbohydrate utilization and storage and the resultant increase in blood glucose. However, even the increased levels of insulin are not sufficient to maintain normal glucose regulation because of the greatly diminished insulin sensitivity of the peripheral tissues, a condition referred to as insulin resistance. Enzyme Linked Immunosorbent Assay (ELISA) for insulin estimation in fifteen patients showed hyperinsulinemia (Table 4). The serum insulin levels came back to normal value after forty five days of yoga-asanas. The beneficial effect on the insulin kinetics may be by improving the sensitivity of the target tissues thus decreasing insulin resistance and consequently, increasing peripheral utilization of glucose. Sahay et al (7) observed a significant increase in insulin sensitivity and decrease in insulin resistance by reporting a significant rise in the number of insulin receptors following yogic-intervention. They also suggested a shift of the peak level of the insulin level to the left with normalization of insulin/ glucagon (I/G) ratio with a reduction in free fatty acid levels. A short lifestyle modification and stress management education program leads to favourable metabolic effects as also studied by Bijlani et al (10) within a period of 9 days. Yoga also reduces oxidative stress and improves day to day performance (14). Significant reduction in the weight and noticeable decrease in Body Mass Index (BMI) following forty five days of yoga-asana was also observed in our study (Table 2). The average reduction in weight was 2.26kg per person and BMI was 1.2kg/m² per person. For the reason cited above, the trend of reduction of both weight and BMI cannot be commented upon. However, out of 30 patients in the yoga group, 3 patients didn't show any change in the weight while the rest 27 had 4.56% reduction in weight and 26 patients had 6.69% reduction in BMI. Sahay et al (7) have also reported a significant decrease in the body fat and increase in lean body mass in type 2 diabetics after yogic intervention. Yoga helps in the redistribution of fat by reduction of fat from waist, thus changing from central obesity to peripheral obesity due to change in insulin resistance. A significant reduction in the skin fold thickness in normal healthy volunteers was also reported in his study. Besides these, following yoga-asanas and pranayamas, many patients reported a feeling of well being, more relaxed and satisfied, and a sense of relief from anxiety. They were more alert and active which could be due to release of opiods and altered adrenocortical activity (15). Yoga-asanas with its change in posture and controlled breathing in pranayama influences mental status of an individual allaying apprehension, stress and brings about feelings of well being and hormonal balance.

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Sense of well being seen in those practicing yoga is also believed to be due to endogenous secretion of melatonin (16). Although improvements were seen in all the parameters in group 2 but none were significant. This may be because they were already taking the same drugs since many years. When combined with yoga (group1), these parameters show significant improvement. Thus, it is not wrong to conclude that diabetes can be better controlled if yoga can also be simultaneously administered along with the conventional medicines . From the beneficial effects of yoga on diabetes as seen in this study, it may be assumed that adoption of yoga on long term basis would bring proper control of blood sugar, lipid profile and insulin levels in diabetes. However, further extensive and long term studies need to be done to prove this and to understand the basic mechanisms involved.

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