

Effect of Long-term Regular Yoga on Physical Health of Yoga Practitioners

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Abstract

Background: Yoga is a physical, mental, and spiritual discipline. The effect of yoga on mental health has been studied extensively in India but less in the context of physical health. **Objective:** The objective was to explore the effect of long-term regular yoga on physical health of yoga practitioners. **Materials and Methods:** It was an interventional study. Inclusion criteria were students who enrolled for 1-year diploma course at the yoga center. Exclusion criteria were nonregular yoga practitioners during the course. Physical health parameters considered for assessment before and after the yoga course were pulmonary function tests, maximum oxygen consumption (VO_{2max}) using Bruce treadmill test, flexibility, body composition analysis, and hemoglobin level. Paired sample *t*-test and Chi-square test were used for statistical analysis. **Results:** The aerobic capacity improved significantly in terms of mean (standard deviation [SD]) forced vital capacity ($P < 0.001$), forced expiration volume at the end of the first second ($P < 0.001$) as well as peak expiratory flow rate ($P = 0.04$). The mean (SD) flexibility score improved significantly ($P < 0.001$). Similarly, the endurance improved significantly in terms of mean (SD) Vo_{2max} ($P < 0.001$) and treadmill time ($P < 0.001$). There was no significant change in body composition and hemoglobin level. **Conclusions:** Regular yoga practitioners demonstrated the improvement in pulmonary functions, cardiorespiratory fitness, endurance, and flexibility.

Keywords: Flexibility, long-term, physical health, pulmonary functions, VO_{2max}, yoga

INTRODUCTION

Yoga is a physical, mental, and spiritual discipline which originated in India. The united nation realized that yoga is a holistic approach and needs a wider propagation of its benefits for the well-being of the community. Yoga is documented as one of several traditional therapeutic systems by the World Health Organization.^[1] Yoga provides strength and self-control to face the challenges in an individual's life. It has been practiced widely across the globe and becoming more relevant in today's conflict-ridden world.^[2] A study on evaluation of the therapeutic effects of yoga of selected articles findings indicates that it improves all over the quality of life and well-being of an individual. There is an activation of the parasympathetic system and its associated anti-stress mechanism in yoga therapy.^[3]

Review article by Arndt Bussing on the effects of yoga on mental and physical health summarizes that a number of areas where yoga may well be beneficial, but more research is required for virtually all of them to firmly establish such

benefits.^[3] This study was planned taking into consideration the scarcity of information about the effects of long-term regular yoga practice on physical health. Hence, the present study was undertaken on a yoga diploma course student who practiced yoga regularly.

MATERIALS AND METHODS

The study population comprised students who enrolled for 1-year diploma course at yoga center. The study was an interventional study, approved by the Institutional ethic committee. Inclusion criteria were students who enrolled for diploma course at yoga center. Exclusion criteria were

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How to cite this article: Gohel MK, Phatak AG, Kharod UN, Pandya BA, Prajapati BL, Shah UM. Effect of long-term regular Yoga on physical health of Yoga practitioners. Indian J Community Med 2021;46:508-10.

Received: 02-07-20, **Accepted:** 27-04-21, **Published:** 13-10-21

Access this article online

Quick Response Code:



Website:
www.ijcm.org.in

DOI:
10.4103/ijcm.IJCM_554_20

to exclude the participants who did not practice yoga regularly during the course. Informed written consent was taken from the enrolled participants. Information was collected regarding sociodemographic data such as age, sex, education, and profession, and any disease. Physical health parameters considered for assessment before and after yoga course were pulmonary function tests (PFT), maximum oxygen consumption ($VO_{2\max}$), flexibility, body composition analysis (Metabolic age, body fat, visceral fat, resting metabolism, and body mass index), and hemoglobin level (Hb). Body mass composition was assessed by body composition monitor with scale-Karada Scan (OMRON), HBF-362 model. PFT was done with a portable RMS HELIOS 401 PC-based spirometer as per the guidelines by Miller *et al.*^[4] PFT parameters were percentage of predicted forced vital capacity (%FVC), forced expiration volume at the end of the first second (%FEV1), FEV1/FVC ratio, peak expiratory flow rate (PEFR), and forced expiratory flow 25%–75%. The best value from the three measurements was considered as final value. Predicted values were calculated by the standard formulae programmed in computerized spirometry. The flexibility test was done by sit and reach flexometer machine. $VO_{2\max}$ assessment was done by motorized treadmill machine following Bruce protocol.^[5] At the end of the test, the total time of exercise was recorded and $VO_{2\max}$ was calculated.

Contents of diploma course were yoga, Human Science, Ayurveda, and Naturopathy. Yoga classes were conducted by yoga experts for 4 h (Theory and practical, 2 h each) on every Sunday. Practical class included prayer, yoga asanas, pranayama, mantra chanting, and meditation. Yogasanas included yogasanas of standing, sitting, prone, and supine positions. Participants were assigned to do self-practice of yoga for 1 h in 5 days a week at home. Participants who self-practiced yoga for 30 min or more time per day for 5 days a week were considered as “compliers” and eligible for postassessment after yoga course.

Statistical analysis

Descriptive statistics (mean [standard deviation (SD)], Frequency [%]) were used to present sociodemographic and baseline clinical/physiological profile of the study participants. Paired sample *t*-test and Chi-square test were used to assess the impact of the yoga training. A $P < 0.05$ was considered statistically significant. The data analysis was carried out using statistical software namely STATA (version 14.2, Stata Corporation, Texas, USA).

RESULTS

All the 80 students enrolled for the 1-year diploma yoga course agreed to participate in the study. Seven students discontinued the course whereas 12 others could not practice yoga regularly. These 19 participants were excluded from the analysis. Further five females and six males could not visit for the end line assessment. Thus, pre and post records of 50 participants were analyzed whereas the demographic data of 61 participants is presented.

Of the 61 participants, 37 (60.7%) were females. About 49.2% of participants had education up to college and 47.5% was with higher education (master degree). Majority of the participants were professionals; job (52.5%), business (16.4%), students (9.8%), and homemakers (21.3%). Participants were free from cardiorespiratory illness and non-smokers. The mean (SD) (median [Q1, Q3]) age of the participants was 38.98 (12.18) (39 (29, 49)) years. Eleven females (35.5%) and nine males (37.5%) had mild anemia according to the World Health Organization classification of anemia.^[6]

The aerobic capacity (FVC, FEV1, PEFR, Flexibility score) and endurance (VO_2 , tread mill time) improved significantly whereas body mass composition and haemoglobin levels were similar before and after the intervention. [Table 1].

DISCUSSION

Yoga is an applied science to bring harmony between man and nature. The respiratory process can be deliberately controlled, partly or totally through pranayama. The practice of asanas removes the obstructions which impede the flow of prana.^[7] In our study, there was a significant change in FVC, FEV1, and PEFR among participants. This could be because of the reduction of sympathetic activity attained with yogic training which may allow broncho-dilatation by correcting the abnormal breathing patterns and reducing the muscle tone of inspiratory and expiratory muscles. Yogic breathing involves three types of breathing, namely, abdominal, diaphragmatic, and thoracic breathing.^[2] Regular yogic breathing exercises lead to the use of respiratory muscles more efficiently with improving its tone and vital capacity of the lung.^[8]

Our findings are consistent with studies done by Vedala *et al.* and Shankarappa *et al.* which found significantly higher values of FVC, FEV1, and PEFR after yoga training.^[9,10] There was no significant change in FEV1/FVC ratio in our study. The same finding was observed by study by Madanmohan *et al.* where a significant increase in FEV, FEV1, and PEFR but no significant change in FEV1/FVC ratio after yoga training.^[11]

There is a significant increase in the pulmonary function parameters after yoga practice which involved the regular combined practice of pranayama, yogasanas, and meditation for 1 year, whereas other studies reported the impact of each individually for different durations.

The assessment of cardiorespiratory fitness was done by $VO_{2\max}$, measured by Bruce treadmill test which is an indirect method to estimate $VO_{2\max}$.^[5] There was significant increase in $VO_{2\max}$ and in both gender among participants. Yogic training stimulates parasympathetic activity which leads to a generalized decrease in vascular tone.^[3] Yoga postures (asanas) involve isometric contraction which is known to increase skeletal muscle strength. Improvement in both lung functions as well as cellular machinery explains raised $VO_{2\max}$ after regular practice of yoga.^[12] Similar findings were observed by Udhan *et al.* where yoga intervention among healthy individuals

Table 1: Impact of long-term regular yoga practice on physical health parameters

Variable	Mean (SD)	
	Baseline (n=50)	Endline (n=50)
Pulmonary function tests		
FVC*	3.01 (0.69)	3.19 (0.72)
FEV ₁ *	2.53 (0.56)	2.79 (0.68)
FEV ₁ /FVC	85.35 (3.74)	85.94 (3.75)
PEFR#	6.47 (1.60)	6.69 (1.79)
Flexibility score*	31.36 (8.65)	35.42 (8.40)
Endurance		
TMT*	8.91 (3.17)	11.32 (3.36)
VO ₂ max*	33.84 (12.60)	43.64 (14.73)
Body composition		
Body fat	30.53 (7.68)	30.73 (7.92)
Visceral fat#	8.06 (5.11)	8.64 (4.98)
Resting metabolism	1396.64 (211.88)	1390.32 (215.55)
Anthropometry		
Weight (kg)	64.96 (12.13)	64.29 (12.24)
BMI	25.04 (4.11)	24.83 (4.37)
Hb	13.26 (1.75)	13.14 (2.43)

FVC: Forced vital capacity, FEV₁: Forced expiratory volume 1 s, PEFR: Peak expiratory flow rate, TMT: Treadmill stress test, VO₂ Max: Maximal oxygen consumption, BMI: Body mass index, SD: Standard deviation, Hb: Haemoglobin, # $p=0.04$, * $p < 0.001$

resulted significant increase in VO₂ max ($P < 0.0001$).^[13] Similar findings were also observed by Doijad *et al.* among M. B. B. S students for both genders.^[14]

Flexibility is an important component of fitness. Regular yoga practice improves flexibility and balance which leads to positive changes in physical performance and well-being. Regular yoga practice involves gentle stretching of muscle, connective tissues around bones and joints which enhance flexibility.^[15] In our study, there was a significant improvement in measures of flexibility. Similar results were observed in a quasi-experimental study by Iftekher *et al.* where yoga training improved the balance and flexibility of shooting athletes.^[16]

There was no significant change in the hemoglobin level of participants, even in anemic participants. A study by Sharma *et al.* observed significant increase in hemoglobin of anemic individuals after yoga training.^[17] A study by Carranque *et al.* observed higher hemoglobin levels ($P > 0.01$) as the effects of long-term yoga practice (more than three years) but preintervention Hb level was not done.^[18] Our study duration was 1 year. It may require longer follow-up of regular yoga practitioners to see the change in hemoglobin level. Diet assessment was also not part of our study. There was no significant change in body mass composition. There is scarcity of scientific literature on the yoga effect on body mass composition which directed us to the scope of research. The limitation of our study is that the dietary intake of participants was not tracked, but healthy and balanced diet advised to follow.

CONCLUSIONS

The intended purpose of this study was to explore the impact of long-term regular yoga practice on physical health. Regular yoga practitioners demonstrated the improvement in pulmonary functions, cardiorespiratory fitness, endurance, and flexibility. Our findings suggest that the regular yoga practice enhances the physical health of yoga practitioner. Future studies in this area should explore the role of long-term regular yoga practice in the field of preventive medicine.

Financial support and sponsorship

Financial support of Rs 50000 from Charutar Arogya Mandal, Karamsad.

Conflicts of interest

There are no conflicts of interest.

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