



IJAYUSH
International Journal of AYUSH
AYURVEDA, YOGA, UNANI, SIDDHA AND HOMEOPATHY
<http://internationaljournal.org.in/journal/index.php/ijayush/>

International Journal
Panacea
Research library
ISSN: 2349 7025

Review Article

Volume 10 Issue 04

July – August 2021

IMPACT OF YOGA IN PREVENTION AND MANAGEMENT OF DIABETES MELLITUS

Bhavika Joshi

Lakulish Yoga University, Ahmedabad Gujarat

Email Id: bjoshi.mobile@gmail.com,

Abstract: -

Yoga is a mind body medicine, which is originated in India before 5000 years. Yogic practice is means of balancing and harmonizing mind, body as well as emotions. In Morden society, there are various types of lifestyle diseases. Yogic practices are useful for the management of these types of disease particularly diabetes also. By doing yogic practice one can maintain glycaemic control and reduces the risk of complications of diabetes. In this review paper, I briefly describe the impact of yoga practice in prevention as well as management of Diabetes Mellitus based on various studies.

Key Words: - Yoga, Yogic Practice, Diabetes Mellitus

Introduction: -

Diabetes is a lifestyle related condition due to in an imbalance in handling a glucose, it is not disease.¹This is condition in which glucose level in the blood are much higher than normal and hence this condition is commonly known as sugar disease. The imbalance in this condition is that either pancreas does not produce insulin properly or the cells of the body are unable to use insulin properly.²

Diabetes mellitus is highly prevalent chronic disease affecting more than 311 million people worldwide.³ In the united states 90 to 95 percent of the population are classified as Diabetes Mellitus ⁴ , because of doubling of prevalence rate from 1990 to 2005 Diabetes Mellitus has been categorized as an epidemic by united states centres of disease control and prevention. Diabetes Mellitus is strongly associated with obesity and fat distribution. It is expected that Diabetes Mellitus will remain substernal with public health burden with global rates exceeding 470 million by 2030.⁵

Yoga is an old Indianscience and way of life. In later a long time the practice of yoga has gotten to be prevalent since it advances positive wellbeing and is additionally valuable within the anticipation and treatment of disease. Yoga has distinctive aliments to decrease wellbeing issues at each level asanas unwind and tone our muscle and knead our inside organs,⁶ pranayama regulates our breathing and stream of pranic vitality and Mediation calm our intellect. ⁷ The distinctive sorts of yoga practice expand each other and are more compelling when do together. When we do the asanas and stretch our muscles, solid pressure is released, and we are ready to unwind effortlessly.

There are two main types of diabetes like type 1 and type 2 Diabetes.Both types of Diabetes are chronic diseases that affect the way our body regulates blood sugar, or glucose. Glucose is the fuel that feeds our body's cells, but to enter our cells it needs a key. Insulin is that key.People with type 1 diabetes do not produce insulin. We can think of it as not having a key.⁸ People with type 2 diabetes do not respond to insulin as well as they should and later in the disease often do not make enough insulin. We can think of it as having a broken key.Both types of diabetes can lead to chronically high blood sugar levels.⁹ That increases

the risk of diabetes complications. If the person has type 1 diabetes, pancreas produce very little, if any insulin. Type 1 Diabetes is also called insulin dependent diabetes mellitus (IDDM)¹⁰. If the person has type 2 Diabetes, pancreas insulin but it is either not enough or the cells of body are unable to use it properly. It is also called Non-insulin Dependent Diabetes Mellitus (NIDDM)¹¹.

Pathophysiology of Diabetes Mellitus: -

According to pathophysiology of the diabetes, a malfunctioning of the feedback loops between insulin action and insulin secretion results in abnormally high glucose levels in blood. In the case of β -cell dysfunction, insulin secretion is reduced, limiting the body's capacity to maintain physiological glucose levels. On the other hand, insulin resistance contributes to increased glucose production in the liver and decreased glucose uptake both in the muscle, liver, and adipose tissue. Even if both processes take place early in the pathogenesis and contribute to the development of the disease, β -cell dysfunction is usually more severe than insulin resistance. However, when both β -cell dysfunction and insulin resistance are present, hyperglycaemia is amplified leading to the progression of type 2 diabetes.¹²

EVIDENCE BASED YOGIC PRACTICE FOR PREVENTION & MANAGEMENT OF DIABETES MELLITUS: -

Yoga practice is a intricate intervention with various constituents, including cleansing processes (kriya), Yoga Postures (asana), Breathing technique (pranayama), Meditation, relaxation, Chanting mantras, Yogic diet, Code of conduct, Philosophy, and Spirituality. There are many yoga practices have been found beneficial in diabetes mellitus. I am discussing the different type of yoga practices and beneficial effects of these practices in table 1.

Yogic technique	Approximate duration and remarks	Effect Of Yogic Technique
Cleansing practices: Shuddhi kriya		
Kapalbhati (frontal brain purification)breathing technique with forceful exhalations and automatic inhalations ¹³	5 round 1 min	Abdominal pressure created during exhalation improves the efficiency of β -cells of the pancreas, helps in the production of insulin and controlling glucose levels in the blood. ¹⁴
Agnisar kriya (stimulating the digestive fire)¹⁵	5 rounds	The 'vacuum' effect of this action massages the internal organs and increase blood flow to the area, Boostmetabolism and facilitates proper functioning of the abdominal organs. ¹⁶
Vaman dhauti (stomach cleansing)¹⁷	Once a week	Increases glucose uptake, minimizes insulin resistance, and promotes the function of insulin by reducing levels of circulating free fatty acids in the body. ¹⁸ Marked reduction in fasting and post-prandial blood sugar levels.
Full Shankhaprakshalana (intestine cleansing)¹⁹	Once a year	Significantly reduces blood glucose levels, Increases insulin production ²⁰
Laghu shankhaprakshalana (short cleansing)²¹	Every 40 days	Tendency to improve bowel's health. ²²
Preparatory practices/warming up	5–10 minutes	Helps in burning out fat that reduce the obesity ²³
Surya namaskar²⁴	Slow speed, 3–7 rounds according.	Stimulates insulin production through brain signalling. ²⁵ Significantly decreases hip

	to an individual's capacity	circumference, exerting beneficial effects on glycaemic outcomes ²⁶
Yoga postures: asanas		<p>Rejuvenates of pancreatic cells through the alternating abdominal contractions and relaxations involved in yoga practice.</p> <p>Improves blood supply to muscles.</p> <p>Enhances insulin receptor expression in the muscles, causing increased glucose uptake by muscles.²⁷</p> <p>Has positive effects on glucose utilization and fat redistribution in type 2 diabetes.²⁸</p>
Standing postures		
Trikonasan (triangle pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute	Help to shedding extra fat from the various parts of the body like stomach, hips, thighs, and waist. ²⁹
Seated poses		
Vakrasan (spinal twist)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute	It stimulates the pancreas and controls the enlargement of liver. ³⁰
Ardhamatsyendrasan (seated spinal twist)		Squeeze the intestines to prevent stagnation of colonic contents. ³¹

Mandukasan (frog pose)		It creates pressure on the pancreas and improves the function of all organs. ³²
Ushtrasan (camel pose)		Exerts stimulating and energizing effects. ³³
Paschimottanasan (seated forward bend)		It helps energizes the nervous system and stimulates abdominal organs. ³⁴
Yoga mudra (forward bend)		Massages and pressurizes the pancreas, stimulating insulin secretion. ³⁵
Prone poses		
Bhujangasan (cobra pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute	It is useful in strengthening the spine and improved abdominal function, so supporting digestion. ³⁶
Dhanurasan (bow pose)		It is useful for abdominal muscles' strength and it is work as stress & fatigue buster. ³⁷
Makarasan (crocodile pose)	Relaxation pose: 2–5 minutes as needed.	
Supine poses		
Pavanmuktasan (wind releasing pose)	Recommended to hold the final pose for 15 seconds, gradually increasing the duration up to 1 minute	It relives excess gas from the abdomen, it also relives constipation thus improve digestion. ³⁸
SuptaVajrasana (supine)		It relives the constipation and

thunderbolt pose)		improve digestion. ³⁹
Setubandhasan (bridge pose)		It is useful in alleviate stress.stimulates lungs,thyroid gland and abdominal organs. ⁴⁰
Matsyasan (fish pose)		It stretches organs of belly and throat, relives stress. ⁴¹
Shavasan (corpse pose)	Relaxation pose: 2–5 minutes as needed	It takes the body in to deep meditative state,letting it relax and rejuvenate. ⁴²
Inversions		
Sarvangasan (shoulder stand)	Hold the final pose for 15 seconds, Graduallyincreasing the duration up to 1 minute	Improve blood circulation. ⁴³
Halasan (plough pose)		
Regulated breathing practices: Pranayama		Improves components of health-related fitness, i.e., cardiorespiratory endurance, flexibility, and body fat percentage ⁴⁴
Anulomvilom (alternate nostril breathing)	5–10 minutes	Augment cerebral blood flow and oxygenation, improving neuronal activities in the brain centres, including those present in the limbic areas, hypothalamus, and medulla, and improve sympathovagal outflow. ⁴⁵
Chandra bhedan (left nostril breathing)	5 minutes	Parasympathetic stimulation

Surya bhedan (right nostril breathing)	5 minutes	Sympathetic stimulating effect; may be recommended in people with diabetes. ⁴⁶
Bhastrika (bellows breath)	3–5 minutes	help in regulation of pinal, pituitary and adrenal gland which is useful in metabolism.
Bhramari (humming bee breath)	5 rounds	Soothing and calming effect on the mind, improves mental and physical health. ⁴⁷
Sheetali/Sitkari (cooling breath)	3–5 minutes	Lowers blood pressure, cooling effect. ⁴⁸
Lock: bandha		Re-directs the flow of blood and lymph to other body parts.
Uddiyan bandha (abdominal lock)	5 rounds	Negative pressure created in the abdominal cavity may improve pancreatic function. ⁴⁹
Aum Chanting	5 minutes	Stabilizes the brain, removes negative thoughts, increases energy, improves mind and body relaxation within minutes of practice. ⁵⁰ Chanting in the supine posture produces an integrated relaxation response. ⁵¹
Yogic relaxation: Yoga Nidra	30 minutes	Improved symptom score, reduction of fasting blood glucose and postprandial blood glucose levels. ⁵²

Most studies have evaluated the effects of yoga practices such as Yoga postures, pranayama, relaxation, and meditation. Above, information is presented regarding a subset of yoga practices that are known to have beneficial effects on diabetes mellitus along with their possible mechanisms of action (Table 1).

Cleansing Process: -

The classical antiquated texts Hatha Yoga Pradipika and Gheranda Samhita describe purification/cleansing practice known as Shatkarmas. Of these, the practice of Vaman dhauti (stomach cleansing with initiated heaving), Kapalbhathi (frontal brain decontamination, which may be a breathing procedure with powerful exhalations and automatic inhalations), and Shankhaprakshalana (intestinal cleansing) offer assistance to extend the generation of affront and to control blood glucose levels. Standard inner cleansing upgrades the functional capacity of the organs.

A studied appeared that Vaman dhauti practice (emetic treatment) caused a marked decrease in fasting and postprandial blood sugar levels.⁵³ It is accepted to extend glucose take-up, minimize affront resistance, and advance the work of affront by lessening levels of circulating free greasy acids within the body. The stomach weight made amid exhalation in Kapalbhathi progresses the efficiency of β -cells of the pancreas. Shankhaprakshalana is the method of cleansing the intestinal tract by practicing a set of yoga pose and drinking lukewarm water with salt in between. This arrangement is rehashed till as it will water is cleared. The level of blood glucose falls essentially with this intestinal cleansing handle. It has been claimed that this practice increments affront generation and makes a difference within the control of diabetes.⁵⁴ Aganisar kriya (incitement of the stomach related fire) includes pulling the guts in (Uddiyan bandha) and snapping it in reverse and advances whereas holding the breath.⁵⁵

Surya Namaskar: -

Surya namaskar includes a arrangement of energetic yoga poses performed in a particular grouping. A brisk Surya Namaskar performed in an enthusiastic way increments cellular prerequisites for oxygen and glucose. To meet these prerequisites, affront generation is invigorated through brain flagging.

In a study, a yoga mediation comprising of 25 minutes of Surya Namaskar together with other yoga poses and a profound unwinding procedure in perimenopausal ladies come

about in a critical diminish in diastolic blood weight and hip circumference, and advantageous impacts on glycaemic results.⁵⁶

Asanas: -

Asanas involve stretching or twisting movements and relaxation. Asanas is performing with two main key stability & comfort. Seated Yoga pose such as Adrdhmatsyendrasana, YogaMudra & Mandukasana improve Pancreatic functions. Forward bending yoga asanas massage & pressurize the pancreas and stimulate the secretion of insulin. Twisting yoga asanas like Vakrasana & Ardhmatsyendrasana squeeze the intestine and massage them to prevent the stagnation of colonic contents. A study showed that yoga asanas had positive impact on glucose utilization & fat redistribution in person with type 2 diabetes. In a study it was observed that optimum control of diabetes was achieved by practicing Dhanurasana and Ardhamtsyendrasana, Halasana, Vajrasana, Bhujangasana and Naukasana were also found to be effective.⁵⁷ However Yogamudra & shalabhasana worsened in diabetes, reasons are not clearly understood.⁵⁸

Pranayama: -

Pranayama is controlled or regulated yogic practice. The slow breathing technique in pranayama causes comprehensive changes in body's physiology by controlling the autonomic nervous system.⁵⁹ It regulates the rate and pattern of breathing as well as regulate the heart rate and its variability. Slow pranayama like Anulom Vilom, Suryabhedan, Sitakari and Bharmari augment cerebral blood flow and oxygenation, so improving the neuronal activities of the brain centres including those present in the limbic areas, hypothalamus and medulla as well as improving sympathovagal outflow.⁶⁰ Anulom Vilom Pranayama has been shown to yield significant improvements in components of health related fitness (ie, cardiorespiratory, endurance, flexibility and percentage of body fat).¹⁶ The vibrations created in Bharmari Pranayama have a soothing and calming effect on the mind and could play a vital role in improving mental and physical health.⁶¹ Bhastrika Pranayama is a powerful and energetic Pranayama referred to as the breath of fire it helps

in regulation of the pineal, Pitutary and adrenal glands which play an important role in the regulation of metabolism. ⁶²

Bandha: -

Bandha refers to a hold, tightening or lock. It constricts a certain part of the body and redirects the flow of body and lymph to the other parts. Asanas and pranayama may be combined with bandhas. Uddiyan bandha which involves creating negative pressure in the abdomen and contracting the abdominal area may have a therapeutic effect in management of diabetes. It is believed that the negative pressure created in the abdominal cavity may improve pancreatic function. ⁶³

Aum chanting: -

Scientific analysis has shown that chanting Aum is based on the physics of sound, vibrations and resonance and has a positive influence on health. Aum mantra chanting results in stabilization of the brain, removal of negative thoughts, and increase of energy and mental improvements and relaxation of the body take place within minutes of practice. Pranava pranayama in the supine posture produces an integrated relaxation response, which may have clinical significance in the management of hypertension and diabetes. ⁶⁴

Yogic relaxation or Yoga Nidra(Yogic Sleep): -

Yoga Nidra is a dynamic sleep. It is comprehensive, profound relaxation technique for removing physical, mental and emotional tension. Yoga Nidra practice in middle age diabetes patient on oral medications led to improved symptom scores and reduction of fasting blood glucose and post prandial blood glucose levels. ⁶⁵

Literature Review: -

S R Thangasami, A Lal Chandani, S Thangasami (2015) investigated in their study Exercise can improve glucose uptake by improving insulin sensitivity and reducing body adiposity in both patients of type 1 and type 2 DM. Yoga is an ancient discipline designed to bring balance and health to the physical, mental, emotional, and spiritual dimensions of the

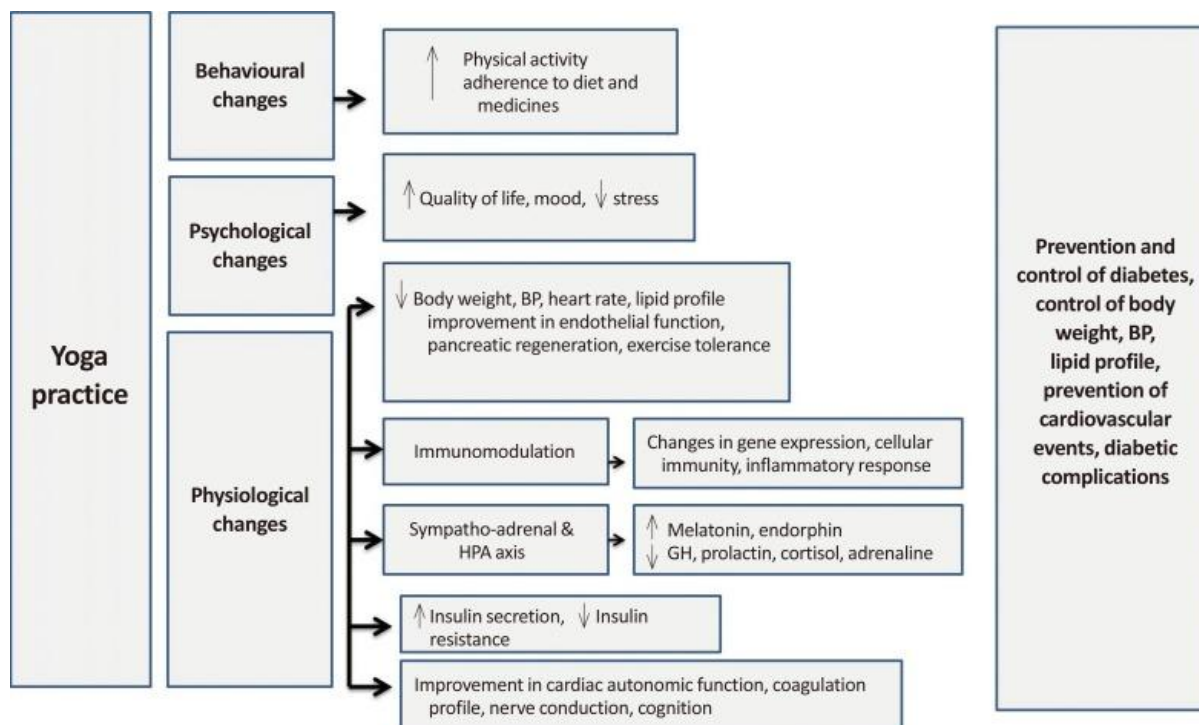
individual. Yoga may be an attractive alternate to traditional aerobic exercises and strength training program, as it requires only a little space and needs no equipment and literally devoid of side effects, mainly focusing on relaxation of mind and body. It provides a less strenuous and more pleasurable exercise experience to an individual. Yoga can help the person feel better, both improving the physical fitness and elevating the mood. Numerous studies have shown positive benefits of yoga in the management of diabetes with good impact on glycemic control, lipid profile and cardiovascular status. Further it can alleviate stress. Yoga can be considered as a good alternate for exercise therapy.⁶⁶

Dr.A Shrma, Dr.M Shrma, Dr.R Shrma, Dr.P D Meena (2015) was studied the effect of Yogasanas on fasting blood glucose, post prandial blood glucose and glycosylated haemoglobin level in patients of type 2 diabetes. The results of the study suggested that yogasans have a beneficial effect on glycaemia control in Type- 2 diabetes and decrease the dosage of oral hypoglycaemic drugs.⁶⁷

A V Raveendran, A Deshpande and S R Joshi, review in this study yoga a means of balancing and harmonizing the body, mind, and emotions. Yoga practice is useful in the management of various lifestyle diseases, including type 2 diabetes. Psycho-neuro-endocrine and immune mechanisms are involved in the beneficial effects of yoga on diabetes. Incorporation of yoga practice in daily life helps to attain glycaemic control and reduces the risk of complications in people with diabetes. ⁶⁸

M Sharma, A Knowlden (2012), reviewed in this article the yoga practice is useful as preventing and controlling type 2 Diabetes Mellitus. Yoga has been complementary and alternative treatment for type 2 Diabetes.⁶⁹

S Prajapati, G Vyas, G Vyas(2017), reviewed in their article that Yoga Practice for the prevention and management of Diabetes Mellitus. Study revealed that optimum control of Diabetes Mellitus was achieved by practicing Pranayama, Suryanamaskar, Tadasana, Konasana, Padmasana, Paschimatanasana, Ardhamatsyendrasana, Pawanmuktasana, Shavasana and Ashtanga yoga program. ⁷⁰

Healing mechanism of Yogic practice: -

The exact mechanisms underlying the apparent beneficial effects of yogic intervention on diabetes risk profiles are not yet well understood. The possible mechanisms are as follows,

Yoga is based on that the mind and body are interconnected. Yoga practice improves flexibility, muscle strength, blood circulation and oxygen uptake.

Yoga practice exhibits many health benefits such as improving physical fitness, relaxation and awareness of self. various life style disorder including diabetes mellitus can be prevented as well as managed through the appropriate yoga practice.

Various yogic intervention 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.⁷¹

Muscular relaxation, development, and improved blood supply to muscles might enhance insulin receptor expression on muscles causing increased glucose uptake by muscles and thus reducing blood sugar.⁷²

Regular Yoga Practice can help to focus the mind and create the right mental approach to dealing with diabetes.⁷³

Yogic intervention effect, changes in biochemical and hormonal profile, elimination of stress, and instilling a sense of discipline. These changes suggest improvement in the insulin sensitivity.

Conclusion: -

Yoga Therapy is relevant for holistic health of the person. The scientific evidence suggests the potential role of yogic practice in diabetes mellitus. It is suggested that psycho neuro endocrine and psycho neuro immune mechanisms have beneficial effects in diabetes mellitus management. These types of practices are also useful for preventive care in diabetes mellitus. Yoga practices such as cleansing processes, Yoga poses, Pranayama, Bandhas, meditation, relaxation are known to reduce the blood glucose level and help to manage the disease conditions associated with diabetes mellitus. Therefore, regular practice of yoga may prevent and control or manage the status of diabetes mellitus and produce the optimum healthy population.

References: -

1. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore; 2016,P 01-08
2. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore; 2016,P 01-08
3. World Health Organization, Diabetes.
<http://www.who.int/mediacentre/factsheets/fs312/en/>. Accessed December 20, 2011.

4. American Diabetes Association . Diabetes statistics.
<http://www.diabetes.org/diabetes-basics/diabetes-statistics/>. Accessed December 20, 2011
5. Hu, FB . Globalization of diabetes. Diabetes Care. 2011;34:1249–1257.
6. Dr .S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:30-53
7. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore,2016,Pg:30-53
8. Gupta T., Jain. S.C., Sharma R.P. and Manuvaryaji, S. Effects of Yogic practices on glucose tolerance and serum lipids in diabetes (abstract), Indian J. Physiol. Pharmacol. 1979; 23 (suppl. I), 45
9. Gharote M.L. . Yoga and Adaption,Applied Yoga,Kaivalyadham S.M.Y.M. Samiti-Lonavala ;1stED. 1990,Pg: 43-50.
10. Ozougwu, K Obimba:The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus,Journal of physiology and pathophysiology,2013,Vol4(4).
11. Ozougwu, K Obimba;The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus,Journal of physiology and pathophysiology, 2013,Vol4(4).
12. Garcia, A Vicenta, S Jaber; Pathophysiology of diabetes mellitus,International journal of molecular science,2015, 21(17).
13. B Raja,SPreetha,JPriya;Effect of Kapalabhati Pranayama in the blood sugar level in diabetic patients,Drug Invention today, 2018,Vol(10)11
14. R M Ansari; Kapalabhati pranayama: An answer to modern day polycystic ovarian syndrome and coexisting metabolic syndrome?,International journal of yoga, 2016, Vol9(2).
15. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:75-78

16. V Malhotra,S Singh, OP Tandon, SB Sharma; The beneficial effect of yoga in diabetes. Nepal Med Coll J, 2005,145–147
17. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:75-78
18. S Patra, Physiological effect of kriyas: Cleansing techniques,International Journal of yoga,phyloshophy,psycology and parapsycology,2007 vol 5(1).
19. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:75-78
20. Shaline, D Mishra, K Kamal, AK Gupta,KK Sharma; Shankhaprakshalana: a yogic karma for purification, Int J Ayurvedic Herb Med, 2012, vol 2
21. G Grag,GMangal,N S chundawat;A COMPARATIVE STUDY OF YOGIC KARMA (SHANKHA-PRAKSHALANA & ASANA) AND SPICO-KALP IN THE MANAGEMENT OF MADHUMEHA (D.M. TYPE2),international ayurvedic medical jopurnal, 2016, Vol 4(5)
22. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:75-78
23. Dr.S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:75-78
24. M Nikam;A role of Suryanamaskar for good health,Aayushi International Interdisciplinary Research Journal, 2020, Vol VII(II).
25. M Nikam; A role of Suryanamaskar for good health,Aayushi International Interdisciplinary Research Journal,2020,Vol VII(II).
26. M Nikam; A role of Suryanamaskar for good health,Aayushi International Interdisciplinary Research Journal,2020, Vol VII(II).
27. V Malhotra,SSingh,OPTandon,SB Sharma; The beneficial effect of yoga in diabetes. Nepal Med Coll J., 2005, Vol 7

28. V Malhotra,SSingh,OPTandon,SB Sharma; The beneficial effect of yoga in diabetes. Nepal Med Coll J.2005, Vol 7
29. A Bhavanai(2018):psychophysiology of yoga posture:Ancient and modern perspectives of asanas,AMDCT Book series
30. A Bhavanai; :psychophysiology of yoga posture:Ancient and modern perspectives of asanas,AMDCT Book series, 2018
31. A Bhavanai, :psychophysiology of yoga posture:Ancient and modern perspectives of asanas,AMDCT Book series, 2018
32. A Bhavanai; psychophysiology of yoga posture:Ancient and modern perspectives of asanas,AMDCT Book series, 2018
33. Dr. S S Srikant, R Nagarathna, H R Nagendra;Yoga for diabetes,Swami Vivekananda Yoga Prakashana,Banglore 2016,Pg:123
34. Dr. S Patel,Dr.M D Bamnikar; Relevance of yoga through paschimottanasana on type 2 diabetes mellitus - A literature review, world journal of pharmacological research, 2018, vol 7(6).
35. P Rani, S Sahu, J Yadav, Integrated approach for diabetes through life style modifications and yoga: A critical review, An international journal of ayush and allied system, 2020, Vol 7(6).
36. P Rani, S Sahu,J Yadav; Integrated approach for diabetes through life style modifications and Yoga: A critical review, An international journal of ayush and allied system,2020, Vol 7(6).
37. K kumar; A Study on the Effect of Yogic intervention on serum glucose level on Diabetics,International journal of yoga and allied science, 2012
38. Dr.Sydv, Dr.N Jain; Yoga And Diabetes Mellitus: Recommendations And Benefits-Systematic Review,International Journal of Ayurvedic and herbal Medicine,2017,Vol 7(4).

39. Dr. Sydadv, Dr.NJain;Yoga And Diabetes Mellitus: Recommendations And Benefits- Systematic Review,International Journal of Ayurvedic and herbal Medicien, 2017, Vol 7(4).
40. Dr. Sydadv, Dr.N Jain(2017):Yoga And Diabetes Mellitus: Recommendations And Benefits- Systematic Review,International Journal of Ayurvedic and herbal Medicien,2017,Vol 7(4).
41. Dr. Sydadv, Dr.N Jain(2017):Yoga And Diabetes Mellitus: Recommendations And Benefits- Systematic Review,International Journal of Ayurvedic and herbal Medicien,2017, Vol 7(4).
42. Swami Shivapremananda. Step by step Yoga for Stress Relief.2003.New Delhi: New Age Books. Pg 72
43. Swami Shivapremananda. Step by step Yoga for Stress Relief.2003.New Delhi: New Age Books. Pg 72
44. Swami Akshaya Atmanand. Yoga and Yogasan.2001.New Delhi: Pratibha Pratishtan. Pg 137.
45. P A Balaji; Physiological Effects of Yogic Practices and Transcendental Meditation in Health and Disease,Northamerican journal of medical scienece,2012, Vol 4(10)
46. Bal BS. Effects of short term practice of Anuloma Viloma Pranayama on components of health-related fitness. EducPracInnov. 2015;2:10–18.
47. Srivastava S, Goyal P, Tiwari SK, Patel AK. Interventional effect of Bhramari Pranayama on mental health among college students. Int J Ind Psychol. 2017;4:29–33.
48. Singh RB, Wilczynska-Kwiatek A, Fedacko J, Pella D, De Meester F. Pranayama: the power of breath. Int J Disabil Hum Dev. 2009;8:141–153
49. S Kudigra, NS Akanksha; Effect of yoga therapy on fasting blood sugar and to study the distribution of anthropometric measures in type-2 diabetes, International Journal of Complementary & Alternative Medicine2018; 11(1),Pg:44-47

50. Gurjar AA, Ladhake SA, Thakare AP. Analysis of acoustic of “OM” chant to study it's effect on nervous system. *Int J Comput Sci NetwSecur*. 2009; Pg:363–367
51. Bhavanani AB, Madanmohan, Sanjay Z, Vithiyalakshmi SL. Immediate cardiovascular effects of pranava relaxation in patients with hypertension and diabetes. *Biomed Hum Kinet*. 2012;4:66–69.
52. Amita S, Prabhakar S, Manoj I, Harminder S, Pavan T. Effect of yoga-nidra on blood glucose level in diabetic patients. *Indian J PhysiolPharmacol*. 2009;53:97–101
53. Jindal N, Joshi NP. Comparative study of Vamana and Virechanakarma in controlling blood sugar levels in diabetes mellitus. *Ayu*. 2013;34:263–269.)
54. Shalinee, Mishra D, Kamal K, Gupta AK, Sharma KK. Shankhaprakshalana: a yogic karma for purification. *Int J Ayurvedic Herb Med*. 2012;2:578–581
55. Skoro-Kondza L, Tai SS, Gadelrab R, Drincevic D, Greenhalgh T. Community based yoga classes for type 2 diabetes: an exploratory randomised controlled trial. *BMC Health Serv Res*. 2009;9:33.
56. Sreedevi A, Gopalakrishnan UA, KarimasseryRamaiyer S, Kamalamma L. A randomized controlled trial of the effect of yoga and peer support on glycaemic outcomes in women with type 2 diabetes mellitus: a feasibility study. *BMC Complement Altern Med*. 2017;17:100.
57. Malhotra V, Singh S, Tandon OP, Sharma SB. The beneficial effect of yoga in diabetes. *Nepal Med Coll J*. 2005;7:145–147.
58. Madhavi S, Raju PS, Reddy MV, Annapurna N, Sahay BK, Kumari DG, et al. Effect of yogic exercises on lean body mass. *J Assoc Physicians India*. 1985;33:465–466
59. Dr.S S Srikant,RNagendra,H R Nagendra(2016):Yoga for Diabetes,
60. P Grover, VD Varma, D Pershad, SK Verma. Role of yoga in the treatment of psychoneuron's bull. *PGI*. 1998;22(2):68–76.

61. K V Santhi, K Kasturi, G Shivnarayana; Impact of Pranayama and Amla, an approach towards the control of Diabetes mellitus; International Journal of Pharma tech Research; 2014,6(3),Pg:1157-1161.
62. Malhotra V, Singh S, Singh KP, Sharma SB, Madhu SV, Gupta P. Effect of yoga asanas and pranayama in non-insulin dependent diabetes mellitus. Indian J Traditional Knowledge. 2004;3:162-67.
63. Singh S, Singh KP, Tandon OP, Madhu SV; Influence of Pranayamas and yoga-asanas on serum insulin, blood glucose and lipid profile in type 2 diabetes. Indian J Clin Biochem. 2008;23:365-68.
64. S Kudigra, NS Akanksha; Effect of yoga therapy on fasting blood sugar and to study the distribution of anthropometric measures in type-2 diabetes, International Journal of Complementary & Alternative Medicine 2018; 11(1),Pg:44-47
65. S A Ranga, S Agrawal; Study of effect of yoga on blood pressure, blood glucose, and glycosylated haemoglobin levels of patients with Type 2 diabetes mellitus; National Journal of Physiology, Pharmacy & Pharmacology; 2021;11(4)
66. Amita, S Prabhakar; Impact of yoga nidra on blood glucose level in diabetics patient, National library of medicine, 2009, 53(1),97-101.
67. Thangasami SR, Chandani AL, Thangasami S ; Emphasis of Yoga in the Management of Diabetes. J Diabetes Metab 6: 613., 2015,doi:10.4172/2155-6156.1000613
68. Dr. AShrma, Dr. MShrma, Dr. RShrma, Dr. P D Meena ; effect of yogasanas on fasting blood glucose, post prandial blood glucose and glycosylated haemoglobin level in patients of type 2 diabetes International Journal of Medical Science and Education, 2015, vol-2
69. M Sharma, A Knowlden; Role of Yoga in Preventing and Controlling Type 2 Diabetes Mellitus, Sage Journals, 2012, 17(2), Pg:88-95

70. S Prajapati, G Vyas, G Vyas; Yogic Practice for prevention and Management of Diabetes Mellitus- A Systemic Review, A Journal of Microbiology and Virology,2017,7(1),Pg31-35
71. V Malhotra, S Singh, OP Tandon; The Beneficial effect of Yoga in Diabetes, Nepal Med Coll J,2005; 7, Pg:145-147
72. R L Bijlani, RP Vempati, RK Yadav; A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and Diabetes mellitus;J Alt and Complement Med; 2005; 11,Pg:267-274
73. SW Lazar, G Bush, RL Gollub, G Khalsa, H Benson; Functional brain mapping of the relaxation response and meditation neurorep 11; 2000; Pg;1581-1585