



Impact of Suryanamaskar Training on Cardiovascular, Respiratory, and Cognitive Functions among Medical Students

Satyanath Reddy Kodidala^{1*}, Priyaka Singh Raj Hans², Jitender Sorout³, Harsha Soni⁴

¹ Associate Professor, JJM Medical college, Davanagere, Karnataka, India

² Assistant Professor, GS Medical College and Hospital, Pilakhuwa, Uttar Pradesh, India

³ PhD Research Scholar, Department of Physiology, RUHS Rajasthan, India

⁴ Post Graduate, Department of Physiology, RUHS Rajasthan, India

*Corresponding author:

Satyanath Reddy Kodidala, Department of Physiology, JJM Medical College, Davanagere, Karnataka, India
Tel: +919912186614
Email: ksatyanath1989@gmail.com

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Abstract

Background and Objective: A great deal of stress is experienced by medical students, causing the medical community to pay attention to yoga practices. Suryanamaskar is a yoga practice composed of dynamic muscular movements that are synchronized with an in-depth rhythmic breathing process and considered the best all-around exercise. To determine the effect of Suryanamaskar practice on cardiovascular, respiratory, and cognitive performances among medical students.

Materials and Methods: A total of 85 first-year medical students (50 males and 35 females) were entered the study voluntarily and received 60-minute training sessions on Suryanamaskar for 6 days weekly for 3 months. Cardiovascular-respiratory parameters and cognitive functions were assessed. Resting blood pressure, pulse rate, vital capacity (ml), maximum ventilatory volume (MVV) (l/min), peak expiratory flow rate (PEFR), maximal oxygen consumption in l/min/kg body weight, and Addenbrooke's Cognitive Examination-Revised for cognitive function testing were recorded at the baseline and after 12 weeks of Suryanamaskar training. Data were analyzed statistically in SPSS software, and the significance was checked by the student's paired t-test. The significance level was considered < 0.005.

Results: After 12 weeks of regular Suryanamaskar practice, a significant decrease was found in resting pulse rate and blood pressure and an increase in vital capacity (ml), MVV (l/min), PEFR, and cognitive functions in both male and female participants.

Conclusions: Based on the results, after 3 months of Suryanamaskar training, it had a significant effect on the improvement of cardiovascular, respiratory, and cognitive functions among medical students.

Keywords: Cardiovascular, Cognitive function, Medical students, Respiratory, Suryanamaskar

Background

India has an ancient and rich tradition of yoga practice. In recent times, yoga is gaining a lot of attention and increasing scientific research from healthcare professionals. Suryanamaskar (Surya: Sun and namaskar: bending with proper forms) is the salutation to God Sun and also a part of yogic practices from ancient times. To start with, each cycle of Suryanamaskar consists of a sequence of particular asana performed along with the pranayama [1]. Every posture in the series is complementary to one other and can cover all body movements. Practicing Suryanamaskar makes the entire body experience stretch and pressure alternately, and therefore, it is said that one of its advantages is giving more health benefits in a short period [2] as most people rarely have time nowadays.

It has already been claimed that Suryanamaskar practice gives the advantage of both asana and pranayama which improves the overall general health, body fitness, and mind and spiritual health [3]. In general, undergraduate medical students experience more stress due to their academic activity and work

stress in comparison to the general population all over the world [4,5]. The association between weight gain due to stress is less clear. Those people who undergo stress may experience changes in dietary habits that lead to gaining weight with various other effects related to sex [6]. High levels of stress have negative impacts on the cognitive functions and learning capability of undergraduate students in the medical college [7].

Objectives

The present research was conducted to investigate the effects of Suryanamaskar practice on cardiovascular-respiratory performance and cognitive parameters among undergraduate Bachelor of medicine and Bachelor of surgery (MBBS) students.

Materials and Methods

The present study was conducted in the Department of Physiology, K.D Medical College, Hospital and Research Center, Mathura, Uttar Pradesh, India. Ethical clearance approval was taken

before initiating the study from Institutional Ethical Committee, Kanti Devi Medical College. The subjects included 85 first-year MBBS students (50 males and 35 females) who participated voluntarily and were at the age range of 18-25 years old. All participants were informed about the nature of the study and obtained written consent. All subjects were enrolled to practice and memorize the whole yoga protocol explained in detail by the investigator and they were also shown the demo by a yoga instructor. On the first day of the study, the baseline data were collected for all the voluntary participants. Vital data, including name, age, gender, height, and weight of the participants, were collected and noted. Each subject was asked to recline comfortably relaxed in a supinated position for at least 5 min. Afterward, the resting pulse rate was counted for 60 sec, and resting blood pressure (BP) was measured using the manual method with a mercury sphygmomanometer to avoid any digital error. An RMS-Helios Spirometer was used to record lung functions, and the parameters were vital capacity in ml, maximum ventilatory volume (MVV) in liters, and peak expiratory flow rate (PEFR) in liters. A bicycle ergometer was used to measure the aerobic capacity of maximal oxygen consumption (VO₂ max; l/min/kg body weight). A standard protocol for continuous bicycle ergometry was followed to collect VO₂ max. For cognitive functions, the brief and simple cognitive screening tool named Addenbrooke's Cognitive Examination-Revised was administered among students [8]. This instrument has been established as a sensitive screening tool for testing mild cognitive impairment, dementia, and

Alzheimer's disease. The scoring criteria with appropriate points were for attention and orientation (18), memory (26), fluency (14), language (26), and visuospatial (16). When all participants completed the recording of baseline parameters, they were allotted for Suryanamaskar training and received yoga instructions by the yoga instructor for full 12 weeks. At the end of 12 weeks of Suryanamaskar practice, all the cardiovascular, respiratory, and cognitive function parameters were reassessed once more. All data were entered into a master datasheet. The collected data were statistically analyzed in the latest SPSS software, and significance was checked by the paired t-test with a significance level of < 0.005.

Results

A total of 85 students were assessed for cardiovascular, respiratory, and cognitive functions before and after 12 weeks of Suryanamaskar practice. It was revealed that all parameters were improved after regular Suryanamaskar practice among the participants. In this regard, pulse rate and systolic blood pressure (SBP) and diastolic blood pressure (DBP) (mmHg) decreased after the performance of Suryanamaskar (P<0.001), which were found to be statistically significant. Vital capacity (ml), MVV (l/min), PEFR (l/sec), VO₂ max (l/min/Kg) increased after the performance of Suryanamaskar (P<0.001), which were significant. The students showed significantly improved performance on all cognitive parameters, such as attention and orientation, memory, fluency, and visuospatial function (P<0.001) (Table 2).

Table 1. Mean values of cardio-respiratory parameters before and after Suryanamaskar (n=85)

S.No	Parameters	Mean±SD (before Suryanamaskar)	Mean±SD (after Suryanamaskar)	P-value
1)	Pulse (beats/min)	83.04±5.12	74.25±4.25	P<0.001
2)	Systolic BP (mmHg)	118.7±6.12	110.2±5.41	P<0.001
3)	Diastolic BP (mmHg)	82.65±4.0	73.24±4.8	P<0.001
4)	Vital capacity (ml)	1.7±0.8	1.82±0.9	P=0.35
5)	MVV (l/min)	58.1±9.42	61.99±9.90	P=0.009
6)	PEFR (l/sec)	8.76±1.5	9.7±2	P<0.001
7)	VO ₂ max (L/min/Kg) 2	29.52±2.1	34.99±3.12	P<0.001

BP: Blood pressure; MVV: Maximum ventilatory volume; PEFR: Peak expiratory flow rate; VO₂: Oxygen consumption

Table 2. Mean values of cognitive function parameters before and after Surya namaskar (n=85)

S.No	Parameters	Mean±SD (before Suryanamaskar)	Mean±SD (after Suryanamaskar)	P-value
1)	Attention and orientation (M.S-18)	14.11±0.31	17.00±0.61	P<0.001
2)	Memory (M.S-20)	16.21±0.69	23.11±1.62	P<0.001
3)	Fluency (M.S-14)	8.47±0.57	12.01±1.27	P<0.001
4)	Visuospatial (M.S-16)	10.47±0.83	14.99±1.39	P<0.001

Discussion

This study aimed to find the efficiency of a 12-week Suryanamaskar training intervention in improving cardiovascular fitness and cognitive functions after-

effect in healthy undergraduate medical student volunteers. The participants showed improved performance in all parameters. The results of prior studies investigating the physiological changes

following Suryanamaskar have shown a positive change in cardio-respiratory performance and psychological functions in young adults. Suryanamaskar is a complete sadhana with spiritual also including asana, pranayama, mantra, and meditation approaches that helps enhance physiological functions and mind concentration. Cardiovascular functions are usually controlled by neural, hormonal, and temperature mechanisms of the body, any defects on which would lead to consequences related to cardiovascular diseases. The concentration of mind is necessary for students to be successful academically and professionally.

Based on our findings, the resting pulse rate, SBP, and DBP reduced significantly among normal healthy participants following 2 months of Suryanamaskar training. The results of studies conducted by Kumar et al. [9] and Ravindra et al. [10] showed a similar decrease in cardiovascular parameters. Accordingly, a statistically significant decrease was observed in pulse rates after the practice of Suryanamaskar training, which was assigned to stimulate vagal tone and could decrease sympathetic activity in persons [11]. The SBP was found to be significantly decreased after the training in a study by Bhutkar et al. [12]. In contrast, Bhavanani et al. [13] reported an increase in SBP following fast Suryanamaskar practice, which might be due to the speed of sadhana causing an increase in venous return and cardiac output.

The main determining factor of DBP is known to be peripheral vascular resistance, which is regulated by sympathetic vascular tone. In the present study, the significant decrease in DBP after Suryanamaskar training could be attributed to the alteration of the hypothalamic discharges leading to a reduction in sympathetic tone and peripheral resistance, and hence, DBP [12,13]. In turn, diminished sympathetic activity lessens catecholamine discharge, which further, leads to vasodilatation resulting in an improvement in the peripheral circulation. It is likewise observed that regularly sadhana practices lower basal metabolic rate and resting oxygen utilization [14].

Regular yoga practices reinforce the respiratory muscles, build the expedition of the diaphragm and lungs, and compliance of thorax with decline airway resistance [11]. The findings of recent studies confirm that the practice of Suryanamaskar increases VO₂ max by training [15,16]. This is due to the reduction in resting O₂ level consumption simultaneously as better utilization of energy at the cellular level. Both the improvement in cellular machinery performance and increased lung functional performance justify the increased VO₂ max after practicing regular Suryanamaskar. It has

been recently documented that Suryanamaskar causes an increase in VO₂ max pointing to the betterment of aerobic capacity and that it exhibits just moderate stress on people's cardio-respiratory health by keeping lactate and anaerobic threshold in control [17]. All these findings support the assumption that the regular practice of Suryanamaskar is an effective physical activity. According to the recommendation of the American College of Sports Medicine, about 50-80% of VO₂ max and 60-90% of reserve heart rate are considered powerful physical activity.

Suryanamaskar is a cognitive booster. The results of studies have added that practicing Suryanamaskar can improve individuals' thinking capability, certain aspects of perception, reasoning, and also importantly remembering the task [18,19]. In the present study, after practicing a 12-week Suryanamaskar training, cognitive functions improved statistically. The exact underlying mechanism of how the Suryanamaskar technique improves the cognitive functions of participants is unknown; however, we hypothesized that improved oxygen supply to the brain enhanced the cerebral cortex function. The findings of a study supported that students had better mental health and psychological empowerment than non-practitioners [20]. In addition, Xiong and Doraiswamy explained that meditation could effectively enhance the power of cognitive circuits in the human brain and increase cognitive capability [21]. Satyanath et al. also demonstrated that the short-term practice of pranayama could also have a good impact on all respiratory parameters [22].

These days, yoga is practiced by the majority of people worldwide belonging to all professions and has highly attracted the attention medical community. It has been claimed that practicing Suryanamaskar improves general health and physical fitness. Moreover, Suryanamaskar boosts pulmonary ventilation, cardiovascular performance, and cognitive functions and helps develop self-discipline. Additionally, the findings of studies have guaranteed the various positive effects of different meditation techniques on particular cognitive functions [23,24].

Conclusions

Based on the results of this study, it is recommended that Suryanamaskar be practiced compulsory by children, students, and especially medical students every day and be advised for non-medical healthy individuals. To get the beneficial effects of Suryanamaskar, it should be practiced at least as a training period of 12 weeks (i.e., 3 months), which can improve cardio-respiratory and cognitive functions.

Limitations of the study

Both males and females were included in this study in a common group; therefore, a separate evaluation was not performed. The sample size in this research was small, highlighting the need to conduct a study with a bigger sample size to reach more compressive and generalizable results.

Recommendation

Further studies may be carried out with the inclusion of psychological patients as Suryanamaskar is helpful to improve cognitive functions and investigation of hypertensive people to have better cardiovascular efficiency as was found in the current study. Suryanamaskar can even reduce mental stress.

Ethical Considerations

Conflict of interest

The authors declare that there is no conflict of interest.

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