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Original Article

Effect of 12 weeks of pranayama training on basal physiological parameters in young, healthy volunteers

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Abstract:

Pranayamas are breathing techniques that exert profound physiological effects on pulmonary, cardiovascular and mental functions. It deals with the knowledge, control and enrichment of this vital force. The study was conducted to study the effect of 12 weeks of pranayama training on basal physiological parameters in young subjectson 60 healthy volunteers. After obtaining informed, written consent, subjects were randomized into pranayama (n=30) and control groups (n=30). Supervised training was given to the pranayama group by a certified yoga instructor and they practiced Pranava, Nadishodana and Savitri pranayamas. Basal physiological parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and respiratory rate (RR) were recorded at the beginning and after 12 weeks of study period. Pranayama training resulted in marginal improvement ($P>0.05$) in the measured cardiovascular parameters while RR decreased significantly from 17.66 ± 1.2 to 16.86 ± 0.92 ($P<0.01$). In control group there was no significant change ($P>0.05$) in the tested cardiovascular parameters such as HR, SBP and DBP. 12 weeks of pranayama training showed improvement in the tested basal physiological parameters with significant decrease in RR. The RR depends on mental-emotional activity and this decrease in RR may be attributed to a calm and stable mind-emotion complex in our subjects.

Keywords : Pranayama, Basal physiological parameters, Yoga.

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Introduction:

The spiritual-scientific discipline of yoga is the most precious gem of Vedic philosophy and our cultural heritage. It incorporates a wide variety of practices whose ultimate goal is the development of mental and physical health, well being, inner harmony and ultimate union of the human individual with the universal and transcendent existence (1-2). As a deep breathing technique, pranayama reduces dead space ventilation and decreases work of breathing. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs(3). Pranayama has variable effect on cardio-respiratory system (4). Regular practice of pranayama improves cardio-vascular and respiratory functions, improves autonomic tone towards parasympathetic system, decreases the effect of stress and strain on the body and improves physical and mental health(5-7). Versions of pranayama vary from single nostril breathing to bellow breathing and it consists of three phases: Purak (inhalation), Kumbhak (retention) and Rechak (exhalation) (8). Few previous studies found out the combined effect of slow and fast pranayama training (9). Also there is a paucity of data on the evaluation of the cumulative effect of commonly practiced pranayamas on basal physiological parameters (10). Hence the present study was planned to find out the cumulative beneficial effects of commonly prescribed pranayama training on basal physiological parameters in young, healthy volunteers.

Materials and Methods:

The present study was conducted in the Department of Physiology, JIPMER, Puducherry on 60 healthy volunteers of both genders.

Inclusion criteria:

Healthy volunteers of both genders in the age group of 18-30 years.

Exclusion criteria:

- History of chronic respiratory illness.
- Subjects receiving medication for any chronic ailment.
- Smokers and alcoholics.
- Athletes.
- Any history of previous yoga or bio feedback techniques training in the last one year.

The purpose of the study, procedures and benefits were explained to them in detail. The willing participants were randomized into pranayama (n=30) and control groups (n=30) after getting informed written consent, by simple randomization method using random numbers generated through computer. Average age of the volunteers was 18.58 ±2.27 (mean ± SD).Among these 60 volunteers, 45 were females and 15 were males. The study did not involve invasive procedures at any stage.

Parameters:

Basal physiological parameters including resting HR, SBP and DBP were measured after 10 minutes of supine rest using digital BP monitor (Citizen- CH 432B, Japan) and respiratory rate (RR) was recorded passively by observing the abdominal movements. The same procedure was followed while recording the values at the end of thestudy period.

Pranayama training:

Supervised pranayama training was given to the study group by a certified yoga instructor at Advanced Centre for Yoga Therapy Education and Research (ACYTER), JIPMER, Puducherry as per the guidelines of Morarji Desai National Institute of Yoga, New Delhi and they practiced Pranav pranayama,Nadishodana and Savitri pranayamas for 30 minutes/day, thrice/week for 12 weeks. Rests of the days, subjects were motivated to practice at their home.

Each round (7 minutes) of session consisted of practicing 2 minutes of Nadishodhana, Pranava and Savitri pranayama interspersed with 1 minute of rest between each pranayama and was done in comfortable posture (Sukhasana). Subjects were asked to perform nine or more rounds according to their capacity.

·**Nadishodhana pranayama** is rhythmic and slow alternate nostril breathing. One round consisted of inhaling through one nostril, exhaling through other nostril and repeating the same procedure through other nostril.

·**Savitri pranayama** is a slow, deep and rhythmic breathing, each cycle having a ratio of 2:1:2:1 between inspiration (Purak), held-in breath (Kumbhak), expiration (Rechak), and held out breath (Shunyak) phases of the respiratory cycle.

·**Pranava pranayama** is slow, deep and rhythmic breathing where emphasis is placed on making the sound AAA, UUU and MMM while breathing out for duration of two to three times the duration of the inhaled breath.

At the end of each session subjects were instructed to lie down in Shavasana and relax for 10 minutes. Control group were not involved in any of the pranayama training during this 12 weeks study period.

Ethics:

The study was conducted after obtaining clearance from the Institute Ethics Committee of JIPMER and carries less than minimal risks.

Statistical analysis:

Data for all parameters were collected as per the study protocol and computerized in Microsoft Excel database. Data was summarized by using descriptive statistics such as mean and SD. Longitudinal changes in each group were compared by using Student's paired t-test. All statistical analyses were done at 5% level of significance and $P<0.05$ was considered as statistical significant.

Results:

Mean age of the volunteers was (18.54 ± 1.65). Changes in Pranayama Group (n=30) and Control Group (n=30) before and after 12 weeks of study period on cardio-respiratory parametershas been given in Table 1. It shows a significant decrease in RR from17.66 ± 1.2 to 16.86 ± 0.92 ($P<0.01$) and marginal decrease in other parameters ($P>0.05$) such as SBP, DBP and HR indicates there was statistically significant improvement in the pranayama group participants on respiratory parameters and marginal improvement on cardiovascular parameters.

Discussion:

Pranayama, the fourth step of Ashtang Yoga is an important component of yoga training. 'Prana' is the vital life force that acts as a catalyst in all our activities and 'Ayama' is its control and expansion. Pranayama can be defined as the science of controlled, conscious expansion of Prana in our energy body sheath (3). Pranayama involves manipulation of breathing movements and the breath is a dynamic bridge between the body and mind. As a technique, pranayama can assume complex forms of breathing. But the essence of the practice is slow and deep breathing. Resting HR is determined mainly by parasympathetic tone and decrease in HR and BP indicates either an increase in parasympathetic activity or a decrease in sympathetic activity (11-12). Our results demonstrate that there was a significant reduction in RR in pranayama group. On the contrary, there was a significant increase in RR in the control group. There was a statistically insignificant but definite trend towards decrease in HR, SBP and DBP in pranayama group. According to the traditional wisdom of yoga, pranayama is the key for bringing about psychosomatic integration and harmony. By voluntarily controlling breathing pattern, it is possible to influence ANS functions(13). A study conducted by Kullok et al in 1990 explained changes in autonomic activity by breathing

Table 1: Comparison of tested basal physiological parameters before and after 12 weeks of study period (Mean ± SD)

Parameters	Pranayama Group (n=30)		Control Group (n=30)	
	Before	After	Before	After
HR (beats/min)	76.41 ± 5.48	75.15 ± 4.52	79.33 ± 3.65	80.47 ± 2.78
SBP (mmHg)	114.93 ± 10.11	113.03 ± 12.58	107.23 ± 13.55	111.4 ± 11.24
DBP (mmHg)	72.76 ± 7.29	71.586 ± 7.35	71.45 ± 6.791	73.73 ± 9.239
RR(beats/min)	17.66 ± 1.2	16.86 ± 0.92**	17.23 ± 1.22	18.33 ± 1.81***

Values are expressed as mean ± SD Analysis done by Student's paired t-test. *P<0.05, **P<0.01, ***P<0.001

exercises on the basis of known anatomical asymmetries in the respiratory, cardiovascular and nervous system and that the coupling mechanisms between each of these systems: lung-heart, heart-brain and lungs-brain are also asymmetrical (14).We propose that these changes might have been caused by pranayama practice resulting in an improved autonomic tone towards parasympatho dominance which leads to hypo metabolic state, relaxed state of mind and improved cardiac vagal tone. When the mind is relaxed and resting, parasympathetic activity increases and RR decreases. Increase in parasympathetic activity decreases resting HR and decrease in sympathetic tone in skeletal muscle, blood vessels, decreases peripheral vascular resistance and hence, decrease in DBP and improved tissue perfusion(13). Further our study substantiates the claim that pranayama practice is beneficial on cardio-respiratory function in healthy volunteers.

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