

## Surya Namaskar (Sun Salutation): A Path to Good Health

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### Abstract

Surya Namaskar (Sun Salutation) is an ancient and sacred yogic technique of India for expressing gratitude to the Sun. Surya Namaskar is a set of 12 Asanas (postures), It is done preferably in the morning while facing the rising sun. There are numerous health benefits of Surya Namaskar for different system of the body specially musculoskeletal, cardiovascular, gastrointestinal, nervous system, respiratory and endocrinal. The heart, liver, intestine, stomach, chest, throat, legs and backbone are main benefited organs. By practicing Surya Namaskar each and every cell of body get revitalize and regenerated, therefore it is highly recommended by all yoga experts for healthy routine life. The regular practice of Surya Namaskar improves blood circulation throughout the body, maintains health and makes the body disease-free. Regular practice of Surya Namaskar gives strength, flexibility and vitality to the body. Sun Salutation asanas help to burn extra body fat on belly, buttocks and back by modulating endocrinal system. It also helps to regulate menstrual cycles among women and also facilitate an easy childbirth. Apart from these benefits of Surya Namaskar also help to keep the mind stress free, calm and illuminated. Thus, a regular practice of Surya Namaskar is highly recommended to keep the body and mind healthy. Though the Surya Namaskar steps are very scientific and practical science ancient time but still it needs advance modern scientific justification to spread it globally, keeping this thing into the mind the present review has been framed to revalidate sacred steps of Surya Namaskar on the basis of available evidence based studies.

**Keywords:** Surya Namaskar, yogic technique, 12 asana, health benefits, scientific justification

### 1. Introduction

Suryanamaskar is an ancient method yogic method to worship Sun. In Sanskrit literature surya means sun, and the word namaskara means salutation. Therefore, this practice is known as the “Suryanamaskar” or 'salutation to the sun'. This specific Postural and breathing protocols was developed in Indian subcontinent thousands of years ago by a great sage Patanjali and their disciples,[1] They advised all human beings to practice these yogic methods in front of the sun in their daily life for good health, illumination, mental and physical stability.

Surya namaskara is a series of asanas with strict breathing pattern. Its revitalizes each and every cell of the body, gives physical strength, flexibility, and mental calmness. Surya namaskara includes a series of asanas (Specific posture of the body) which are- Pranamasan, hasta utthanasan, padahastasan, ashwasanchalanasan, ashtanaga namasakar, bhujangasan, and parvatasan[2]. While doing each asana a specific mantra should be chanted to worship the sun.

By practicing these asanas the all abdominal organs gets toned, stomach and intestine are stretched and compressed results in complete massage to the organ so that they work perfectly. If these organs are ill then Suryanamaskara re-tuned and revitalize them too. In the movements of surya namaskara, the spinal column is bent and stretched in a specific manner, thus stimulating the blood circulation to whole spinal column and brain and results in healthy and tuned entire nervous systems [3]. By these movements, the whole musculoskeletal system stretched and contracted in a systematic manner provides more strength and flexibility to them. Surya namaskara stimulates the peristaltic movement of the gut, which helps to remove excess gas and constipation [4]. While doing these asanas the perspiration cleanses all the pores of the skin resulting in the glowing, clean complexion of the practitioner which is a sign of good skin health. It increases the myocardial contractility and strength [5,6]. Therefore, the cardiac output is increased [7-9], It helps to eliminate hidden toxins from the body. Microcirculation of the different body organs also increased resulting more oxygenated blood in that area. While doing surya namaskara, the lungs exhale and inhale in specific

periodic manner results improved contractility of respiratory tree and increased vital capacity[10,11] leading to the more stable, revitalized, oxygenated lungs and whole body too. It balances the whole endocrinal system by direct massaging of glands and by increase blood flow [12]. The practitioner can feel extra supercharge of energy in his body after doing it regularly. Surya namaskara gives peace to mind and reduces emotional stress [13-15]. In this way, the practice of surya namaskara can also give us many subtle benefits beyond the physical.

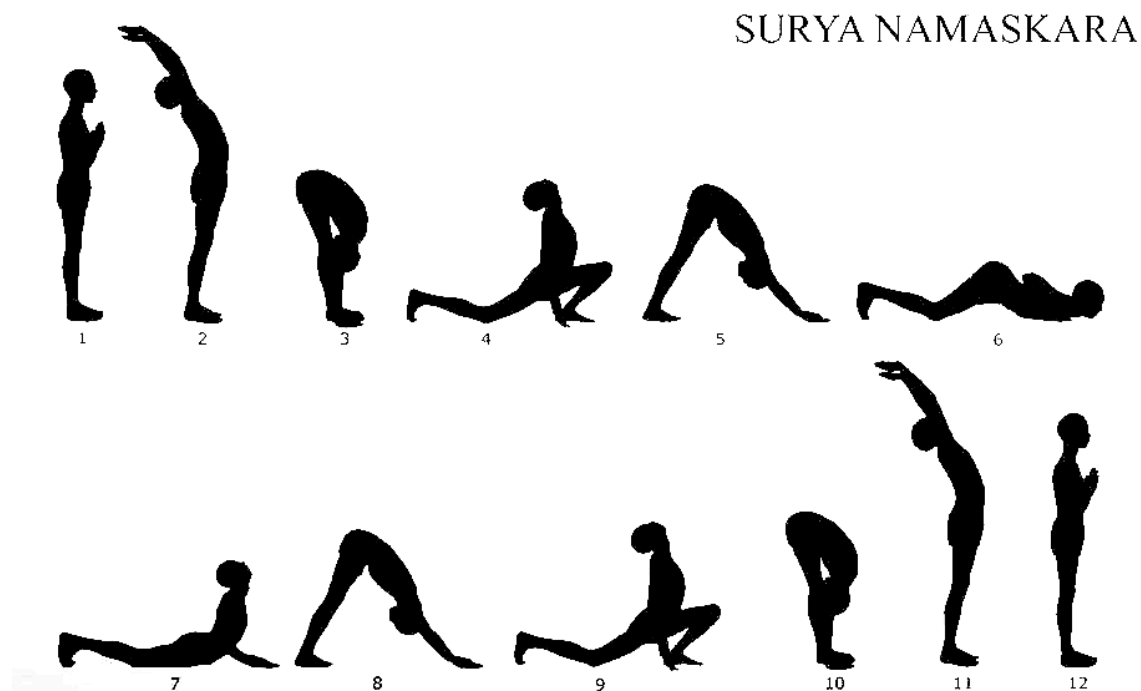
Suryanamaskar is a traditional practice of India specifically but the present world is now more attracted towards it due to its paraphysical benefits. Also due to remarkable side effects of modern medicines prescribed by medical professionals in any diseased condition the scientists now search for safe, natural, alternative and cheap therapeutic measure to replace them. There are very few scientific studies on the effects of suryanamaskar on physiological and psychological parameters. The aim of this present review to analyze steps of suryanamaskar and to establish its effect of on body based on previous studies.

## 2. Asana (Postures) of Surya Namaskar

Surya Namaskar or sun salutation is a traditional Indian yogic practice series of 12 physical postures. These postures encompass periodic forward and backward bending along with deep exhalation and inhalation respectively to the maximum possible extent. The 12 different asanas of Surya Namaskar and their Bija mantra are following [16-20]:

Asana	Chakra Position	Bija Mantra
1. Pranamasana	Anahata (Heart)	ॐ ह्रां (Om Hrām)
2. Hasta Uttanasana	Vishuddhi (Throat)	ॐ ह्रीं (Om Hrīm)
3. Hastapaadasana	Swadhisthana (Sacrum)	ॐ ह्रूं (Om Hrūm)
4. Ashwa Sanchalanasana	Ajna (Third eye)	ॐ ह्रौं (Om Hraim)
5. Adho Mukha Svanasana / Parvatasana	Vishuddhi (Throat)	ॐ ह्राँ (Om Hraum)
6. Ashtanga Namaskara	Manipura (Solar plexus)	ॐ ह्रः (Om Hrah)
7. Bhujangasana	Swadhisthana (Sacrum)	ॐ ह्रां (Om Hrām)
8. Adho Mukha Svanasana/ Parvatasana	Vishuddhi (Throat)	ॐ ह्रीं (Om Hrīm)
9. Ashwa Sanchalanasana	Ajna (Third eye)	ॐ ह्रूं (Om Hrūm)
10. Hastapaadasana	Swadhisthana (Sacrum)	ॐ ह्रौं (Om Hraim)
11. Hasta Uttanasana	Vishuddhi (Throat)	ॐ ह्राँ (Om Hraum)
12. Pranamasana	Anahata (Heart)	ॐ ह्रः (Om Hrah)

Figure 1: Twelve postures of Surya Namaskar [21]



SURYA NAMASKARA

### 2.1 Pranamasana (Prayer pose) – 1<sup>st</sup> & 12<sup>th</sup> Pose

Pranamasana or the Prayer Pose is the starting and twelfth pose for Surya Namaskara. In Sanskrit the word ‘Pranam’ means ‘to pay respect’; so this asana known as Pranamasana.

Method: Stand erect with folded hands close to the chest and palms are held together in the form of prayer pose. Look straight ahead, Exhale the breath normally.

Benefits: It creates a sense of relaxation, calmness and concentration in the mind at beginning the Surya Namaskara.

### 2.2 Hasta Uttanasana (Raised arms pose)- 2<sup>nd</sup> & 11<sup>th</sup> pose

Hasta Uttanasana or the raised arms pose is part of the Surya Namaskara series of asanas come at 2<sup>nd</sup> and the 11<sup>th</sup> steps.

Method: Raise both the hands up above the crown from Pranamasana pose. Inhale the breath normally while raising your hands. Bend the trunk and neck slightly backward.

Benefits: It improves digestive process; It strengthens and tones the abdominal and chest musculature. It supports respiratory system too.

### 2.3 Padahasthasana (Hand to Foot pose)- 3<sup>rd</sup> & 10<sup>th</sup> pose

Padahasthasana or the Hand to Foot pose is part of the Surya Namaskara series of asanas come at 3<sup>rd</sup> and the 10<sup>th</sup> steps.

Method: Bend forward from Hasta Uttanasana pose and try to touch the floor with your both hands. Exhales breathe normally while bending forward.

Benefits: Padahasthasana makes the body flexible and strengthen, helps to decrease excess abdominal fat and very beneficial for the gastrointestinal and nervous system.

### 2.4 Ashwa Sanchalanasana (The Equestrian Pose) – 4<sup>th</sup> & 9<sup>th</sup> pose

Ashwa Sanchalanasana or the Equestrian pose is part of the Surya Namaskara series of asanas come at 4<sup>th</sup> and the 9<sup>th</sup> steps.

Method: Stretch the left leg as far back as possible from Padahasthasana pose while inhaling the breath normally. At the same time, bend the right knee. While looking straight ahead the hands should be kept straight with fingers touching the floor. Arch the back a little with head tilted back. The same steps should be repeated with left knee in the second round of Surya Namaskara.

Benefits: Ashwa Sanchalanasana tones the abdominal organs, It gives flexibility to the body and balances central nervous system.

### 2.5 Parvatasana (The Mountain Pose) – 5<sup>th</sup> & 8<sup>th</sup> pose

Parvatasana or the Mountain pose is part of the Surya Namaskara series of asanas and come at 5<sup>th</sup> and the 8<sup>th</sup> step. In Sanskrit terminology, ‘‘Parvata’’ means mountain and this pose looks like a mountain so it is known as Parvatasana.

Method: While exhaling, take the right leg backward from Ashwa Sanchalanasana pose and place it parallel to the left leg, raise the buttocks at the same time. Place the hands straight supporting the weight of the body. The head should be placed between the hands.

Benefits: Parvatasana strengthens the muscles of both upper and lower limbs, maintains the blood circulation to Central nervous system and tones peripheral nervous system.

### 2.6 Ashtanga Namaskara (Eight-Limbed salutation) – 6<sup>th</sup> pose

Ashtanga Namaskara or the Eight-Limbed salutation is part of the Surya Namaskara series of asanas come at 6<sup>th</sup> step. In this pose, the body touches the ground in eight locations –the head, the chest, the two palms, the two knees, and the two toes. In Sanskrit grammar, ‘‘ashta’’ means eight and ‘‘anga’’ means part. Hence this asana is known as Ashtanga Namaskara.

Method: Lower the body to the ground from Parvatasana pose in such a way that it touches the floor at eight locations – the head, the chest, the two palms, the two knees, and the two toes, Suspended the breath for a while. Try to lift other parts in air.

Benefits: It strengthens the muscles of the both upper and lower limbs and strengthens respiratory system.

### 2.7 Bhujangasana (The Cobra Pose)- 7<sup>th</sup> pose

Bhujangasana is also famous as a cobra pose in yoga. The meaning of ‘Bhujanga’ in Sanskrit means ‘cobra’ snake and ‘Asana’ means ‘Pose’. In this asana person’s head and trunk resembles a cobra with raised hood, hence the name Bhujangasana. It is a major backward bending asanas used in yoga. It appears as the 7<sup>th</sup> pose in the Surya Namaskara series asanas.

Method: While inhaling raise the body by using the hands from Ashtanga Namaskara pose. Arch your head backward. This position looks like the cobra which has raised its hood.

Benefits: Bhujangasana strengthens the whole back musculature especially lower back, It improves the flexibility of the spine and surrounding muscles, good for the gastrointestinal, reproductive and urogenital system.

### 3. Mantra Chanting and Surya Namaskara

A particular mantra is also chanted while we practice Surya Namaskara. The Surya Namaskara or Sun Salutation consists of 12 poses, each is done chanting a particular mantra for the Sun God. The 12 postures and their corresponding mantras are given below [22]:

Posture	Mantra
1 <sup>st</sup>	ॐ मित्राय नमः (Om Mitrāya Namaḥ)
2 <sup>nd</sup>	ॐ रवये नमः (Om Ravaye Namaḥ)
3 <sup>rd</sup>	ॐ सूर्याय नमः (Om Sūryāya Namaḥ)
4 <sup>th</sup>	ॐ भानवे नमः (Om Bhānave Namaḥ)
5 <sup>th</sup>	ॐ खगाय नमः (Om Khagāya Namaḥ)
6 <sup>th</sup>	ॐ पूष्णे नमः (Om Pūṣṇe Namaḥ)
7 <sup>th</sup>	ॐ हिरण्यगर्भाय नमः (Om Hiraṇya Garbhāya Namaḥ)
8 <sup>th</sup>	ॐ मरीचये नमः (Om Marīcaye Namaḥ)
9 <sup>th</sup>	ॐ आदित्याय नमः (Om Ādityāya Namaḥ)
10 <sup>th</sup>	ॐ सवित्रे नमः (Om Savitre Namaḥ)
11 <sup>th</sup>	ॐ अर्काय नमः (Om Arkāya Namaḥ)
12 <sup>th</sup>	ॐ भास्कराय नमः & ॐ श्रीसवितृसूर्यनारायणाय नमः (Om Bhāskarāya Namaḥ & Om Śrīsavitṛsūryānārāyaṇāya Namaḥ)

### 4. General benefits of Surya Namaskara

The practice of surya namaskara as a whole gives a great number of benefits which are following:

1. Suryanamaskar, or Sun Salutations, ideally done facing the early morning sun, helps our body to soak in its benefits — sun rays are a rich source of vitamin D and helps to strengthen our bones and also helps to clear our vision.
2. This asana, apart from improving one's posture, also gives a proper workout to the body and so helps in losing unwanted body flab.
3. Regular practice of this asana can also help you lose the excess body fat.
4. It loosens up the joints in the body and tones the muscles and the internal organs.
5. Surya Namaskara balances the respiratory, circulatory, reproductive and the endocrine system.
6. The posture in Suryanamaskar stretch our muscular system and makes our body very flexible.
7. The moves and postures of the asana help all our internal organs function better the various poses regulates our blood flow, benefits the respiratory, circulatory, reproductive and the endocrine system and makes it more efficient.
8. It helps combat insomnia as it relaxes the body, calms the mind, removes lethargy and makes our mind alert.
9. It helps regulate menstrual cycles and makes childbirth easier.
10. Surya Namaskara activates the Pingala nadi (Surya nadi) which enhances the energy level in the body.

### 5. Physiological effect of Surya Namaskar on body

#### 5.1 Effect on musculoskeletal system

Regular training of Surya Namaskar required four times more energy than the daily requirement, Thus it is a very good fat burner. It's training improves the flexibility of body muscles especially leg, back, chest and buttock muscles [23]. It is found that by practicing Surya Namaskar regularly can significantly increase Hand grip, strength and endurance [24-26].

#### 5.2 Effect on respiratory system

Surya namaskar training significantly increases maximum inspiratory pressure and maximum expiratory pressure [25]. This suggests that its training improves the strength of both expiratory and inspiratory muscles. It also improves the strength of the intercostal muscles ultimately leads to Increase vital capacity and contractility of lungs [26]. It is also found that by regular Surya Namaskar training there is significant change noted in forced vital capacity (FVC), forced expiratory vital volume in 1st second (FEV1), peak expiratory flow rate (PEFR) and Vital capacity (VC) [27,28].

#### 5.3 Effect on cardiovascular system

It reported that yoga practice incorporating Surya Namaskar in daily routine life can improve cardiorespiratory efficiency and fitness. An increase in systolic blood pressure, peak expiratory flow rate, forced vital capacity, and reduction of respiratory rate, heart rate, and diastolic blood pressure also reported in practitioner [29-31]. There are a

number of reports, which show that regular Surya Namaskar practices lead to relative vagal dominance, reduced sympathetic tone, and improved cardiovascular function. [32-35].

#### 5.4 Effect on endocrinal system

Regular practicing Surya Namaskar modulates endocrinal system of the body especially, pancreas, thyroid, adrenals and pituitary glands. The overall effect is very beneficial for Metabolic Syndrome, Obesity, Diabetes Mellitus, Hypothyroidism and menstrual disorders [36].

#### 5.5 Effect on nervous system

Surya Namaskar tunes the central, Peripheral and autonomic Nervous system. This effect is a boon for patients with lower backache, diabetes mellitus, and different neuronal weaknesses [37,38].

#### 5.6 Effect on gastrointestinal system

Regular Surya namaskar practice improves digestion, combat constipation and different gastrological problems [39,40].

#### 5.7 Effect on mind

Many studies have shown that Surya Namaskar exerts positive effects on both the physiological and psychological variables. It's different postural, breathing and chanting pattern produces calm, relax, more stable and stress free mind [41,42].

#### 5.8 Effect on different biochemical parameters

Surya Namaskar significantly decreases in fasting blood sugar, postprandial blood sugar and Glycosylated haemoglobin HbA1c level in diabetic patients.[43]. The Autonomic nervous system generally involved in diabetic patients but by practicing Surya Namaskar, a positive impact also noted on autonomic function of the body. Its regular practice of significantly decreases the oxidative stress of the body which plays a key role in insulin resistance [44] and complication in diabetes patients [45]. It also improves the lipid profile in diabetic patients which plays a supportive role in its complications. This results in the reduction of weight, BMI and waist-hip ratio. [46,47].

## 6. Conclusion

Surya Namaskar is a common sequence of asanas. Its roots are hidden within the ancient tradition of Surya worshiping Hindu population of the Indian subcontinent. Surya Namaskara comprehensively includes asana, pranayama, mantra and meditative awareness. Different evidence-based study suggested that Surya namaskar improves metabolic function, strengthen and flexible musculoskeletal system, balances endocrinal system, tunes central nervous system, supports urogenital system and boosts gastrointestinal system. Surya Namaskar practice revitalizes body and keeps mind calm, attentive and stress-free. Most of the physiological and psychological effect of Surya Namaskar still unexplored on the scientific ground but thousand years old tradition of these yogic practices explains its immense therapeutic potential. Thus, It should be a need to incorporate Surya Namaskar practices in modern lifestyle for healthy mind and body.

## References

- [1] Bryant The, Edwin F, A. Sūtras of Patañjali: Edition, Translation and Commentary. New York North Point Press ISBN 0865477361. 2009.
- [2] Saraswati S. Suryanamaskar-A technique of solar vitalization. Munger Yoga Publications Trust. 1983.
- [3] Robert B. "Yoga vs. physical therapy vs education for chronic low back pain in predominantly minority populations study protocol for a randomized controlled trial *Trials* 67. 2014; 15.
- [4] Evans S, Lung KC, Seidman LC, Sternlieb B, Zeltzer LK, Tsao JCI. Iyengar yoga for adolescents and young adults with irritable bowel syndrome. *Journal of Pediatric Gastroenterology and Nutrition*. 2014; 59(2):244–53.
- [5] Mody BS. Acute effects of Surya Namaskar on the cardiovascular & metabolic system. *Journal of Bodywork and Movement Therapies*. 2011; 15(3):343–7.
- [6] Bhavanani AB, Udupa K, Madanmohan, Ravindra P. A comparative study of slow and fast suryanamaskar on physiological function. *International Journal of Yoga*. 2011; 4(2):71–6.
- [7] Hagins M, Moore W, Rundle A. Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness? *BMC complementary and alternative medicine*. 2007; 7:40.
- [8] Bhutkar OM, Bhutkar MV, Taware GB, Vinayak D, Doddamani BR. Effect of suryanamaskar practice on cardio-respiratory fitness parameters: A pilot study. *Al Ameen J Med Sci*. 2008; 1(2):126–9.
- [9] Sasi A, Sivapriya D, Thirumeni S. Effects of surya namaskar on cardiovascular and respiratory parameters in school students. *Recent Res Sci Tech*. 2011; 3:19–24.

- [10] Raub JA. Psychophysiological effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. *Journal of alternative and complementary medicine (New York, N.Y.)*. 2002; 8(6):797–812.
- [11] Bhole MV, Karambelkar PV, Gharote ML. Effect of yoga practices on vital capacity. (A preliminary communication). *The Indian Journal of Chest Diseases*. 1970; 12(1):32–5.
- [12] Kaduskar P, Suryanarayana KM. Yoga: An endocrine therapy. *Indian Journal of Endocrinology and Metabolism*. 2015; 19(3):437–8.
- [13] Smith J, Jackson L. Breathing exercises and relaxation states. In: Smith J, editor. *Advances in ABC Relaxation - Application and Inventories*. New York: Springer Publication; 2001. p. 202-204.
- [14] Smith JC. ABC Relaxation theory and yoga, motivation, and prayer: Relaxation dispositions, beliefs and practice variables. In: Smith J, editor. *Advances in ABC Relaxation - Application and Inventories*. New York: Springer Publication; 2001. p. 197-201.
- [15] Rice S, Cucci III L, Williams J. Practice variables as predictors of stress and relaxation dispositions for yoga and meditation. In: Smith J, editor. *Advances in ABC Relaxation - Application and Inventories*. New York: Springer Publication; 2001. p. 193-6.
- [16] [http://brihaspati.net/downloads/Gheranda\\_Samhita\\_S\\_C\\_Vasu.pdf](http://brihaspati.net/downloads/Gheranda_Samhita_S_C_Vasu.pdf). [Place, publisher, date unknown].
- [17] A, Taylor H. *raisonnée* [sic] of oriental manuscripts, Rev. William Cooke Smith, (year Page 246). 1860.
- [18] A. Simhajī, Bhagavat. *History of Aryan Medical Science*. Macmillan. 1896.
- [19] Sjomani N, Mujumdar Dattatraya, A, India Profusely. *Yoga tradition in Mysore Palace*. [place unknown: publisher unknown]; 1950. 81–7017 p.
- [20] Bhutkar P, Bhutkar M, Taware G, Vinayak D, Doddamani B, J, Mujumdar Dattatraya, A, India Profusely. [place unknown: publisher unknown]; 1950. 126–9 p.
- [21] <http://www.yogaclubnamaste.co.uk>. [place, publisher, date unknown].
- [22] <http://www.geetganga.org/suryanamaskar-mantra>. [place, publisher, date unknown].
- [23] Sinha B, Ray US, Pathak A, Selvamurthy W. Energy cost and cardiorespiratory changes during the practice of Surya Namaskar. *Indian Journal of Physiology and Pharmacology*. 2004; 48(2):184–90.
- [24] Raghuraj P, Telles S. Muscle power, dexterity skill and visual perception in community home girls trained in yoga or sports and in regular school girls. *Indian Journal of Physiology and Pharmacology*. 1997;41(4):409–15
- [25] Madanmohan, Thombre DP, Balakumar B, Nambinarayanan TK, Thakur S, Krishnamurthy N, Chandrabose A. Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Indian Journal of Physiology and pharmacology*. 1992; 36(4):229–33.
- [26] Jatiya L, Udupa K, Bhavanani A, J. Madanmohan, Effect of yoga training on handgrip, respiratory pressures and pulmonary function. *Indian Pharmacol*. 2003; 47:387–92.
- [27] Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. *Indian Journal of Physiology and Pharmacology*. 2001; 45(4):493–6.
- [28] Makwana K, Khirwadkar N, Gupta HC. Effect of short term yoga practice on ventilatory function tests. *Indian Journal of Physiology and Pharmacology*. 1988; 32(3):202–8.
- [29] Bhutkar MP, Bhutkar VM, Taware BG, Doijad V, Doddamani BR. Effect of suryanamaskar practice on cardio-respiratory fitness parameters: A Pilot Study. *Al Ameen J Med Sci* 2008; 1:126-9.
- [30] Chaya MS, Nagendra HR. Long-term effect of yogic practices on diurnal metabolic rates of healthy subjects. *International Journal of Yoga*. 2008;1(1):27–32
- [31] Blank S, J. Physiological responses to iyengar yoga performed by trained practitioners. *Physiol Online*. 2006; 9:7–23.
- [32] Ray US, Mukhopadhyaya S, Purkayastha SS, Asnani V, Tomer OS, Prashad R, Thakur L, Selvamurthy W. Effect of yogic exercises on physical and mental health of young fellowship course trainees. *Indian Journal of Physiology and Pharmacology*. 2001; 45(1):37–53.
- [33] Harinath K, Malhotra AS, Pal K, Prasad R, Kumar R, Kain TC, Rai L, Sawhney RC. Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*. 2004; 10(2):261–8.
- [34] Raju PS, Kumar KA, Reddy SS, Madhavi S, Gnanakumari K, Bhaskaracharyulu C, Reddy MV, Annapurna N, Reddy ME, Girijakumari D. Effect of yoga on exercise tolerance in normal healthy volunteers. *Indian Journal of Physiology and Pharmacology*. 1986; 30(2):121–32.
- [35] Ross A, Thomas S. The health benefits of yoga and exercise: a review of comparison studies. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*. 2010; 16(1):3–12.
- [36] P, Khandelwal B, Namgyal T. Vijay and Sherpa, 'Psycho-neuro-endocrine-immune mechanisms of action of yoga in type II diabetes', *Anc Sci Life*. 2015; 35(1):12–7.

- [37] B. Robert, "Yoga vs. physical therapy vs education for chronic low back pain in predominantly minority populations study protocol for a randomized controlled trial *Trials* 67. 2014; 15.
- [38] Singh S, Malhotra V, Singh KP, Madhu SV, Tandon OP. Role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. *The Journal of the Association of Physicians of India*. 2004; 52:203–6.
- [39] Podzemny Lorenzo, J. Vlasta Pescatori, and Mario Pescatori, 'Management of obstructed defecation', *World Jan* 28; : . 2015; 21(4):1053–60.
- [40] Evans S, Lung KC, Seidman LC, Sternlieb B, Zeltzer LK, Tsao JCI. Iyengar yoga for adolescents and young adults with irritable bowel syndrome. *Journal of Pediatric Gastroenterology and Nutrition*. 2014; 59(2):244–53.
- [41] Buckworth J, Nigg C. Physical activity, exercise, and sedentary behavior in college students. *Journal of American college health: J of ACH*. 2004; 53(1):28–34.
- [42] Godse AS, Shejwal BR, Godse AA. Effects of suryanamaskar on relaxation among college students with high stress in Pune, India. *International Journal of Yoga*. 2015; 8(1):15–21.
- [43] Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. *Evidence-based complementary and alternative medicine: eCAM*. 2007; 4(4):469–86.
- [44] Chaya MS, Ramakrishnan G, Shastry S, Kishore RP, Nagendra H, Nagarathna R, Raj T, Thomas T, Vaz M, Kurpad AV. Insulin sensitivity and cardiac autonomic function in young male practitioners of yoga. *The National Medical Journal of India*. 2008; 21(5):217–21.
- [45] Bijlani RL, Vempati RP, Yadav RK, Ray RB, Gupta V, Sharma R, Mehta N, Mahapatra SC. A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*. 2005; 11(2):267–74.
- [46] Malhotra V, Singh S, Tandon OP, Sharma SB. The beneficial effect of yoga in diabetes. *Nepal Medical College Journal* 2005;7(2):145–7.
- [47] Yang K. A review of yoga programs for four leading risk factors of chronic diseases. *Evidence-based complementary and Alternative Medicine: eCAM*. 2007; 4(4):487–91.