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Dhanraj Vaijinathrao
Research Scholar, Department Of Physical Education, OPJS University Churu, Rajasthan, India

Dr. Vikram Singh
Associate Professor, Department Of Physical Education, OPJS University Churu, Rajasthan, India

Correspondence
Dhanraj Vaijinathrao
Research Scholar, Department Of Physical Education, OPJS University Churu, Rajasthan, India

Impact of yoga practices on physiological and biochemical changes of Indian adolescents

Dhanraj Vaijinathrao and Dr. Vikram Singh

Abstract
Yoga is an ancient Indian science which teaches man how to live in unity within himself and with those around him. It is recognized as one of the most important and valuable heritages of India. More than 2000 years ago, our ancestors developed it to bind the body, mind and spirit, as a harmonious whole. It has been growing in popularity with unbelievable rapidity over the years. Today the whole world is looking towards yoga for answers to the various problems the modern man is facing.
Yoga is a way of life. It is an integrated system of education for the body, mind and inner spirit. This art of right living was perfected and practiced in India thousands of years ago but, as yoga deals with universal truths, its teachings are valid today as they were in the ancient times. Yoga is a practical aid, does not belong to one religion and its techniques could be practiced by the Buddhists, Jews, Christians, Muslims, Hindus and the Atheists alike.

Keywords: Yoga, life, mind, body, spirit

Introduction
Yoga is an art in all its aspects, from the most practical to the highest. It is a spiritual art, in the sense that it transforms the seer and brings him into contact with his inner soul. It is a fine art, since it is aesthetic, expressive, visual art, since the body is made to form geometrical designs, lines architectural shapes and the like which are beautiful to behold. It is essentially a useful art for the doer and is presented as a performing art for viewer.
Pranayama is an exact science. It is the regulation of breath which is the stoppage of inhalation and exhalation that follows after securing that steadiness of posture or seat, Asana. As the Bible states, "Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living being".
The Sanskrit word prana means 'vital force' or 'cosmic energy'. It also signifies 'life' or 'breath', Ayama means the control of the prana. Hence pranayama means control of the vital force by concentration and regulated breathing. It is physical, mental, spiritual and cosmic energy. All forms of energy are prana. Prana is usually translated as breath; which moves in the thoracic region absorbing vital energy; yet, this is the only one of its many manifestations in the body. So pranayama is the science of breath control. The movements of the thoracic organs include vertical ascension, horizontal expansion and a circumferential movement.
The aim of yoga is to attain perfection of the intellect, both of the head and the heart, so that, the artist becomes devoted, true and pure. This demands an almost total relinquishment of interest in other activities of life except the chosen path. The mind is fluid and runs after sensual pleasures. Art demands total undivided focal attention. Hence Patanjali explains that the mind must be controlled and then submitted to serve the artistic nature of yoga to its highest potency. Yoga or any art requires acute sharpness of intellect and alert organs of perception. In yoga, there is no competition but it requires freedom to think and reconstruct with a desire to perform better. Then it brings to the yogi the most exalted enlightenment.
Yoga is considered as a fully fledged science. The science of yoga consists of acquiring knowledge through observation and experiment. It is a science which deals with the body and mind controlling the body through the practice of Yoga to achieve the rhythm of mind. The health and strength of the body and the mind are acquired, only when a state of equilibrium is attained whereby the body and the mind are balanced. Like all other arts, Yoga is also a science as well as a philosophy too. As science is concerned with analyses Yoga too is bent on analysis.

Yoga analyses the turbulent mind and shows the ways and means of reaching the ultimate goal of freedom. As any other science, yoga too conveys truth. On a practical level, yoga keeps the body healthy the mind quite and pure, and self in beatitude. It is therefore a darsana. The practical aspect of yoga darsana conveys the artistic aspect of Yoga with its precision and beauty.

The science of yoga works on physical, mental, emotional, psychic and spiritual aspects of a person, when imbalance is experienced at this level, the organs, muscles and nerves no longer function in harmony, rather they act in opposition to one another. Therefore, yoga aims at bringing the different bodily functions into perfect co-ordination so that they work for the good at the whole body. Therefore yoga develops the personality of an individual mentally, morally, spiritually and intellectually.

The formation of self-concept is fundamental to the development of the individual's personality. Hence, self-concept means how a person thinks or feels about him/her self. It may be positive or negative. In recent years, there has been growing realization of the importance of self-concept in understanding and predicting the human behavior. A self-concept is an understanding that one is separate and independent person.

Yoga is union with all. It brings peace to the human beings by physical practices with or without a toner on spiritualism. As we live in the age of modern science and technology, our lifestyle has become very fast. It is also becoming very hard and difficult to live a natural and normal life because of the changing scenario of the world. The very air is becoming unfit for human consumption. Our cities are growing noisier, dirtier and congested. All these do create tension. The mind is always under strain due to various social evils. When we are under stress, our digestion is not proper and we may suffer from some fairly serious ailments like Asthma etc. and yoga comes to our rescue at this juncture.

Review of related literature

The reviews of related literature for better understanding of the study and to interpret the results have been presented in this study.

It was studied the physiological and biochemical changes following the practice of some yogic exercise. The result shows that the 12 normal subjects decreased average systolic blood pressure after 3 months of hatha yoga practices but returned to the pre-experiment value after 6 months. The average change involved was small. In contrast to the small changes in resting blood pressure observed in normal hypertension subjects who practiced yoga, there was observation of significant decrease in resting blood pressure of hypertension who practiced Corpse Posture with predominant of hypertension as an ailment. The serious circulatory ailments statistically correlated with hypertensive segments of the population. It is an encouraging result of research in yoga that considerable evidence has been found suggesting that a program of relaxation or meditation may be helpful in lowering blood pressure in hypertensive patients. It also helps to maintain blood pressure in hypertensive patients and in maintaining blood pressure control while decreasing the level of drug therapy.

The present study is on the effect of yoga on pulse and blood pressure among students – boys and girls in the age group of 16-18 years. The students were divided into two groups. One group was given yoga training for a period of 6 weeks while the second group acted as a control. Resting pulse rate and blood pressure was measured in both groups before starting the course and at the end of the course. Results were analyzed and compared. There was decrease in pulse rate and blood pressure after the yoga training in both boys and girls.

There were 38 males and 6 females in the age of 20-69 years (average year 42 years) original systolic pressure from 140 to 180 mm hg and diastolic pressure from 140 to mm hg and diastolic pressure from, 90 to 180 mm hg. They were taught to perform Savasana, twice a day for 30 minutes. The pulse rate, blood pressure and respiration were recorded before and after the practice. After three months of practice, the patients had a definite feeling of well being as they observed a marked impotent in headache, narrowness, irritability, factions etcetera, and also their average mean blood pressure reduced from 130 to 107 mm hg after the treatment.

Also a study was conducted on the effect of pranayama and transcendental meditation on the pulse rate and blood pressure of the male students. For this purpose, 75 college students were randomly assigned to one of the three groups. The first group performed pranayama, the second group performed transcendental meditation and the third group performed pranayama and transcendental meditation. Subjects in each group were trained with respective programmers for a period of six weeks, five days a week from Monday to Friday and two sessions of 20 minutes duration both in the morning and in the evening. Prior to and at the end of the training period, all the subjects were tested for pulse rate and blood pressure. The result showed that the pranayama reduced the blood pressure.

Transcendental meditation has a positive effect on systolic blood pressure only combined pranayama and transcendental meditation showed very good effect on all the physiological parameters.

It was studied that the effect of Yogasanas and Pranayamas on blood pressure, pulse rate and some respiratory function was effective. Two groups of male volunteers, 20-33 years in age and having the same experimental group consisted of 14 subjects in Yogasanas and Pranayamas for a period of six weeks. The group consisted of fourteen normal untrained subjects, who carried out non-yogic exercise - that is, long walk and playing light games. Pre-test and Post-test were conducted to both the groups before and after training. The results of both groups were compared. The trained persons had greater vital capacity, more tidal volume and less respiratory rate than the untrained group. The prescribed standard exercise increased the respiratory rate in both the groups who instead exhibited a corresponding increase in total volume.

A study was also conducted to find out the effect of short term yoga practice on ventilatory function test. For this purpose, 35 healthy normal male subjects were called, their age ranging from 20 to 15 years. The experimental group of 25 subjects underwent 10 weeks of yogic practices, 90 minutes daily in the morning.

Yoga training limited the exercise i.e., Surya Namaskar, Sharir Sanchalana, Eleven Asana, Pranayama and Prayer. A control group of 15 subjects were not performing yoga or any other physical exercise. All the subjects were tested for ventilator function in the beginning, before starting yogic training and practices and again after a period of ten weeks of yogic practices.

It was observed that

1. For the yoga group, the rate of respiration decreased significantly (PL .05) more than the control group.
2. Vital capacity has been found increased significantly in yoga than the control group.

Research methodology
In this study, the procedures followed towards the experimental design and procedure, selection of variables, instrument reliability, collection of data and statistical techniques have been explained.

Experimental Design and Procedure
The subjects selected for the present study were divided randomly into two equal groups called control and experimental, consisting of 20 adolescent boys and girls in each group. 12 weeks of yogasanas, pranayama and meditation training were given to the experimental group. The control group were not allowed to participate in any of the training programs, except their routine physical education classes.
Measurements for the variables were taken at the beginning (pre - test) and at the end of the experimental period, after twelve weeks (post - test) the data were collected for all the variables from both control and experimental groups, for five days. During this period the subject were not allowed to participate in any training.

Selection of variables
In the present study, the investigator referred different relevant literature and consulted with experts in biochemistry, physiology and psychology to identify most suitable variables.

Instrument Reliability
The instruments like Computerized Pulmonary Function Spiro meter, Mercury Manometer, Sphygmomanometer, Stethoscope, Forceps, Stop Watch, Nose Clip, Weighing Machine, Stadiometer and other instruments used for biochemical variables analysis were all manufactured by standard companies. The researcher conducted his research work in the Medical Research Institute laboratory; the instruments were standardized and reliable.

Statistical Technique
The data collected from the two groups on the selected Biochemical, Physiological and Psychological variables were used for the statistical treatment to find out whether or not there was any significant difference between the two groups by the analysis of covariance (ANCOVA) method. The level of significance was fixed at 0.05 level of confidence. All the statistical calculation was carried out using SPSS, 11.05 packages.

Hypotheses
It was hypothesized that there would be significant effects on biochemical, physiological and psychological variables as a result of twelve weeks of yogasanas pranayama and meditation practice when compared with the control group.
The hypothesis mentioned in the study is that there would be significant effect on biochemical variables as a result of twelve weeks of yogasanas, pranayama and meditation practice. The results of the study reveals that there is significant reduction in blood glucose, total cholesterol, triglycerides, low density lipoprotein, and very low density lipoprotein level. Since there is significant difference between the experimental group and the control group in the above mentioned variables, therefore the hypothesis has been accepted.

Findings of the study
1. Blood Glucose
It is observed that there is no significant change in the means of the blood glucose level on pre test between the control and the experimental groups. But the Blood Glucose level has decreased significantly for the experimental group after the twelve weeks of yogasanas, pranayama and meditation than the control group.

2. Total Cholesterol
There is significant difference between control and experimental groups on Total Cholesterol. The experimental group has higher level in pre test. However, due to Yogasanas, pranayama and meditation training, the Total Cholesterol level has been decreased significantly in the experimental group when compared with the control group.

3. Triglycerides
There is no significant difference in the Triglycerides of control and experimental groups of pre test, while it is decreased significantly in the experimental group than the control group due to yoga training.

4. High Density Lipoprotein
There are no significant differences between the control and the experimental groups of pre test and post test. But the High Density Lipoprotein level slightly increases in the post test of the experimental group than the control group.

5. Low Density Lipoprotein
There is significant difference in the Low Density Lipoprotein on pre test between control and experimental groups. Due to 12 weeks of yogasanas, pranayama and meditation, the Low Density Lipoprotein level is decreased in the post test of the experimental group than the control group.

6. Very Low Density Lipoprotein
No significant difference in Very Low Density Lipoprotein between pre test control and pre test experimental group. And because of 12 weeks of yogasana training, there is a significant change in Very Low Density Lipoprotein for the post test of the experimental group than the control group.

Data collection
The data has been collected from primary and secondary sources. The basic premises of my study are primary data but at the same time it is supplemented with the secondary data. The respondents were contacted personally and the research instrument use of gathering data was the questionnaire.
A study involving 50 healthy male subjects of 18–25 years age group, subjected to Mukh Bhastrika (yogic bellows), a type of pranayama breathing training for 12 weeks showed an increase in parasympathetic activity, that is, reduced basal heart rate, increase in valsalva ratio and deep breathing difference in heart rate; and reduction in sympathetic activity, that is, reduction in fall of systolic blood pressure on posture variation.
In a randomized controlled trial (RCT) conducted on 57 adult subjects with mild or moderate bronchial asthma, there was a steady and progressive improvement in pulmonary functions, the change being statistically significant in case of forced expiratory volume in first second (FEV1) volume at 8 week, and peak expiratory flow rate at 2, 4, and 8 weeks as compared with the corresponding baseline value and also a significant reduction in exercise induced broncho constriction as well as in Asthma Quality of Life (AQOL) scores in the yoga group compared with control group.

Delimitations

1. The study was restricted to forty college male students.
2. Forty male students were selected for the study, of which twenty was considered as the control group and the remaining twenty as the experimental group.
3. The age of the selected subjects ranged from 18 to 23 years and all of them were healthy and normal.
4. The twelve weeks of yogasanas, pranayama and meditation training were given for the experimental group.
5. The criterion variables selected for the study were confined to the following select yogasanas, pranayama and meditation on biochemical, physiological and psychological variables.

Definition and explanation of the terms

Yoga

Yoga is a method by which one can obtain control of one's latent powers. It offers the complete means to self realization. Yoga is a timeless pragmatic science evolved over thousands of years dealing with the physical, moral and spiritual well being of a man as a whole.

Pranayama

Pranayama means control of life force through the art of breathing. Pranayama means breath control. In Sanskrit, prana means breath and ayama means a control. In modern literature on yoga, prana, even in the compound pranayama, has been often interpreted to mean a subtle psyche force or a subtle cosmic element.

Prana means a subtle life force which provides energy to different organs (including mind) and also controls many vital life processes e.g. circulation, respiration etc. Ayama signifies the voluntary effort to control and direct this prana.

Meditation

Meditation essentially means temporary freedom thoughts. Unlike sleep, it is a "wakeful" thought – free state, in which all our senses are alert and awake. In fact, during meditation, we are many times more alert and awake than during our day-today life. It is a state of mind in which our thinking process comes to an end for a short period of time.

Lipid Profile

Lipids are insoluble in water but are soluble in alcohol and other solvents. When dietary fats are digested and absorbed into the small intestine, they eventually re-form into triglycerides, which are then packaged into lipoproteins.

Cholesterol

Cholesterol is the fatty substance formed in the blood. Cholesterol is a white fatty alcohol of steroid group, found in body tissue, blood and bile, assists in synthesis of vitamin D and various hormones. Excessive deposits of cholesterol on inside of arteries are associated with arteriosclerosis and coronary heart disease.

Statistical analysis

The effect of selected yogasanas, pranayama and meditation on biochemical, physiological and psychological variables of male students were examined using voluntary subjects randomly drawn into two groups of twenty each. One group acted as the control group and the other group acted as the experimental group. The twelve weeks of yogasanas, pranayama and meditation training was given only for the experimental group and the other group did not do any physical training. The data for the above mention variables were collected prior to the training (pre test) and after twelve weeks of training (post test). The analysis on the effect of 12 weeks of yogasanas, pranayama and meditation training on the biochemical, physiological and psychological variables were statistically examined by analysis of covariance (ANCOVA).

Table 1: Analysis of Covariance for Pre Test and Post Test Data on Blood Glucose of Control Group and Experimental Group

	Control Group	Experimental Group	Source of variance	Sum of squares	df	Mean squares	'F' ratio
Pre Test Mean	84.60	84.85	Between	0.625	1	0.625	0.008
SD	10.007	7.350	Within	2929.350	38	77.088	
Post Test Mean	82.65	74.75	Between	624.100	1	624.100	12.776*
SD	6.667	7.297	Within	1856.300	38	48.850	
Adjusted Post Test Mean	82.681	74.719	Between	633.649	1	633.649	13.942*
			Within	1681.562	37	45.448	

* Significant at 0.05 level.

Required table value at 0.05 level of significance for 1 & 37 degrees of freedom = 4.104 1 & 38 degrees of freedom = 4.096

Significance of the study

The finding of the study would reveal the effect of select yogasanas, pranayama and meditation on biochemical, physiological and psychological variables of male students.

1. The study would provide scientific base and guidance to the physical educationist, coaches and players to understand the effect of select yogasanas, pranayama and meditation on biochemical, physiological and psychological variables of male students.
2. The present study would give some basic knowledge to the sports scientists to conduct further research in the area of physiological, biochemical and psychological variables.
3. The result of the study would add to the quantum of knowledge in the area of sports training, exercise biochemistry and exercise physiology related to yogasanas, pranayama and meditation.
4. This study will help to create awareness among the citizens to understand the importance of yogic training.

Conclusion

Based on the research findings the following conclusions were drawn in the present study.

1. The results of the biochemical variables like Blood Glucose, Triglycerides, High Density Lipoprotein and Very Low Density Lipoprotein were not significantly different in the pre test between the experimental and the control groups. Whereas in the total cholesterol and low density lipoprotein there is a significant difference in the pre test control group.
2. The biochemical variables like Blood Glucose, Total Cholesterol, Triglycerides, Low Density Lipoprotein and Very Low Density Lipoprotein have significantly decreased after a period of twelve weeks of yogasanas, pranayama and meditation in the post test experimental group when compared to the pre test control and experimental groups.
3. It is inferred that the yoga practice did not lead to

significant changes in the High Density Lipoprotein of the pre test and the post test control and the experimental groups and also the adjusted post test mean.

4. The results of the study have shown that the Physiological Variables like Forced Vital Capacity (FVC); Forced Vital Capacity First Second (FEV1) and Peak Expiratory Flow Rate, Pulse Rate, Systolic Blood Pressure, Diastolic Blood Pressure and Rate Pressure Product did not show any significant changes in the pre test control and experimental groups. Whereas in the Maximum Expiratory Pressure and Maximum Aspiratory Pressure reveal that there existed significant changes in the pre test control and the experimental groups.
5. In the Physiological Variables like Forced Vital Capacity, Forced Vital Capacity First Second and Peak Expiratory Flow Rate, there is no significant increase in the post test experimental group after the twelve weeks of yogasanas, pranayama and meditation practice. But there is a significant change in the adjusted post test mean.
6. In the Systolic Blood Pressure there is no significant difference in the pre test and post test experimental group but in the Diastolic Blood Pressure there is significant difference in the post test experimental group and the Adjusted post test mean.

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