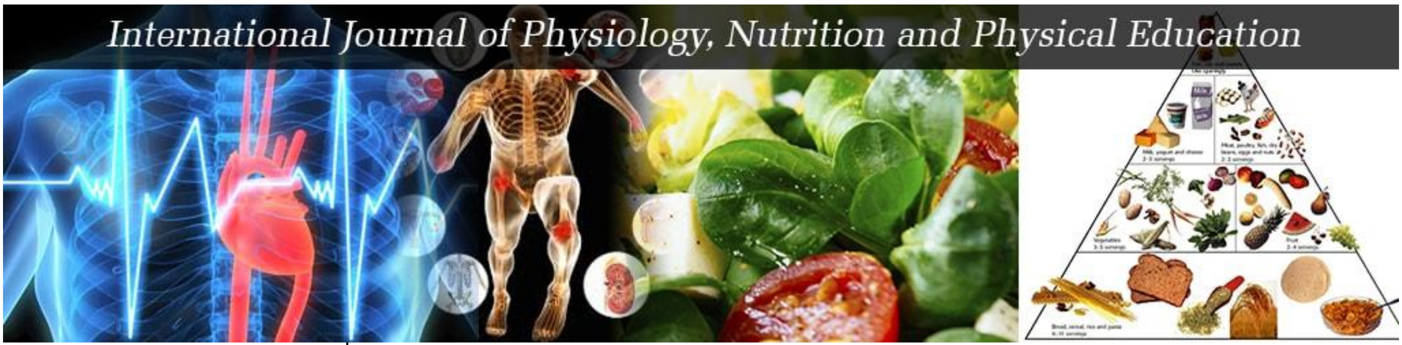
International Journal of Physiology, Nutrition and Physical Education 2018; 3(1): 2140-2147



ISSN: 2456-0057
IJPNPE 2018; 3(1): 2140-2147

www.journalofsports.com
Received: 01-06-2018
Accepted: 20-06-2018

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Perceived stress, metabolism and cardiovascular functions of healthy Indian men at moderate altitude: effect of a one-month yogic intervention

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Abstract
Background: There is paucity in published scientific work addressing effect of yoga training on healthy individual at altitude above sea level. Thus, this study was aimed to observe effects of one month yogic intervention on perceived stress and other responses of healthy Indian men at moderate altitude.
Methods: Twenty two healthy Indian men aged 29.7 ± 4.3 years (Mean ± SD) participated in an one month yoga training program for 6 days in a week, during 6-7am in the morning, at an altitude of 1600m (5052ft). Their perceived stress score (PSS), resting heart rate (RHR), arterial blood pressure (SBP, DBP) and peripheral capillary oxygen saturation (SpO_2%) were measured at baseline and after one month yoga practices. Metabolic analyzer was used to measure resting oxygen consumption ($\dot{V}O_2$rest), carbon dioxide production ($\dot{V}CO_2$rest), and energy expenditure (EEm). Graphpad prism 6 and IBM SPSS 21 were used to perform statistical tests as applicable to analyze the within subject changes for all the variables except age and height. Correlation coefficients of changes in between $\dot{V}O_2$rest, $\dot{V}CO_2$rest and EEm were also calculated.
Results: Most of the variables decreased significantly post one month yogic intervention and trends of reduction was observed for $\dot{V}O_2$rest (p=0.06), R (p=0.127) and EEm (p=0.058) after one month yoga training. Reduction in EEm was found to be significantly correlated with $\dot{V}O_2$rest and $\dot{V}CO_2$rest ($p<0.001$) respectively.
Conclusion: One month yoga training at moderate altitude may reduce perceived stress, resting metabolism, and improve cardiovascular functions of healthy Indian men.

Keywords: altitude, blood pressure, metabolism**,** stress, yoga

Introduction
Stress is a major epidemic nowadays and prolonged stress may lead to metabolic and cardiovascular dysfunctions [1, 2]. Researchers proved the efficacy of yoga in reducing stress with health benefits [3, 4]. On the other hand, Goldberg and team found that altitude ascent of even 725m above sea level is associated with a decrease of oxygen saturation in healthy individuals [5] whereas Yoga practices have been found useful for the prolonged stay at high altitude [6]. The sympathetic nervous system plays the superior role in regulating physiological functions via adrenal-medullary pathways in response to stressful conditions and may be overactive sometimes leading to physiological disorders [1]. This sympathetic over-activity can be decreased through yogic relaxation [7]. Furthermore, it was earlier reported that meditation and Shavasana may decrease oxygen consumption with improvement in breath volume [8]. Each yogic posture has its own oxygen consumption, energy expenditures and metabolic demands [9] whereas, an advanced yoga practitioner could tolerate O_2 levels of 12.2% and CO_2 levels of 7.3% in ambient air even during a prolonged stay in an airtight environment [10] whereas long-term yogic intervention including both stimulatory and inhibitory yogic practices may decrease resting metabolic rate even lower than that of predicted by the 1985 FAO/WHO/UNU prediction equations [11]. Besides, Yoga can improve cardiorespiratory functions with reduction of stress along with the promoting melatonin secretion that is known as one of the most important biomarkers as it helps in promoting many physiological functions [12]. Melatonin helps in protection against reactive oxygen species, promoting better sleep by entrainment of the circadian rhythm.

An individual faces all these problems with the time of his altitude ascent and thus may be benefitted through yogic practices [6]. Thus, this study was undertaken to determine the effects of a one-month yoga intervention on measures of perceived stress, cardiovascular function as well as resting metabolism in a cohort of physically healthy India men at a moderate altitude of 1600m (5052ft).

2. Materials and Methods

2.1 Participants: Forty-nine Indian men aged 20 to 52 years agreed to participate in this scientific research work after understanding the detailed study protocol.

2.1.1. Inclusion Criteria: Physically healthy Indian men residing more than one month at the moderate altitude, aged 20 to 39 years, with no record of recent illness or injury and taking no medication were included in this study. The volunteers who had no experience of yoga or other exercise training within the last six months were chosen for this study to avoid the effect of their previous yoga sessions on the outcome measures. Only non-alcoholic and nonsmoker individuals were included in this study as these factors can play important role in predicting the outcome variables [13]. Taking all these factors into account, ten subjects were not included.

2.1.2. Exclusion Criteria: Underweight (<18.5 kg/m2), obese (>30 kg/m2), hypertensive (>140 mm Hg), hypotensive (<100 mm Hg) individuals were excluded (N = 7). Ten study participants, who were unavailable at the time of data collection after one month, were excluded from the data analysis.

Thereafter, 22 healthy Indian men aged 29.7 ± 4.3 years (Mean ± SD) participated in this single arm pre-post paradigm study of one-month yogic intervention. The brief schematic diagram of study design is presented in Fig.1.

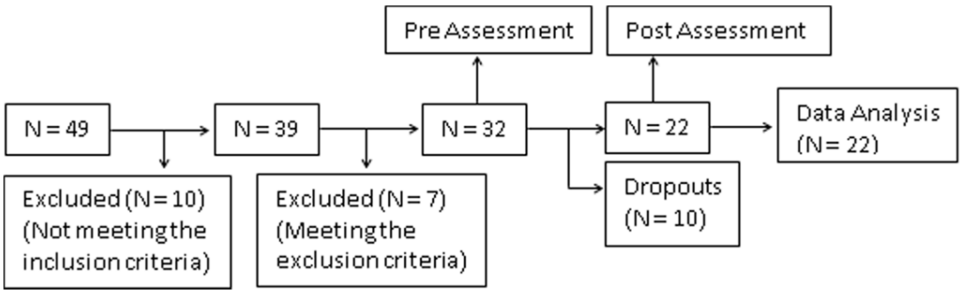

Fig 1: Schematic Diagram of the Study Design

2.2. Ethical Consent: Institutional Ethical Committee approved this study and written informed consents were obtained from the participants. Ethical standards outlined in the code of ethics of World Medical Association have thoroughly adhered.

2.3. Intervention: A customized yogic module, named 'Yoga for Health Promotion' (Table-1) have been developed by our institute keeping the traditional and scientific concepts of yoga in mind to improve the physical, physiological and cognitive health of the individual. One proficient yoga instructor imparted this yogic module, consisting of sukhsma-vyama and sthula-vyama including suryanamaskar, breathing maneuvers and meditation to the study participants for one hour and six days in a week between 6-7AM in the morning in a well-ventilated space.

Table 1: The imparted customized yoga module

Yoga for Health Promotion	
Asana/ Breathing Maneuvers/Meditation	**Duration (minutes)**
Standing Postures	**8min**
Griva-Shakti-Vikasak, Kati-Shakti-Vikasak, Jangha-Shakti-Vikasak, Padamul-Shakti-Vikasak, Tadasana, Vriksasana, Konasana, Ardhachakrasana, Suryanamaskar	
Supine Postures	**7min**
Shavasana, Pawanmuktasana, Markatasana, Makarasana, Bhujangasana, Ardhasalabhasana, Balasana	
Sitting Postures	**4min**
Bhadrasana, Vakrasana, Uttanmandukasana, Simhasana	
Breathing Manuevers	**6min**
Kapalbhati, Nadishodhan Pranayama, Bhramari Pranayama	
Meditation	**3min**
Total Time	**28 minutes**

2.4. Assessments: A well-ventilated room was provided to undertake all the scientific works. The subjects were requested not to consume spicy foods during this yoga training program as this may play a significant role in changing the physiological functions [12]. The environmental temperature and relative humidity were almost same during the study period.

2.4.1. Demographic profile and physical characteristics: Information regarding date of birth, the highest educational qualification, food habit, trade, and ethnicity were collected from every individual. Standard procedures were employed to measure height (cm) and weight (kg). Table-2 represents the physical characteristics of the participants, participated in this study.

Table 2: Physical Characteristics of the volunteers, BMI= Body mass index, Values are expressed as Mean ± SD, CI=Confidence Interval, d = Effect Size

Parameters	Before	95% CI	After	95% CI	p-value	d
Age (years)	29.7±4.3	27.77-31.59	29.7±4.3	27.77-31.59	-	-
Height (cm)	172.8±4.61	170.8-174.9	172.8±4.6	170.8-174.9	-	-
Weight (kg)	72.1±8.5	68.36-75.92	72±8.2	68.35-75.62	0.465	0.16
BMI (kg/m^2)	24.1±2.2	23.12-25.07	24.1±2.1	23.11-24.99	0.507	0.14

2.4.2. Self-reported perception of stress: Perceived stress score (PSS) of all the participants were obtained by administering a widely used perceived stress scale [14]. It is a self-report test of 10 item questionnaire that quantifies the perception of stress in life during the last one month. Each question was rated in scores minimum 0 to maximum 4. A total score was calculated by summing up the scores from all the responses of one individual. The battery of questions was designed as the higher the total score of the individual, the more stressed the person was. Participants completed this test battery while seated in a quiet and peaceful location before the measurement of other variables.

2.4.3. Resting physiological function: Resting heart rate (RHR in beats per minute) was measured for one minute by the standard palpatory method by using the index, middle and ring fingers of the right hand with the help of a digital stopwatch. Systolic blood pressure (SBP in mm Hg) and diastolic blood pressure (DBP in mm Hg) was checked with the help of stethoscope and mercury sphygmomanometer following standard protocol. Average of three consecutive measurements was taken for each individual. Pulse Pressure (PP in mm Hg) was evaluated by subtracting readings of DBP from SBP. Mean arterial blood pressure (MAP in mm Hg) was calculated using the standard formula, i.e. MAP = DBP + (PP/3). Rate pressure product (RPP in mm Hg beats per minute) was computed by the formula, i.e. RPP = HR X SBP X 10-2. The product of heart rate and mean arterial blood pressure (RHR-MAP in mm Hg beats per minute) was also calculated. Percentage of peripheral capillary oxygen saturation (SpO_2%) was measured by attaching digital pulse oximeter, i.e. Nonin Onyx Vantage 9590 probe on the index finger.

2.4.4. Resting Metabolism: Direct breath by breath measurements of resting oxygen consumption ($\dot{V}O_{2rest}$ in l/min), carbon dioxide production ($\dot{V}CO_{2rest}$ in l/min), respiratory exchange ratio (R), and resting energy expenditure (EEm in kJ/min) were obtained using a portable computerized metabolic analyzer, i.e. $K4b^2$-Cosmed s.r.l., Rome, Italy. The equipment was calibrated against the ambient temperature as per standard method before measuring variables from each and every subject. In addition, the system was also calibrated with the help of 3L Volume Syringe and standard gas mixture (16% O_2, 5% CO_2) on each day of the experiment. Furthermore, the delay time in between the sampling process was also calibrated when asked by the system to do so. The data were filtered by eliminating errors, if any, and averaged for 30sec time interval using the software provided with the instrument.

All the participants were given a comfortable rest of 15 to 30 min in a well-ventilated room before initiation of the measurements.

2.4.5. Statistical Analysis: Normality of the variables was checked by D'Agostino & Pearson omnibus normality test. Paired sample t-test and Wilcoxon signed rank tests were performed for parametric and non-parametric measures respectively to evaluate the trend of changes in the variables post yogic intervention. Standard formulas were used to calculate the effect sizes [15]. Pearson product moment correlations and Spearman rank order correlations were carried out as applicable to find out the relation of age, height, weight, and BMI with the other variables using. Bivariate correlations between the changes of the $\dot{V}O_{2rest}$, $\dot{V}CO_{2rest}$, and EEm were also evaluated. All the statistical operations were performed using GraphPad Prism 6 and IBM SPSS Statistics Version 21 after checking all the assumptions of the tests.

3. Results

Forty-nine individuals were willing to participate in this study. However, thirty-nine participants, satisfying the inclusion criteria, were admitted from them. Ten of them were excluded following the exclusion criteria. Seven individuals were unable to present in the data collection post-intervention. Thereafter, twenty-two healthy Indian men completed this pre-post yoga training program. Their weight and BMI remain almost unchanged after one month of yoga practices at moderate altitude. No subject dropped yoga classes for even a single day and no injuries occurred during the study tenure.

3.1. Perceived Stress and resting cardiovascular function: One-month yoga training lowered PSS by a mean of 5.9, from 12.5 to 6.6 (95% CI= 3.67 to 8.15; $p<0.001$) with a large effect size (d=1.17). RHR significantly decreased by approximately 4 beat/min (bpm), from 71.9 bpm to 68.2 bpm (95% CI= 1.97 to 5.40 bpm; $p<0.001$) with a large effect size (d=0.95). Reduction of SBP after one month yogic practices from 120.7 to 116.4 mm Hg with an average change about 4 mm Hg (95%CI= 1.66 to 7.07 mm Hg; p=0.003) and a moderate effect size (d) of 0.72 was observed. DBP decreased from 80.9 to 79.1 mm Hg with a mean reduction of about 2 mm Hg (95% CI= 0.34 to 3.39 mm Hg; p= 0.019) with a moderate effect size (d= 0.54). PP dropped about 3 mm Hg from 39.8 to 37.3 mm Hg (95% CI= 0.24 to 5.24 mm Hg) but it was statistically inconclusive (p=0.072) whereas, one month yogic intervention reduced MAP about 3 mm Hg, from 100.8 to 97.7 mm Hg (95% CI= 1.40 to 4.83 mm Hg; p=0.001) and possess a large effect size (d=0.81). RPP decreased about 8 mm Hg bpm, from 87.1 to 79.4 mm Hg bpm (95% CI= 4.39 to 10.99 mm Hg bpm; $p<0.001$) with a large effect size (d= 1.03). This one-month yogic intervention also lowered the RHR-MAP by a mean of 599 mm Hg bpm, from 7278 to 6679 mm Hg bpm (95% CI= 347.2 to 850.6 mm Hg bpm; $p<0.001$) with a large effect size (d= 1.06). All these changes are represented in Table-3.

Table 3: Cardiovascular changes following one-month yoga training at moderate altitude, Values are expressed as Mean ± SD, CI=Confidence Interval, d=Effect Size, bpm = beat/min, RHR (bpm) = Resting heart rate in beats per minute, SBP (mm Hg) =Systolic blood pressure in mm Hg, DBP =Diastolic blood pressure, PP =Pulse pressure, MAP =Mean arterial pressure, RPP (mm Hg bpm) =Rate pressure product expressed in mm Hg per beats per minute, RHR-MAP=Product of resting heart rate and mean arterial pressure.

Parameters	Before	95% CI	After	95% CI	p-value	d
PSS	12.5±5.2	10.15-14.76	6.6±4.8	4.41-8.69	<0.001	1.17
RHR (bpm)	71.9±9.6	67.65-76.17	68.2±8.4	64.51-71.94	<0.001	0.95
SBP (mm Hg)	120.7±7.3	117.5-123.9	116.4±5.5	113.9-118.8	0.003	0.72
DBP (mm Hg)	80.9±4.9	78.77-83.14	79.1±5	76.89-81.29	0.019	0.54
PP (mm Hg)	39.8±6.1	37.09-42.45	37.3±6.5	34.41-40.14	0.072	0.40
MAP (mm Hg)	100.8±5.4	98.44-103.2	97.7±4.1	95.90-99.56	0.001	0.81
RPP (mm Hg bpm)	87.1±14.7	80.58-93.64	79.4±10.9	74.59-84.25	<0.001	1.03
RHR-MAP(mm Hg bpm)	7278±1222	6736–7820	6679±964.5	6251–7107	<0.001	1.06

3.2. Oxygen saturation and resting metabolism: SpO_2 (%) significantly increased by a mean of 0.5%, from 97.7 to 98.2% (95% CI= 0.28 to 0.81%; p<0.001) with a large effect size (d= 0.92). A statistically insignificant reduction of $\dot{V}O_{2rest}$ following participation in the one-month yoga training programme (Z= -1.88, p= 0.06) with an effect size (r) of 0.28 was observed. The median (interquartile range) values of the $\dot{V}O_{2rest}$ were 0.32 (0.27 - 0.37) and 0.28 (0.20 - 0.38) respectively at baseline and post-yoga training. One month yoga training elicited decrease of $\dot{V}CO_{2rest}$ by mean of 0.04 l/min, from 0.22 to 0.18 l/min (95% CI= 0.01 to 0.06 l/min, p=0.009) with a moderate effect size (d= 0.62). Respiratory exchange ratio (R) decreased from 0.66 to 0.62, by a mean of 0.04 (95% CI= -0.10 to 0.01, p= 0. 127) which was statistically insignificant with a small effect size (d=0.34). Medians of EEm showed a significant decrease (Z= -2.18, p= 0.03) from 6.24 (5.29 - 7.08) to 5.36 (3.83 - 7.33) when compared the post-yoga training values with the values obtained at baseline. These changes are represented in Table-4. Based on the results of this study, change of $\dot{V}O_{2rest}$ is strongly related [r = 0.99, p<0.001] with the change of EEm. Likewise, $\dot{V}CO_{2rest}$ is also found to have a significant positive correlation [r = 0.71, p<0.001] with EEm. The results of the correlations are also expressed in Fig. 2 and 3 respectively.

Table 4: Metabolic changes following one-month yoga training at moderate altitude.

Parameters	Before	95% CI	After	95% CI	p-value d
SpO_2%	97.7±0.8	97.31-98.05	98.2±0.59	7.99-98.46	<0.0010.92
$\dot{V}O_{2rest}$ (l/min)	0.32(0.27 -0.37)	0.29-0.37	0.28(0.20-0.38)	0.24-0.33	0.0600.28
$\dot{V}CO_{2rest}$ (l/min)	0.22±0.04	0.20-0.23	0.18±0.07	0.15-0.21	0.0090.62
R	0.66±0.11	0.61-0.71	0.62±0.05	0.59-0.64	0.1270.34
EEm(kJ/min)	6.24(5.29-7.08)	5.68-7.19	5.36(3.83 -7.33)	4.62-6.31	0.0300.33

Values of parametric and non-parametric measures are expressed as Mean ± SD and Median (Interquartile range), CI= Confidence Interval, d=Effect size, SpO_2%=Percentage of peripheral capillary oxygen saturation, $\dot{V}O_{2rest}$ (l/min) =Oxygen consumption per unit time, $\dot{V}CO_{2rest}$ (l/min) =Carbon-dioxide production per unit time, R=Respiratory Quotient, EEm (kJ/min) =Energy Expenditure per unit time.

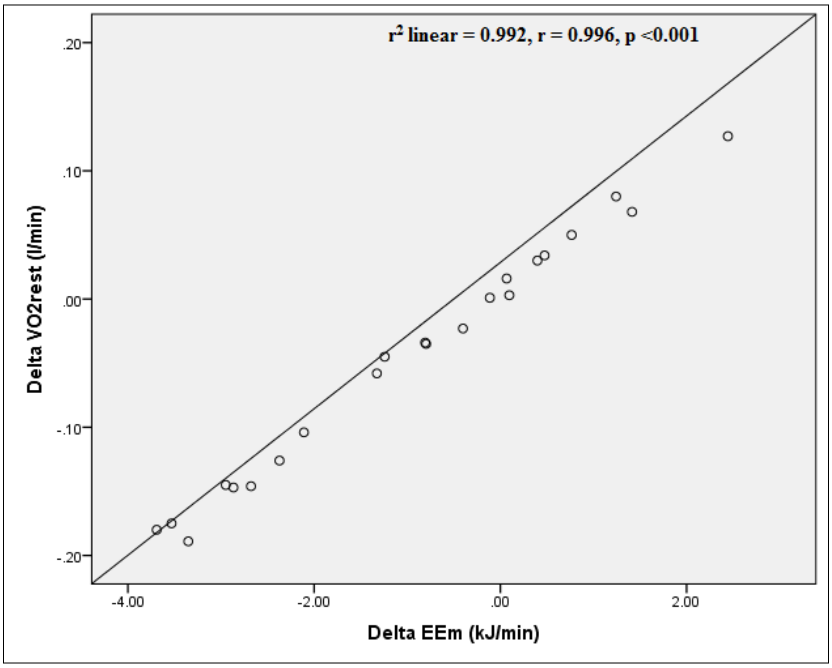

Fig 2: Correlation of $\dot{V}O_{2rest}$ with EEm (kJ/min), r=correlation coefficient

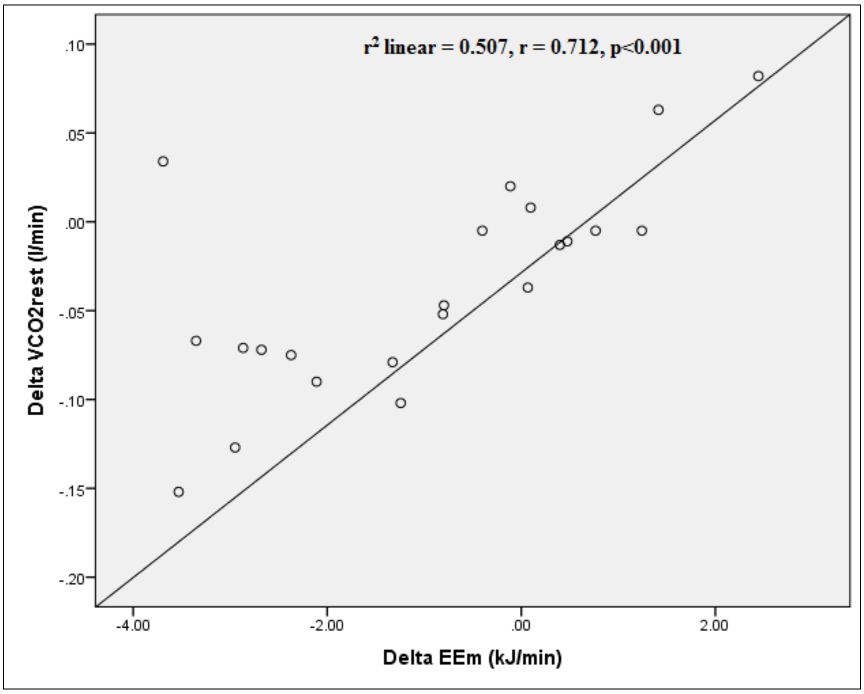

Fig-3: Correlation of $\dot{V}CO_{2rest}$ (l/min) with EEm (kJ/min), r=correlation coefficient

4. Discussion

A study, named 'blood pressure changes in young male subjects exposed to moderate altitude' showed that arterial systolic blood pressure of 15 healthy Turkies young men, residing at 1860m was elevated as a result of elevated sympathetic tone [16] that may be responsible for increased myocardial workload at moderate altitude. Previously Sakai *et al*. [17] trained healthy persons with bicycle exercises for 5 weeks at two different altitudes of 610m and 1500m. They did their experiments at different simulated low and high altitudes (2000m, 4000m) in a hypobaric chamber and reported the increase of blood oxygenation as well as reduction of heart rate during step test exercise in the group of participants trained at 1500m. Thus, in turn, provides evidence that training at moderate altitude may be helpful for human performance at higher altitudes. Effect of hiking at an altitude of 1700m was also studied by Neumayr et. al. [18] who observed even a 3 weeks hiking vacation can elicit improvement in cardiovascular variables in patients with metabolic disorders. Yoga is a unique practice of mind and body involving isometric stretching exercises, stretching practices, shatkarma, mudra, bandha, pranayama and meditation, having low energy cost than exercise [3, 4] however, this is the first study to observe beneficial effect of one month yogic intervention at moderate altitude in healthy Indian men.

On the other hand, Stress is a modern epidemic that affects many physiological functions [4] can be overcome through Yoga [19]. On the contrary, in a recent study, researchers found that 16 week practice of Bikram Yoga may not significantly attenuate stress of both sedentary and stressed individuals if practiced 3 to 5 sessions per week [20] whereas, we found that one month yoga training was able to reduce the perceived stress of healthy Indian men, supported by other recent research insights in different cohorts of the society like working population and elderly individuals [21, 22]. Most of these studies were of more duration than this one. Furthermore, practices involving yoga asanas appear to reduce cortisol, which may protect against the development of stress-related mental outcomes and also has their role in regulating the autonomic nervous system especially in the regulation of hypothalamic-pituitary-adrenal axis [23]. Thus, in our study, the simultaneous practices of breathing maneuvers and postures in the yoga module may be responsible to elicit reduction of perceived stress.

In this study, one month of yogic practices significantly reduced resting heart rate along with systolic, diastolic and mean arterial blood pressure. Previously, eight weeks of Bikram yoga practices in sedentary, normotensive young adults were found helpful in this regard with increased physical functions [24]. These observations were quite similar to previous scientific studies those reported reductions in arterial blood pressure after 10 weeks of yoga practices [4, 12]. The possible mechanism may be the reduction of sympathetic overactivity [7] after yoga training that may, in turn, modulate conditioning effects of yoga on autonomic function, controlled through higher areas of the central nervous system [12]. In their observation, Selvamurthy et. al. [25] stated that Yogic practices have the ability to decrease sodium and potassium concentration with decreased rennin activity in the circulating blood driving blood pressure towards normal range in the hypertensive patients. Reduction of norepinephrine and epinephrine following yogic practices may be another possible way to decrease systolic and diastolic blood pressure in the hypertensive patients with restoration of baroreceptor sensitivity. Besides, an insignificant change in arterial blood pressure with the significant reduction in resting heart rate was reported in a 10-week controlled trial of yoga and relaxation for moderately stressed people [26]. Conversely, even 15 days of pranayama and meditation practice may elicit benefits in cardiovascular functions irrespective of age, gender and BMI in 50 healthy volunteers at sea level [27]. RHR, SBP, DBP, RPP were found to be significantly correlated with BMI in pre-hypertensive men [28] though we found no significant correlation of BMI with any variables related to the cardiovascular health of the study participants at moderate altitude. Pal and his research team also advised lifestyle modifications to achieve the homeostasis and controlling blood pressure in pre-hypertensive individuals. Furthermore, reduction of rate pressure product (RPP) and the product of resting heart rate and mean arterial blood pressure (RHR-MAP) of healthy men are also observed in our study after one-month yoga training at an altitude of 1600m. They are the well-known estimator of myocardial oxygen consumption [29] and myocardial workload [30]. In a study of Polyvascular Abnormalities in Community, Wang *et al* suggested the higher the values RPP and RHR-MAP the more the chance of being affected by arterial stiffness [31]. The result of this study may also be helpful in this regard as we noted the decrease of these variables with the changes of individual parameters, used to calculate them. In a most recent meta-analysis Pascoe *et al*. reported shreds of evidence that indicate yoga asanas combined with other interventions may reduce RHR, SBP, DBP, MAP and these effects of yoga on cardiovascular functions are may be associated with the practice of physical postures and mindfulness meditation [23].

On the other hand, Peripheral capillary oxygen saturation is a noninvasive estimation of arterial hemoglobin oxygen saturation, which non-invasively measures the amount of oxygen in the blood. SpO2% of 97 ± 2% is considered to be normal for the healthy individual at sea level that [32] corresponds to the partial pressure of about 60 mmHg of O2 on the arteries. Lower SpO2% is often observed even at lower altitude [5] and sometimes used to predict moderate to severe acute mountain sickness [33] though in our study it was not observed. Recent studies showed the improvement of blood oxygen saturation after eight to twelve months of yogic practices [34] but in our observation, this is the only study to report improved SpO2% at moderate altitude post one-month yogic intervention. Improvement of SpO2% in this study may be due to practicing chest opening postures and breathing maneuvers [35] during the yoga sessions. Our finding may also be relevant in forming the acclimatization strategies as satisfactory SaO2% leads to a minimal increase in ventilation and reduced metabolic rate [11]. Our finding is opposite of the finding of Telles *et al*. who observed one-month training with uninostril and alternate nostril yogic breathing may increase oxygen consumption and heart rate of healthy male participants [36]. There is another study that produces no significant change in metabolism even after 3 months of yogic practices [37]. On the contrary, Pal et. al. [34] reported the significant decrease in oxygen metabolism after practicing 3months customized yoga module which also supports our study finding. In our view, these changes in the metabolic state following one-month yogic practices may be due to meditation and relaxing postures in this yogic module. Yoga may instead increase the efficiency of oxidative phosphorylation and thus, reduce resting O2 demand [38]. Likewise, in a classical literature, Wallace et. al. reported yoga as a hypometabolic conscious physiological state that may decrease oxygen consumption and carbon dioxide elimination [3]. In a study of savasana and meditation, Sarang & Telles reported calming yogic practices followed by stimulating practices may increase breath volume with reduction of resting oxygen consumption. Their result also supported the idea of the combination of resting asanas along with yogic postures may elicit more beneficial responses than only one does [8]. Thus in turn yoga may serve as a modality to improve physical, mental, cognitive performances of an individual by reducing the anxiety, tension, resting energy expenditure, oxygen consumption so that it may provide better cardiovascular reserve even at difficult terrain conditions. [4, 6, 9]. This is a single arm pre post-paradigm study with limited sample size hence, without a proper control group. This may be required to overcome possible interferences of the extraneous factors which may be responsible to cause any changes in the outcome measures. On the other hand, in our observation, it resembles the first study of yogic intervention with a customized yogic module on stress, metabolism and cardiovascular functions of healthy Indian men at an altitude of 1600m (5052 ft).

5. Conclusion

The study showed that one-month yogic training with the customized yoga module is beneficial to overcome stress, improve cardiovascular functions as well as reducing the resting metabolism of healthy Indian men at moderate altitude. This may, in turn, helpful in difficult stressful climatic conditions which have detrimental effects on cardiovascular as well as metabolic health. This research work may produce light on helping the induction of the participants from moderate to higher altitudes, required in different operational conditions. Yoga may be found helpful in this regard.

6. Acknowledgment

This research work was carried out in Defence Institute of Physiology and Allied Sciences (DIPAS), DRDO, Delhi. The administrative and financial support rendered by Director, DIPAS is gratefully acknowledged. The study was financially supported by DIPAS, DRDO, Delhi, India. We are grateful to all the staffs of our laboratory as well as our institute for their valuable contributions in completing this study. We gratefully acknowledge the official staffs of SSB, Assam, India and the participants without whom the study would not have been possible.

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