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Dr. Surinder Singh
Assistant Professor, Badri
Vishal P.G. College,
Farrukhabad, Uttar Pradesh,
India

Dr. Ashok Kumar Malik
Assistant Professor,
Chaudhary Devi Lal
University, Sirsa, Haryana,
India

Dr. Arun Khatri
Assistant Professor, Kalinga
University, Raipur,
Chattisgarh, India

Influence of select asanas and pranayamas on the cardio-vascular efficiency of girl students

Dr. Surinder Singh, Dr. Ashok Kumar Malik and Dr. Arun Khatri

Abstract

Introduction: Yoga is an ancient science based on a harmonizing system of development for the body, mind and spirit. The ultimate goal of Yoga is ‘Salvation’ (i.e *Kavalya/Moksha*) through ‘Self-realization.’ In modern world the essence and motive of the great Indian philosophy of Yoga has changed and shrink only up to health and wellbeing. Its ultimate aim has been forgotten. So the only aspects related to physical, physiological and psychological health and well being comes under the preview of modern Yoga. Many scientific researches asserted that a regular and disciplined yoga practice may immensely helpful in improving physical, physiological and psychological functions. This study aimed at assessing the effect of Asanas and Pranayamas on the cardio-vascular efficiency of adolescent girls.

Material and Methods: This is an experimental study with pre & post-test experimental design. Through purposive sampling a group of 45 volunteer girl students of age group 12-15 years of standard VIIth to Xth are selected. These subjects are randomly divided into three equal groups of 15 subjects each. Besides general warming up, Group A and B have gone through yogic exercises for one hour daily in morning for 6 days a week during twelve-week training program under strict supervision of the researcher. Group A (Asana group) has given some select Yogasanas, Group B (Pranayama and Kriya group) has given some select Pranayamas and Kapalbhati Kriya, and Group C is a controlled group and has not given any type of exercise except general warming-up exercises. All the three groups have been pre-tested and post-tested for select physiological component viz. Cardio-vascular fitness. The change in the dependent variable is credited to the particular exercises given to the groups.

Results: For Asana Group as well as Pranayama-Kriya Group, the t-value is found statistically highly significant at 5% level of significance for 14 degree of freedom.

The calculated F-value [$F(0.05, 2, 42) = 26.42, p = 0.00$] of post-tests is found statistically significant. So the post-tests mean differences between the groups are significant.

Conclusion: The present study showed that there is a significant effect of Yogic training on the Cardio-vascular efficiency of girl-students. Both Asanas as well as Pranayamas are beneficial in improving cardio-vascular efficiency. Pranayamas and Kapalbhati Kriya are little bit more effective than Asanas in enhancing Cardio-vascular efficiency of girl-students.

Keywords: hathayoga, asana, pranayama, kriya and cardio-vascular efficiency

1. Introduction

Yoga is an ancient science based on a harmonizing system of development for the body, mind and spirit. Originally, the concept of Yoga has emerged from ancient Indian literature. Indian literature is a treasure of vast knowledge based on systematic, scientific and empirical research by Authoritative Research Scientists (*Maharishis*). We can trace the footprint of the philosophy of Yoga in Indian sacred books viz. the Vedas, the Upvedas, the Upanishads, the Vedangs, the Upangas and the Puranas, the Ramayana and the Mahabharata.

Yoga is a branch of Indian soteriology i.e. a religious doctrine whose purpose is to achieve ‘Salvation’ for its practitioners. The ultimate goal of Yoga is ‘Self-realization’ which means ‘the realization of one’s true identity as the self’.

According to Yogic scriptures, Yoga leads to the union of individual consciousness (*Aatma*) with that of the universal consciousness (*Ishwar*), showing a complete solidarity between the mind and body and also between man & nature. Yoga is the situation of beatitude when all the five senses detach from their subjects and stable with mind, and the mind also detach from the anti soul gesticulations.

Correspondence
Dr. Surinder Singh
Assistant Professor, Badri
Vishal P.G. College,
Farrukhabad, Uttar Pradesh,
India

In modern world, the essence and motive of the great Indian philosophy of Yoga has changed and shrink only up to health and wellbeing. The ultimate goal of Salvation (i.e. *Kavalya/Moksha*) through Self-realization has been forgotten. The modern human want to achieve what he can perceived through senses and he don't want to confuse with that which is beyond the capacity of his senses. So the only aspects related to physical, physiological and psychological health and well-being comes under the preview of modern Yoga or more precisely say Asanas and Pranayamas.

Now a day, modern Yoga is a popular discipline practiced in whole world especially in India and western world. It is used as preventive as well as curative measure to attain health and well-being. A growing body of research evidence supports the belief that certain yoga techniques may improve physical and mental health. Many studies have been published throughout the world, which highlight the beneficial effect of practicing Yoga (more particularly Hathayoga) on human health. Many scientific researches asserted that Yogic practice produce consistent and beneficial physical, physiological and psychological changes. A few weeks of regular and disciplined yoga practice may immensely helpful in improving many physiological and psychological functions. Sasi Kumar A. et al [1]. examine the effects of Surya namaskar on cardio-vascular and respiratory parameters in school students. The study inferred that Surya namaskar practice improves pulmonary and cardio-vascular function besides general health and fitness. Some researches revealed the effect of a particular Asana on blood pressure [2]. Some previous studies proposed that Yoga has immense power to slow the aging process. Normally cardiovascular parameters alter with aging but these changes are slower in persons who practice Yoga regularly. So with the intervention of Yoga the morbidity and mortality from cardio-vascular diseases due to aging can be reduced [3]. The present study aimed at assessing the effect of select Asanas and Pranayamas on the cardio-vascular efficiency of adolescent girls.

In our present study few technical terms are used. These terms are discussed here with the meaning they connote in the study.

Asana

Hathayoga describes Asana in different way than *Astanga* Yoga. In Patanjali's '*Yoga darshanam*', Asana is defined as '*Sthira Sukham Asanam*' i.e. An Asana is posture in which we can sit in a steady and comfortable manner. It is the third limb of Patanjali's eightfold path (*Astanga Yoga*) following the *Yamas* and the *Niyamas*. Any particular poses is not specify in any *sutra* of the *Yogadarshanam*. The *Yogadarshanam* provides us a straight way path of *Moksha* (*Kavalya*) through *Samadhi*. *Astanga Yoga* of Maharishi Patanjali describes Asana as a stable and comfortable sitting posture used for meditation.

In Hathayoga, the term 'Asana' is used for a particular physical posture, which not only provides the practitioner physical and mental health but also provides a path for opening the energy channels and psychic centers, commonly known as *Kundlini Jagran* in Hathayoga. Historically, different texts and *Rishis* have described different numbers of Asanas. For Instance, the *Shiva Samhita* describes 84 Asanas, the *Hathayoga Pradipika* describes 15 Asanas and the *Gherand Samhita* describes 32 Asanas. In Present study, the word Asana is used in the context of Hathayoga. So the

meaning of Asana should be taken in the context of Hathayoga.

Pranayama

The word Pranayama consists of two words, '*Prana*' means breath and '*ayama*' means dimension or expansion. In the *Yogadarshanam*, Pranayama is to stop the motion of inhaling and exhaling as per strength. In another words, to control or regulate the life force i.e. *prana* is called Pranayama. Different types of Pranayamas are described in various texts. In the *Yoga darshanam* three main types of Pranayamas are described viz. *Bahiya Pranayama*, *Abhyantra Pranayam* and *Stambhvriti Pranayama*, whereas, in the *Hathayoga Pradipika* and the *Gherand Samhita* eight types of Pranayamas, with slight difference from each other, are described.

Kriya

The word Kriya in the study connotes the *Shudhi Kriyas* or the purification processes. In Hathayoga, six purification processes are described viz. *Dhoti, Vasti, Neti, Nauli, Tratak* and *Kapalbhati*. Among these six Kriyas, only Kapalbhati comes in the purview of our study.

Cardio-vascular efficiency

The cardio-vascular efficiency is generally referred as the efficiency with which the cardio-vascular system (heart, lungs and blood vessels) distribute blood and oxygen to the body cells. It is a measurement of how effectively the circulatory system performs its functions. It is generally measured by counting number of beats per minute and calculating the maximum volume of oxygen that is taken by an individual during exercise.

Hathayoga

For a common man, there is no difference between Yoga and Hathayoga. Generally, some parts of Hathayoga like Asana and Pranayama are practiced by common people. And for common people these Asanas and Pranayama is Yoga. However, Yoga is a very broad concept and is of many types. Hathayoga is one of the types of Yoga and further Asanas and Pranayamas are only the parts of Hathayoga. Hathayoga is also known by other names viz. *Hathavidhya, Kundaliniyoga* and *Pranayoga*. The word '*Hatha*' means with firmness or perseverance.

2. Material and Methods

2.1 Participants

A group of 45 volunteer girl students studying in standard VIIth to Xth have been selected from the campus of Govt. Sr. Sec. School, Ritauli, Rohtak. The age group range lies between 12 to 15 years. Furthermore, these 45 students have been divided equally into three groups on random basis, consisting of 15 students each. Each group has subjects of equal status with respect to age, diet, socio-economic conditions and residential area.

2.2 Design

The study is an experimental one, where pre & post-test experimental designs have been followed. In the present study, three groups of students were selected through purposive sampling procedure and given specific exercises with general warming up. Here Group A and B have gone

through yogic exercises daily for one hour during morning session. The training program consists of twelve week for 6 days a week under strict supervision of the researcher. Both the experimental groups were assigned specific exercises after general warming up and each group named accordingly. Group A (Asana group) has given some select Yogasanas, Group B (Pranayama and Kriya group) has given some select Pranayamas and Kapalbhati Kriya, and Group C is a controlled group and has not given any type of exercise except general warming-up exercises. All the three groups have been pre-tested and post-tested for a select physiological component viz. Cardio vascular fitness. The change in the dependent variable or say component is credited to the particular exercises given to the groups.

The different groups were given different exercises.

Group A (Asana group) practiced the following twelve Yoga sanas during training. Viz. Halasana, Matsyasana, Paschimottanasana, Chakarasana, Padahasta Asana, Ardha Chandrasana, Yoganindrasana, Dhanurasana, Kurmasana, Mayurasana, Naukasana, Shirshasan. Group B (Pranayama and Kapalbhati group) was given the following five Pranayamas and one Kapalbhati Kriya during training viz. Bahiyah Pranayama, Abhyantara Pranayama, Stambhavriti Pranayam, Bhramri Pranayama, Bhastrika Pranayama, Kapalbhati Kriya.

2.3 Tool used

Measurement of the cardio-vascular condition

The Harvard Step Test is used to measure cardio-vascular condition. The test is developed by Brouha *et al.* (1943) during Second World War in the Harvard Fatigue Laboratories for testing aerobic fitness. Skubic and Hodgkins proposed a three minute step test for girls and women. Here the word 'girls' connotes junior as well as senior high school girls. In the present study Harvard Step Test for College Women and Girls by Skubic and Hodgkins is used. This cardio-vascular endurance test measures the person's ability to recover after a strenuous exercise. This test asserted that after strenuous workout more quickly the heart returns to normal condition, the better is the cardio-vascular efficiency. The Harvard step test easily computes the cardio-vascular capability of the subjects to exercise continuously for the extended length of time without fatigue.

Scoring

The cardiovascular efficiency score (CES) in this test is determined in a manner similar to the short form of the Harvard Step Test.

Cardiovascular efficiency $\frac{100 \times \text{No. of Seconds Completed.}}{\text{score (CES)} = 5.6 \times \text{Pulse Count}}$

Test duration is 180 seconds (if completed the whole 3 minutes)

So, Cardiovascular Efficiency Score (CES) =	18000. 5.6A
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Where, A is pulse count between 1 to 1.5 minutes after finishing the test.

2.4 Data analysis

The data obtained through pre-tests and post-tests will be compiled and tabulated for the particular variable and also group wise. The statistical analysis will be done on a computer by using SPSS 16.0 version. At the initials stage, the values of means, standard deviations, t-values for the variable viz. cardio-vascular condition will be computed to know the level of significance of the differences between pre-scores and post-scores of the variable.

At the second stage, Analysis of Variance (ANOVA) will be applied separately on both pre-tests as well as post-tests of the variable. ANOVA will be applied against the variable to know the significance of differences among various exercise groups. F-value and P-value will provide us level of significance at the .05 level of confidence. Furthermore, if significant difference will be shown by F-value and P-value, then Scheffe's post hoc test in ANOVA will be applied for multi comparison between groups. The results will be tabulated to know the level of significance of differences among various groups. A detailed computation will be given in the form of tables and graphs.

3. Results

Results of the study are shown in Table 1 to 3 and Fig. 1

Table 1: Paired t-test statistics of harvard step test (for Cardio-Vascular condition) for two experimental groups and one control group

Groups	Pre - Test		Post - Test		t Value	P value
	Mean	S.D.	Mean	S.D.		
Asana	46.71	1.23	50.35	1.20	21.19**	0.00**
Pranayama & Kriya	46.92	1.85	51.58	2.13	21.36**	0.00**
Control	47.15	1.79	47.19	1.65	0.23	0.81

*P<.05 = 2.145, ** P<.01 = 2.977

A paired t-test is applied on the paired data obtained by pre-test and post-test from each group individually. Table 1 facilitates the comparison of pre and post means, standard deviations, t-values and P-values of all three groups.

For Asana Group, the t-value [$t(14) = 21.19, p = 0.00$] is found statistically highly significant at 5% level of significance for 14 degree of freedom.

For Pranayama-Kriya Group, the t-value [$t(14) = 21.36, p = 0.00$] is also found statistically highly significant at 5% level of significance for 14 degree of freedom.

Whereas, for Control Group, the t-value [$t(14) = 0.23, p = 0.81$] is found statistically insignificant at 5% level of significance for 14 degree of freedom.

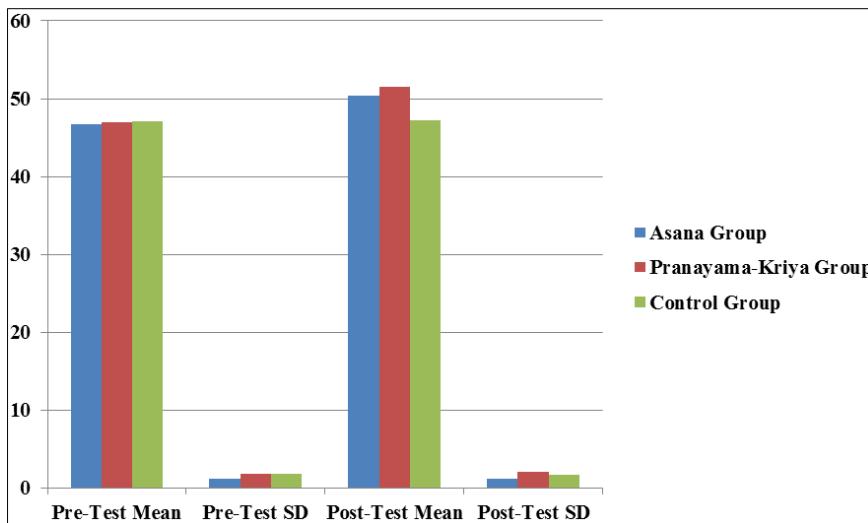


Fig 1: Graphical representation of pre-test and post-test Means and SD of Harvard Step Test (for Cardio-vascular condition) for two Experimental Groups and one Control Group.

Table 2: Analysis of variance statistics for two experimental groups and one control group on harvard step test (for cardio-vascular condition)

	Asana Group	Pranayama-Kriya Group	Control Group	Ss	DF	MS	F	P
Pre-test Means	46.71	46.92	47.15	B.G: 1.45 W.G: 114.82	2 42	0.726 2.73	0.26	0.77
Post-Test Means	50.35	51.58	47.19	B.G: 154.04 W.G: 122.40	2 42	77.02 2.91	26.42**	0.00**

*P<.05 = 3.22, ** P<.01 = 5.15

ANOVA is applied on the data obtained by pre-tests (of 45 subjects of all three groups) and also on post-tests (of same 45 subjects of all three groups) separately, to determine whether there is a statistically significant mean difference among pre-tests' and post-tests' values of these groups.

The calculated F-value [$F(0.05, 2, 42) = 0.26, p = 0.77$] of pre-tests is found statistically insignificant. So the pre-tests mean differences between the groups are insignificant.

The calculated F-value [$F(0.05, 2, 42) = 26.42, p = 0.00$] of post-tests is found statistically significant. So the post-tests mean differences between the groups are significant.

Table 3: Multiple comparisons of posttest on harvard step test (for cardio-vascular condition) by scheffe method in post –hoc test in ANOVA

Asana Group	Pranayama-Kriya Group	Control Group	Mean Difference	P Value
50.35	51.58		1.23	0.15
50.35		47.19	3.16	0.00**
	51.58	47.19	4.39	0.00**

*P<.05 = 3.22, ** P<.01 = 5.15

Scheffe's Post-hoc test in ANOVA is applied on the data obtained by post-tests (of 45 subjects of all three groups) to obtain results by multiple comparison between groups.

Post-tests' multiple comparisons

The post-test mean difference of Asana group with Pranayama-Kriya Group is 1.23. The P-value indicates that their means difference is statistically insignificant.

The post-test mean difference of Asana Group with Control Group is 3.16. The P-value indicates that their means difference is statistically highly significant.

The post-test mean difference of Pranayama-Kriya Group

with Control Group is 4.39. The P-value indicates that their means difference is also statistically highly significant.

4. Discussion

The present study, on the basis of the results, showed that there is a significant effect of yogic training on the Cardio-vascular efficiency of girl-students. The subjects of Group A, who practicing the Yogasana (or Asana) during training schedule showed that their cardio-vascular efficiency has been improved after practicing Asanas for twelve week. The Same changes are measured in Group B, who practicing Pranayama and Kapalbhati kriya during training Schedule of same tenure. Whereas no such changes in the cardio-vascular efficiency of group C (Control group) are measured. So, it can be inferred that even practicing a part of Yoga (i.e. either practicing Asanas or practicing Pranayama or both) in daily life provides better cardio-vascular efficiency or say aerobic performance.

Moreover, from the results, it can be inferred that Pranayamas and Kapalbhati Kriya are little bit more effective than Asanas in enhancing Cardio-Vascular efficiency of girl-students.

The results of our study are consistent with many previous studies. The study by Eliska Sovova *et al* [4]. On positive effect of Yoga on Cardio respiratory fitness, showed that the group practicing the Yoga in Daily Life system had better aerobic performance than controls performing other aerobic physical activity for the same amount of time per week. They concluded that in spite of low energy expenditure during sessions, yoga has a positive effect on individuals' aerobic performance. An another study by Robert G. Holly [5] also indicate that regular Hathayoga practice can elicit improvements in the health-related aspects of physical fitness. The study further proposed that Cardio-respiratory

endurance, as measured by $\text{VO}_{2\text{max}}$, is significantly increased by Hathayoga practice.

A study by Ramos-Jimenez A., *et al* [6]. on senior physically active women reported that a proposed Hathayoga schedule improves physical fitness and reduces cardio-vascular disease (CVD) risk factors in physically active adult women. The study further asserted that heart rate during Hathayoga exercise, asana performance skills and percentage assistance to the intervention program, determined about 42-89% of the changes in cardiovascular health in senior physically active women.

The present study was conducted to examine effect of 12-week (6 days a week) Asanas and Pranayamas practice on girl students. The Hathayoga training of same tenure was also conducted by Caren Leu *et al* [7]. to study the effects on cardio-respiratory endurance, muscular strength and endurance, and lower back and hamstring flexibility in Hong Kong Chinese adults. Their study results asserted that a 12-week Hathayoga intervention has favorable effects on cardio-respiratory endurance, muscular strength and endurance, and flexibility in Chinese adults.

Some studies examine the effect of short term Yoga training schedules; the results of such studies also strengthen the findings of our present study. Roopa B. Ankad *et al* [8]. studied the short-term effect of Pranayama and Meditation on Cardiovascular Functions, the findings of the study asserted that regular practice of Pranayama and Meditation for minimum of 15 days is beneficial in improving the cardiovascular functions even in healthy individuals irrespective of age, gender, and BMI. In another research by Bodhe *et al* [9]. also reached at the same inference that a short term practice of Pranayama shows a significant decrease in heart rate and systolic blood pressure in young healthy volunteer.

The present study has examined the influence of Asana and Pranayama on girl-students i.e. on adolescents. Suchitra B Parkhad *et al* [10]. also examined the effect of Yoga on indices of cardio-vascular system on 200 adolescent school going girls. The inferences of the study are also consistent with our inferences. The study proposed that after yoga training a given level of exercises produced a milder cardiovascular response, suggesting a better exercise tolerance. Further, exercise produced a significant increase in heart rate (HR), systolic pressure, rest pressure product (RPP) and double product (DoP), and a significant decrease in diastolic pressure.

The results of the study by Dr. Tamal Chakraborty *et al* [11]. are also compatible with our results. Dr. Tamal Chakraborty *et al*. Conducted a study to find the effects of some simple Yogic Asanas and Pranayamas on select cardiovascular function. To accomplish the research 39 elderly healthy individuals (both men and women) between 50 to 70 years of age were selected. The study revealed that after 6 week of yoga practice there is an improvement in cardio-vascular functions and also observe a significant decrease in mean Arterial Pressure (MAP), Resting Heart Rate(RHR), Heart Rate post exercise (HRPE), Heart Rate Recovery Time (HRRT).

5. Conclusion

The present study showed that there is a significant effect of yogic training on the Cardio-vascular efficiency of girl-students. Both Asanas as well as Pranayamas are beneficial in improving cardio-vascular efficiency. Moreover, from the

results, it can be inferred that Pranayamas and Kapalbhati Kriya are little bit more effective than Asanas in enhancing Cardio-vascular efficiency of girl-students. However further studies are required for more precise comparison.

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