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Original Research Article

Effect of Sudarshan Kriya Yoga on Blood Pressure, Pulse rate, Anxiety and Quality of life in Pre-diabetic subjects

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Abstract:

Objective: The present randomized control trial is performed to study the effect of Sudarshan Kriya Yoga on Blood Pressure, Pulse rate, Anxiety and Quality of life in Pre-diabetic subjects

Material and Methods: In this study fifty pre-diabetic subjects were underwent Sudarshan Kriya Yoga (SKY) interventions regularly for the duration of three months. Study parameters Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Pulse rate (PR), Hamilton anxiety score (Ham-A) and Quality of life score (QOL) were measured at baseline and after 3 months of SKY interventions.

Results: SKY interventions resulted in statistically highly significant decrease in SBP, DBP, PR, Ham-A and QOL score ($p<0.001$) after 3 months of regular practices in the study subjects.

Conclusion: SKY interventions are found to statistically significant decrease in Blood Pressure, Pulse rate, Anxiety and improved Quality of life score in study participants. Application of SKY before the development of Diabetes Mellitus in the individuals may help to prevent them to develop into clinical cases. The underlying mechanism to decrease Blood Pressure, Pulse rate, Anxiety score and improved Quality of life score in the study participants, may be through increased parasympathetic activity along with decreased sympathetic activity.

Keywords: Sudarshan Kriya Yoga (SKY), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Pulse rate (PR), Hamilton anxiety score (Ham-A), Quality of Life (QOL), Pre-diabetics.

Introduction

Nowadays fast and industrialised life along with many risk factors like smoking, consumption of alcohol, high stress level, deranged eating habits and lack of regular physical activity has made modern man more prone for the diabetes mellitus, hypertension and many other lifestyles stress related diseases. Lifestyle modifying interventions like yoga meditation have been found useful in the management of these lifestyle diseases. Therefore, they may be practised to maintain or promote physical and mental health of the individuals.

According to WHO Subjects having fasting blood glucose level between 100-125 mg/dl are considered pre-diabetics. Pre-diabetics have been found to have 25-40% increased risk to get Diabetes Mellitus over the period of 5 years. It is associated with an increased risk of cardiovascular diseases also. Recently cases of Diabetes mellitus, due to the decreased insulin secretion or insulin resistance are rising with a high speed. It has been predicted by the International Diabetic Federation that the number of patients suffering from Diabetes Mellitus may be increased to a very high number upto 642 million by 2040, due to the risk factors like lack of physical activity, changed dietary habits and obesity. [1]

Hypertension also known as silent killer of mankind has become a prominent health problem worldwide, affecting billions of people. It raises the risk of coronary heart diseases and other cardiovascular related burden of diseases and becomes a major cause of mortality. [2]

SK and related practices have been found to lower the blood pressure of the healthy practitioners along with improved mental health parameters like anxiety and depression. [3]

Anxiety is characterized by feelings of inner turmoil and often manifests with nervous behaviour like pacing. The severity of a patient's anxiety can be assessed using the Hamilton Rating Scale for Anxiety (Ham-A), developed by M. Hamilton in 1959. This widely used interview scale evaluates anxiety based on 14 parameters. Each parameter is scored on a scale of 0 (not present) to 4 (severe), allowing clinicians to document the effectiveness of

pharmacotherapy or psychotherapy interventions. [4]

The WHOQOL-BREF is a shortened version of the WHOQOL-100 designed to assess quality of life. It evaluates four domains: physical health, psychological health, social relationships and environmental health, along with facets on overall quality of life and general health. With 26 items, it covers various aspects of well-being, with scores ranging from 1 to 5. These scores are then transformed to a scale of 0 to 100, making it a valuable tool for research, clinical trials, and evaluating the effectiveness of health interventions or treatments. [5,6]

Yoga: The meaning of word 'yoga' in Sanskrit is "to unite". From the ancient time Yoga has been practised as an Indian science and tradition. Yoga have been found to integrate mind and body. Sage Patanjali in his Yoga sutras has described text on yoga in detail with systematic approach that help the man to gain the highest state of performance on physical, mental and spiritual planes of health. [7]

The autonomic nervous system (ANS) primarily regulates the visceral functions of body. Previously it was believed that the ANS activities cannot be modified voluntarily has evolved. Now it is discovered that mind body interventions like yoga, meditation, and other relaxation techniques can affect the ANS. SKY is one of such techniques which came into existence in 1982 in Shimoga, India when Sri Sri went into silent meditation for a period of ten days.[8]

The rising number of cases of diabetes mellitus, hypertension, anxiety and other psychosomatic diseases is a concerning trend in modern society. This created an intense desire to perform a scientific study on pre-diabetic subjects with the cardiovascular, mental health parameters along with quality of life so that their progression into apparent clinical cases can be stopped. Non-pharmacological lifestyle modifying interventions, such as Sudarshan Kriya Yoga impacts health of the individuals positively and become helpful to regulate their blood pressure and blood glucose level so that their progression to apparent clinical cases can be checked.

Material and Methods

In the current study fifty subjects aged between 30-60 years with pre-diabetes were engaged to perform Sudarshan kriya yoga for one hour daily over three months. SKY involved practices of yogasnas and breathing processes followed by meditation. This study was conducted at the Department of Physiology, S.P. Medical College, Bikaner, from December 2017 to March 2022 with informed consent of the subjects. The ethical approval was obtained from the human ethical committee of S.P. Medical College, Bikaner. Before starting the intervention baseline parameters (SBP, DBP, PR, Ham-A and QOL score) were measured for all the study subjects, three months after completion of study period the same set of observations was repeated. All the subjects participated voluntarily in the study. The patients suffering from coronary heart disease, diabetes mellitus, pulmonary tuberculosis, asthma, any other major illness and non-cooperative subjects were excluded from the study.

Results

Statistically highly significant benefits of SKY interventions were obtained in SBP, DBP, PR, Ham-A and QOL score after 3 months of practices in pre-diabetic subjects.

Tables 1 and 2 showing the demographic profile of pre-diabetic subjects practicing SKY interventions according to their age and gender.

Table 3 showing statistical analysis of SBP, DBP, PR and Ham-A score between pre and post treatment in pre-diabetic subjects practicing SKY. There was statistically highly significant decrease in SBP, DBP, PR and Ham-A score after three months of SKY intervention in pre-diabetic subjects ($p < 0.001$). Table 4 showing statistical analysis of QOL score between pre and post treatment in pre-diabetic subjects practicing SKY. There was statistically highly significant improvement in QOL (DOM 1 to 4) after three months of SKY intervention in pre-diabetic subjects. ($p < 0.001$).

Table 1: Distribution of cases according to age group

Age Group (years)	Pre DM	
	Yoga	
	No.	%
34-40	11	22.0
41-50	28	56.0
>50	11	22.0
Total	50	
Mean	45.82	
SD	6.22	

Table 2: Distribution of cases according to gender

Gender	Pre DM	
	Yoga	
	No.	%
Female	17	34.0
Male	33	66.0
Total	50	

Table 3: Statistical analysis of SBP, DBP, PR and Ham-A score between pre and post treatment in pre-diabetic subjects

Parameters	Pre treatment		Post treatment		T	p
	Mean	SD	Mean	SD		
Systolic BP	114.48	3.37	110.72	3.37	18.508	<0.001
Diastolic BP	75.68	1.99	74.60	2.15	4.010	<0.001
Pulse Rate	85.56	5.99	75.72	3.24	13.768	<0.001
Ham-A	22.12	3.77	4.34	1.71	39.897	<0.001

Table 4: Statistical analysis of QOL (DOM 1 to 4) between pre and post treatment in pre-diabetic subjects

DOM	Pre Treatment		Post Treatment		t	p
	Mean	SD	Mean	SD		
DOM-1	41.76	9.40	62.52	11.85	12.611	<0.001
DOM-2	38.38	9.32	60.58	12.04	16.915	<0.001
DOM-3	39.50	10.49	62.14	13.27	14.578	<0.001
DOM-4	38.34	9.04	66.76	9.66	23.113	<0.001

Discussion

Lifestyle modification through SKY interventions have proved their positive effect to significantly decrease SBP, DBP, PR, Ham-A score while improved QOL in pre-diabetic subjects. There are many mechanisms that explain these beneficial effects in the practitioners.

SKY influences the vagus nerves that affect the physiological functions of heart, blood vessels, brain, endocrine glands and other organ systems. They impact the nerve signals reaching into the thalamus, limbic system and cortical areas of brain. Due to the presence of these intricate connections among the various neural areas of the brain SKY influences the autonomic nervous system and the higher functions of brain. [9]

During SKY many breathing processes are performed one of them is the ujjayi breathing in which sensory inputs generated in throat, lungs and chest wall muscles influences the vagal and spinal pathways. When these signals reach into the parabranchial nucleus and locus coeruleus nuclei of the brainstem, they modulate the heart rate by increased parasympathetic while decreased sympathetic discharge.[10]

SKY interventions have been found to promote a healthy and pleasant mind, triggering the production of chemical messengers that travel from the nervous system to the immune system, thereby enhancing the overall health of both body and mind. This process involves infusing maximum oxygen into the cells, facilitating the release of neuropeptides that regulate abnormal brain wave patterns in individuals with neural disorders. The increased oxygen supply also aids in the release of burdensome emotions, ultimately seeking to de stress the mind and alleviate ailments through this mind-body intervention. These interventions when practiced regularly has been observed to relieve stress, that cause decreased secretion of adrenocorticotropic hormone (ACTH) and cortisol. As a result, the secretion of aldosterone, a potent vasoconstrictor is reduced. This reduction in aldosterone secretion contributes to a decrease in blood pressure. [11,12]

Yogic practices have been found to restore normal baroreceptor activity also relieve stress-induced sympathetic hyperactivity in patients with essential hypertension (EH). They also influence the secretion of hormones such as renin, angiotensin, adrenaline and vasopressin, which play key roles in blood pressure regulation.[13]

SKY has been observed to decrease oxidative stress by reducing malondialdehyde adducts (MDA), serum urea and free radicals, while simultaneously increasing levels of SOD, catalase, and glutathione peroxidase. These findings suggest that SKY may contribute to improved cardiovascular and renal functions by mitigating oxidative stress and enhancing antioxidant defenses. [14]

Yogic practices exert a dual effect: they inhibit sympathetic nervous system activity and reduce stress, there by playing a beneficial role in stress-related diseases and decreasing blood glucose levels. [15]

The combination of stretching exercises, asanas, and controlled breathing in SKY enhances circulation and oxygen supply to vital organs while releasing excess Co2, promoting relaxation and relieving tension. Guided meditation during SKY reduces stress perception, anxiety, and oxidative stress, contributing to overall well-being. Reduction in serum lactate levels post-SKY practices suggest induction of a relaxation state. [16]

EEG study during meditation showed decreased beta/alfa power while increased alfa/delta power which is suggestive of highly focused, concentrated and calm alert state of mind. [17]

The findings of present study align with previous studies, such as Sharma et al systematic review, which demonstrated significant decreases in anxiety scores with yoga practice. [18] Similarly Gaba et al found significant reductions in anxiety levels among healthy individuals after SKY intervention. [3]

It has been found effective to cure as well as prevention of human physical and physiological diseases by regular practices of yogic exercises. Yoga improves pattern of sleep, enhance over all wellbeing and quality of life of individuals. [19]

Furthermore, research by Vishwanathan V et al demonstrated that SKY significantly improved physical and psychosocial domains and overall quality of life in diabetic patients after a 3-month duration. Overall, the results suggest that SKY practices are safe, cost-effective, and free of unwanted side effects, making them valuable tools for managing hypertension and diabetes. [20]

Conclusion

Sudarshan Kriya Yoga have been found to decrease blood pressure, pulse rate, hamilton anxiety and quality of life score in the study participants. They establish balance between the activity of parasympathetic and sympathetic nervous system. While further controlled clinical trials are necessary to establish the benefits of comprehensive intervention programs like SKY in the prevention of emergence of diabetes mellitus. Current evidence suggests their potential as a low-risk adjunct for managing diabetes mellitus, stress-related conditions as well as improving overall well-being.

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