EFFECT OF YOGA ON PSYCHOLOGICAL STATES, SLEEP AND EMOTIONAL INTELLIGENCE OF SCHOOL TEACHERS SUFFERING FROM TYPE 2 DIABETES MELLITUS: A PILOT STUDY

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Abstract

Teaching is one of the stressful professions. The presence of diabetes contributes to the further increase in their stress levels, andthis negatively affects their sleep quality and emotional states. Yoga is known to reduce stress and have a beneficial effect on healthy and diseased conditions. The objective of the study comprised to study the effect of yoga on stress, sleep quality, and emotional states of school teachers suffering from type 2 diabetes. The methodology involved 39 (all female) schoolteachers who have type 2 diabetes since minimum of 3.4±2.2 years, with age range 30 to 55years (44 ± 6.6). Subjects with known cases of cardiac disease, psychiatric illness, recent surgery, pregnancy, were excluded from the study. All the subjects underwent one month of yoga intervention, one daily for five days a week. Fasting, postprandial blood glucose level, Perceived stress, emotional regulation and sleep quality were assessed before and at the end of the intervention. Data analysis was performed using SPSS version 10. Paired sample t test was used to find the pre-post differences in all variables. Paired sample t test showed significant reduction in perceived stress (p< 0.001, -37.89%), Fasting Blood Sugar (p< 0.001, -24.45%), Postprandial Blood Sugar (p< 0.001, -26.53%) along with a significant improvement in sleep quality (p< 0.001, -50.58%). Out of 39 subjects, 21 (54%) were having perceived stress score more than 13 suggesting above-average stress level. At the end of the study, this was reduced to 9 (23%). Also, it is observed that out of 39 subjects, 13 (33%) were having a perceived stress score of more than 20, suggesting a high-stress level. At the end of the study, this was reduced to 1 (2%). And we found out 39 subjects, 10 (26%) were having global PSQI score more than 10 indicating bad sleepers. At the end of the study, this was reduced to 2 (5%). Also found that out 39 subjects, 18 (46%) were having global PSQI scores more than 5 indicating poor sleepers. At the end of the study, this was reduced to 4 (10%).One month of yoga intervention may help in improving emotional regulation and sleep quality by reducing perceived stress level in female teachers suffering from type 2 diabetes. However, further randomized controlled studies need to be performed to confirm the findings of the present study.

***Keywords**: Teacher, yoga, perceived stress, Emotional regulation, Diabetes mellitus, Sleep.*

Happiness is the core of our human personality. All human endeavors are aimed at achieving this happiness. But in the present-day world, the materialistic pursuits and rat race, which every man has to inevitably undertake for tasting success, invariably undermines his/her chances of achieving happiness. It also adds lots of stress and anxiety, which gets piled up each and every day. This results in depression and an unhealthy physical constitution.

Stress and its impact on health

Stress is a physiological response of the body to the stressor(The World Book Encyclopedia, 1992). When the individual is exposed to chronic stress it leads to increased sympathetic tone via up-regulation of HPA axis (Kudielka, Schommer, Hellhammer & Kirschbaum, 2004).Stress affects the health by increasing the heart rate, blood pressure, respiratory rate (Vrijkotte, Van Doornen & De Geus, 2000) increased basal muscle tone etc. (Rachev & Hayashi, 1999), it also increase the anxiety (Maes, Song, Lin, De Jongh, Van Gastel, Kenis & Smith, 1998), depression (Van Praag, 2004), restlessness and impulsivity.Stress is an independent cause of many physical and psychological health conditions such as back pain (Flor, Turk & Birbaumer, 1985), fibromyalgia (Van Houdenhove, & Egle, 2004), gastritis etc.

Chronic stress leads a variety of changes in physiology by causing dysregulation HPA axis (Traustadóttir, Bosch & Matt (2005). It elevates the inflammatory markers like IL6 (Yudkin, Kumari, Humphries, & Mohamed-Ali,2000), oxidative stress, serum cortisol (Finlay & Mckee 1982), cytokines, (Evans, Goldfine, Maddux & Grodsky, 2002) etc.

Stress increases the progression of the chronic disease and symptoms associated with it. The presence of stress in chronic disease increases the chances of anxiety (Robinson, 1990), depression (Hammen, 2005) and negative emotions (Kuiper, Olinger, & Martin, 1988).

Stress is strongly associated with many chronic health conditions like hypertension (Kulkarni, O'Farrell, Erasi, & Kochar, 1998), asthma (Wright, Busse,& Lemanske, 2005), diabetes (Bradley, 1988), osteoarthritis (Zautra, & Smith, 2001), Parkinson's disease (Jenner, 2003) etc.

Stress triggers the acute episodes of many remitting and relapsing diseases like, asthma(Wright, Busse,& Lemanske, 2005), rheumatoid arthritis (Zautra, & Smith, 2001), multiple sclerosis (Ackerman, Heyman, Rabin, Anderson, Houck, Frank & Baum, 2002), migraine (Köhler & Haimerl, 1990) etc.

Emotional Intelligence and health

Emotions help us to be aware of oneself, empathy, i.e. understanding the other person, self-motivation, staying composed in all situations, managing relationships, understanding the person's weakness and strength, orientation towards ethical standards and commitment to keep promises.

Emotional intelligence (EI) is an ability of an individual to be aware about one's own emotions, understand them and use them according to need (Caruso, Mager, &Salovery, 2004). Enhanced EI hasa positive correlation with physical health and psychological well-being (Tsaousis, & Nikolaou, 2005).Chronic health conditions like cardiac disease, diabetes, hypertension, osteoarthritis are characterized by decreased EI.

Stress and EI

EI has a negative correlation with stress. Reduced EI increases the susceptibility of an individual to stress and its effects on mind and body (van Heck, & den Oudsten, 2008). EI acts as preventive measure against bad behavior, anxiety, frustration, boredom, and depression (Kauts, & Kaur.2015). Application of emotional intelligence can increase effectiveness and reduce occupational stress among teachers (Mehta, 2013).

The stress related to work induce unpleasant and negative emotions resulting from some aspects of work which leads to loss of productivity and to mental health problems such as depression and anxiety (Leung, Chiang, Chui, Mak, & Wong, 2011). Stress induces burnout and it leads to emotional exhaustion. Emotional exhaustion is the tiredness a person experiences when they are drained and irritated. Emotional exhaustion is negatively related to self-confidence and emotional steadiness. To come out of high stress coping mechanisms are used like expressing anger, blaming others, avoiding the people, minimizing the work, not accepting new responsibilities. Continuing these states for a longer time will affect their mental health negatively(Fisher, 2011). Stress and emotions always co-exist and they are interrelated. Certain negative emotions like anger, envy, jealousy, anxiety, fright, guilt, shame and sadness can be called as stress emotions because they raise from stressful, harmful, threatening or challenging conditions(Lazaras, 1999)

Stress and Sleep

Sleep plays an important role in physical health. Sleep is involved in the healing and repair of heart and blood vessels. Ongoing sleep deficiency is linked to an increased risk of heart disease, kidney disease, high blood pressure, diabetes, and stroke. Studies also show that sleep deficiency alters activity in some parts of the brain. If sleep deficiency occurs, one may have trouble in making decisions, solving problems, controlling emotions and behavior, and coping with change. Sleep deficiency also has been linked to depression, suicide, and risk-taking behavior.

Stress systems qualify us to face everyday challenges. Sleep loss affects the stress system. Changes in the actions of the stress system and insufficient sleep will give serious problems in health and well-being. Studies are showing sleep deficiency and restriction are linked with a mild increase in the activity of the major neuroendocrine stress system, i.e. autonomic sympathoadrenal system and the hypothalamus-pituitary-adrenal axis. In the long run the system's reactivity to other stresses and challenges will be getting affected. Insufficient sleep, by acting on stress systems, may sensitize individuals to stress-related disorders. Indeed, epidemiological studies suggest that sleep complaints and sleep restriction may be important risk factors for a variety of diseases that are often linked to stress, including cardiovascular diseases and mood disorders(Meerlo, Sgoifo, & Suchecki, 2008)

Diabetes Mellitus

Diabetes is a medical condition characterized by chronic hyperglycemia. It is a major challenge for the health care system worldwide. Long-standing diabetes leads many comorbid conditions like, cardiovascular disease, cerebrovascular disease, chronic renal disease, depression and impaired cognitive functioning, which makes the patients' quality of life poor. Long-term impediments of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual problems. Patients with diabetes have an increased risk of atherosclerotic cardiovascular, peripheral arterial and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes. The

vast majority of cases of diabetes fall into two broad etiopathogenetic categories (American Diabetes Association).

Metabolic activity gets disturbed in the presence of Stress. The "counter-regulatory hormones are released in response to stress and that elevates blood glucose levels and decreased insulin action. In diabetes, because of a comparative or complete lack of insulin, stress-induced increases in blood glucose cannot be effectively metabolized. Thus, stress is a potential contributor to chronic hyperglycemia in diabetes(Surwit & Schneider, 1993)

Prevalence and Complications

The fast increasing potential epidemic with more than 171 million individuals is diabetes. India now has the largest population of diabetics (62 million). This number is expected to increase in prevalence as 366 million worldwide by 2030. In 2000, India was in top with highest population having diabetes (37.1 million). Now in Chennai the percentage is more compared to other cities in India. Nearly 13.5 percent (Kaveeshwar & Cornwall, 2014)

Stress and diabetes

Obesity contributes to the development of type 2 diabetes; obesity causes endoplasmic reticulum (ER) stress. This stress, in turn, leads to suppression of insulin receptor. These findings demonstrate that ER stress is a central feature of peripheral insulin resistance and type 2 diabetes(Ozcan et al., 2004)

A central organelle called the endoplasmic reticulum (ER) is assigned with lipid synthesis, protein folding and protein maturation. For recognition and targeting of unusual proteins for degradation, this has been gifted with a quality control system.A stress response (ER stress) is switched on when the capacity of this quality control system is exceeded. Prolonged stress leads to apoptosis and may be an important factor in the pathogenesis of many diseases. The unfolded protein response is evolved to maintain the balance between a load of newly produced proteins and the capacity of ER to help in the maturation. When unfolded protein response is not functioning according to requirement, it may lead to some diseases which involve tissues which is responsible for extracellular protein synthesis. Since pancreatic beta-cells depend on the efficient unfolding protein response to meet the demands for constant fluctuating levels of insulin synthesis. Recent studies have indicated that the importance of the UPR in diabetes is not restricted to the beta-cell, but also to the tissues of peripheral insulin resistance such as the liver and adipose tissue(Rajan, Srinivasan, Balasubramanyam, & Tatu, 2007)

The metabolic syndrome with normal glucose tolerance indicates a person at a very high risk of diabetes and cardiovascular disease. Diseases associated with excessive secretion of growth hormone, cortisol, glucagon, epinephrine can cause diabetes.Stress induces the release of some hormones, which can elevate blood glucose levels. Regulation of these stress hormones may be abnormal in diabetes. The studies show that in establishing diabetes, stress can stimulate hyperglycemia, hypoglycemia, or have no effect at all on glycemic state. Then, there is increasing indication of autonomic contributions to the pathophysiology of this condition(Surwit & Schneider, 1993)

Sleep and Diabetes

Dwindled sleep duration or quality may increase diabetes risk. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Perceived sleep debt was calculated as the difference between preferred and actual weekday sleep duration. In patients without diabetic complications, glycemic control was associated with perceived sleep debt but not PSQI score. United with present proof linking sleep loss to increased diabetes risk, these data advocate that enhancing sleep duration and quality should be tested as an intervention to improve glucose control in patients with type 2 diabetes(Knutson, Ryden, Mander, & Van Cauter, 2006)

School Teachers and stress

Teachers have an enviable task of molding society. Researches are showing that teachers are exposed to a number of causes of stress. The main sources of stress for teachers start from teaching students who lack motivation, retaining discipline in the classroom; exerting too much for that and job demands, undergoing lots of changes in the work environment, being weighed by others, challenging relationship with colleagues, management pressure. (Cameron & Andre, 2005). The teaching profession is an occupation at high risk for stress. Normally work pressure is creating stress in all fields. But particularly in this study we have seen teachers are having lots of stress than in other fields. Chronic work stress and overtiredness lead to health hazards in the long run. As the teaching profession is a potentially high stressful occupation, chronic work stress (effort-reward-imbalance) and exhaustion were assessed(Bellingrath, Weigl, & Kudielka, 2009)

Yoga

It is an ancient science of mind-body practices helps in enhancement of relaxation at physical and mental level. It was discovered, developed and practice for higher purposes like self-realization. Yoga makes the mind and body work more efficiently. Previous scientific studies on yoga demonstrated its beneficial effects in many health-related conditions like asthma, osteoarthritis, cardiac disease, anxiety and depression(Swami Shankardevananda, 1977)

Yoga and diabetes

Yoga is one of the most ancient body practices, discovered, developed and practiced by ancient Indian sages like *Patanjali*, Yoga *vashistha*, *swatmaram*, etc. for the higher goals like attaining the state of thoughtless mind (*Samasdhi*) or achieving the spiritual powers (*Sidhi's*). Recent scientific investigations in yoga revealed many of its health-benefiting effects and made it one of the complimentary medicine (Mahdipour & Bahraei, 2005).

After understanding the perspectives of diabetes, it is clear that Diabetes is a lifestyle-related aging disease which is on the increase. The role of emotions and stresses on the mind in quickening the progression of this disease is proved. Our personality has five layers according to yogic concept as told in the *taitriyopanishad.* First, the Physical body is mentioned as *Annamayakosha*, which involves all the organs, tissues, cells, nerves. It functions as the food nourishes. Second is *Pranamayakosha. Prana* flows through the body and makes them function. The third is *Manomayakosha.* The mind-body is vital to activate the *prana.* The fourth is *Vijnanamaya kosha.* The intellect is

essential to keep the mind in proper shape emotionally, psychologically. The fifth is the *Anandamaya kosha,* which is the strongest one, which is always responsible for the other four layers, functions. The bliss body of the personality. So, yoga helps to relax the mind, increase sleep quality, and bring balance in their emotions. In turn by doing yoga for all the layers of personality, we can manage the disease and live healthily(Srikanta, Nagarathna, Nagendra, 2003)

It is proved the useful role of yoga in the control of diabetes mellitus. Fasting and postprandial blood glucose levels came down significantly. It helps to maintain good glycaemic control for a long time. It is observed that the drug requirement is lowered and the occurrence of acute complications like infection and ketosis is reduced. There were important changes in the insulin kinetics and those of counter-regulatory hormones like cortisol. There was a reduction in free fatty acids. There was an increase in lean body mass and decrease in body fat percentage. The number of insulin receptors was also increased. There was an enhancement in insulin sensitivity and deterioration in insulin resistance. All these suggest that yogic practices have a role even in the prevention of diabetes. There is a beneficial effect on co-morbid conditions like hypertension and dyslipidemia(Sahay, 2007)

Methodology

Having an aim of studying the effect of one-month yoga intervention on psychological states and blood glucose level in female school teachers suffering from type 2 diabetes mellitus, with objectives to study the changes in Fasting Blood Sugar Level (FBS), Post Prandial Blood Sugar Level (PPBS), Perceived Stress level (PSS), Sleep Quality (PSQI) and Emotional Intelligence (EIS), we started approaching schools in Chennai. In four schools, samples recruited for the study were 39 female teachers. Only the single group pre post-study was conducted. Teachers were asked to check their Fasting Blood Sugar (FBS) and Post Prandial Blood Sugar (PPBS) before and after yoga. Also, they were asked to fill the questionnaires for observing the changes in their stress, sleep quality, and emotional Intelligence. The variables used are The Pittsburgh Sleep Quality Index, Cohen Perceived Stress Scale, and Emotional Intelligence Scale. Then started the one-month yoga intervention with one-hour duration five days a week in their school premises. In the intervention, we have given breathing exercises, loosening exercises, *Suryanamaskar*, Yoga *asanas* and *Pranayama* along with *Nadanusandana, Omkar* meditation.

Teachers were in the age group between 30 and 55. The teachers, who were willing to attend yoga classes, who were on regular anti-diabetic medication, were included in the study. The teachers who were not interested, the teachers having cardiovascular disease, having a history of recent surgery, having uncontrolled diabetes, who were on any anti-psychotic medication, who have previous exposure to any form of yoga in last one year were excluded. After a month of yoga intervention, they were asked to fill the questionnaires, check the fasting blood sugar and postprandial blood sugar.

The data of pre and post yoga were extracted and analyzed in SPSS softer version 16.

Results

Paired sample t test showed significant reduction in perceived stress ($p< 0.001$, -37.89%), Fasting Blood Sugar ($p< 0.001$, -24.45%), Postprandial Blood Sugar ($p<$

0.001, -26.53%) along with a significant improvement in sleep quality (p< 0.001, -50.58%).

Table 1: Pre-post changes in mean, SD, percentage of all the variables along with p values.

Sl No	Variables	Pre(Mean± SD)	Post(Mean ± SD)	% Change	P[a] value
1	FBS	144.85±39.622	109.44±26.010	-24.45%	<.001**
2	PPBS	268.64±59.076	197.38±50.798	-26.53%	<001**
3	PSS	18.08±4.126	11.23±3.710	-37.89%	<001**
4	PSQI	7.79±3.246	3.85±3.246	-50.58%	<001**
5	EIS	122.31±13.117	126.08±15.744	3.08%	<673

[a] Paired sample t test, FBS-Fasting Blood Sugar, PPBS-Post Prandial Blood Sugar, PSS-Perceived Stress Scale, PSQI-Pittsburgh Sleep Quality Index, EIS-Emotional Intelligence Scale

Figure 1: Graph showing pre-post changes in mean score of FBS& PPSS

Figure 2: Graph showing pre-post changes in mean score of PSS

Figure 3: Graph showing pre-post changes in mean score of PSQI

Figure 4: Graph showing pre-post changes in mean score of EIS

Out of 39 subjects, 21 (54%) were having perceived stress score more than 13 suggesting above average stress level. At the end of the study, this was reduced to 9 (23%). Also, it is observed that out of 39 subjects, 13 (33%) were having perceived stress score more than 20 suggesting a high stress level. At the end of the study, this was reduced to 1 (2%). And we found out 39 subjects, 10 (26%) were having global PSQI score more than 10 indicating bad sleepers. At the end of the study, this was reduced to 2(5%). Also found that out 39 subjects, 18 (46%) were having a global PSQI score more than 5 indicating poor sleepers. At the end of the study, this was reduced to 4 (10%).

Table 2: showing percentage changes in variables who were having a different PSQI score and PSS score

Variables	Before yoga	After yoga	% change
Number of the subjects with Global PSQI scores> 5, (%)	18, (46%)	4, (10%)	-78%
No. of the subjects Global PSQI score > 10, (%)	10, (26%)	2, (5%)	-80%
No. of the subjects with PSS Score > 13, (%)	21, (54%)	9, (23%)	-57%
No. of the subjects with PSS score > 20, (%)	13, (33%)	1, (2%)	-92%

Discussion

In this study study the efficacy of one-month yoga intervention on perceived stress, emotional intelligence and sleep quality of the teachers suffering from type 2 diabetes. At the end of the study, we observed significant reduction in stress ($p< 0.001$, -37.89%), Fasting Blood Sugar ($p< 0.001$) and (-24.45%), Postprandial Blood Sugar ($p< 0.001$, 26.53%) along with a significant improvement in sleep quality ($p< 0.001$, -50.58%).

We also observed a significant reduction in the number of subjects having high-stress levels and sleep problem after one-month yoga intervention.

In an earlier study, in the preliminary report on role of yoga on oxidative stress in NIDDM, Subjects were given yoga training including *suryanamaskar*, yoga *asanas*. The *asanas* were done every day for 40 days. FBG, PPG, was estimated before and after 40 days of yoga *asanas* regimen. The age group is between 30 and 60. Significant reduction was seen in FBG from 220 mg/dl to 162 mg/dl, PPG from 311 mg/dl to 255 mg/dl. The decrease was statistically significant ($p<0.001$) for FBG and PPG(Singh et al., 2001).

In current study, the age group is between 30 and 55, and yoga intervention was for 30 days every day one hour practice. And we have observed reduction in FBS $p<0.001$ and PPBS $p<0.001$ along with changes in Perceived Stress changes $p<0.001$, Sleep quality changes $p<0.001$.

In an earlier study, The effects of a gentle yoga program on sleep, mood, and blood pressure in older women with restless legs syndrome (RLS): A preliminary randomized controlled trial, the yoga group demonstrated significantly more significant improvements than controls in multiple domains of sleep quality and mood, and significantly more substantial reductions in insomnia prevalence, anxiety, perceived stress, and blood pressure (all $p\leq0.05$). Their preliminary findings suggest yoga may offer an effective intervention for improving sleep, mood, perceived stress, and blood pressure in older women with RLS(Innes & Selfe, 2012)

In the current study, the psychological state, sleep, and emotional intelligence were observed combining with blood sugar level changes in female school teachers in the age group of 30 to 55. The results here show significant ($p<0.001$) in perceived stress, sleep, and fasting as well as PP blood sugar.

In earlier studies, it was observed that the practice of yoga leads to a reduction in stress hormone levels and an increase in neurotrophic factors. This may be a possible reason forthe reduction of stress. Reduced stress levels, improve sleep quality, and thus, changes have come in blood sugar levels. Yoga intervention first brought breath control in them and had a perfect sleep. When their sleep quality is good, they are able to handle day to day tensions and stress very effectively. In turn, they could get confidence. They could get flexibility, which could increase their movements very relaxed in the direction of their work. They found themselves very active the whole day. Because of that, they could do more work without any tension. Some people started finding they are feeling very light as if their weight is reduced. *Omkar Dhyana* gave them a very good focus on the student's academics; they could show a positive attitude towards everything and everybody.

Conclusion

One month of yoga intervention may help in improving emotional regulation and sleep quality by reducing the perceived stress level in female teachers suffering from type 2 diabetes. However, further randomized controlled studies need to be performed to confirm the findings of a present study.

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