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Dr. Limon Kumar Saha
Assistant Professor, Department of Physical Education, Post Graduate Govt. Institute for Physical Education, Banipur, West Bengal, India

Corresponding Author:
Dr. Limon Kumar Saha
Assistant Professor, Department of Physical Education, Post Graduate Govt. Institute for Physical Education, Banipur, West Bengal, India

Impact of yoga asana on selected physiological variables

Dr. Limon Kumar Saha

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Abstract
Now a days, our modern society realise about the significance of yoga in their daily life. That's why the present investigation was taken as an initiative to find out the effect of yoga asana on selected physiological variables among high school boys. The study was conducted on 60 high school boys of Banipur Baniniketan high school, divided into two groups equally, namely control and experimental group. Their age ranged from 12 to 14 years. The experimental group treated by a six weeks training programme based on yoga asana whereas the control group did not undergo any type of training. Respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure, and breathe hold time were selected as physiological variables and were measured using the standardized tests before and after given the treatment. Analysis of covariance (ANCOVA) was employed to analysis the data statistically. In results, significant effects were observed on respiratory rate, heart rate, systolic blood pressure and breathe hold time whereas in case of diastolic blood pressure, insignificant result was found.

Keywords: Yoga asana, respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure, breathing hold time

1. Introduction
Yoga is an ancient India body of knowledge that deles back more than 5000 years ago. Yoga asana is being utilized from the most fundamentally personal to the social and educational implication of the society as a whole. No matters how times and life styles change the judgment of the ancient sages in matters relating to life and conduct is still relevant. Even though our attitude to the nature of yoga asana itself may be different from those who was instalment before in its evolution, its wisdom applies. It is also a spiritual pursuit for many seekers of truth. In the modern world, western countries like America use yoga as a tool for mental, physical and spiritual development keeping behind their financial saturation to find peace.

Yoga asana may be an important tool for every individual to maintain health and to improve quality of life. Asana are simple action for keeping the internal and external parts of the body in good health. Yogic exercises affect by and large all the organs and systems of the body. Yoga asana has gained popularity as a way to achieve relaxation through relaxation posture or shavasana when yoga asana stripped its mystical elements, yoga asana emerges as a safe, enjoyable and relaxing flexible programmers.

From the last decade some changes are observed in thoughts of our society and they are now little more conscious about their health. Though we are busy in our daily schedule, we need to spend some time to maintain our health and to lead a productive life style. Various studies suggested that yoga asana has fruitful results in this regard. That's why the present study was an initiative to find out that whether yoga asana has any effects or not on physiological variables among high school boys.

2. Methodology
The primary objective of the study was to investigate regarding the effect of yoga asana practices on respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure and breathe hold time. Sixty subjects were selected at random basis from the age group twelve to fourteen [12-14] years studying in class VII and VIII of Banipur Baniniketan High School, Banipur, Barasat Sub-division, north 24 Parganas. Sixty students were divided in two groups, one was experimental group and another was control group which consist 30 students.

Only male students were selected. The experimental group treated by a six weeks training programme based on yoga asana whereas the control group did not undergo any type of training. Pre-tests and post tests were conducted to measure the selected parameters.

2.1 Criterion measures

Variables	Tools	Unit
Respiratory rate	Stopwatch and blank matches box,	In numbers
Heart rate	Blood pressure monitor	bpm
Blood pressure	Blood pressure Monitor	mm/hg
Breath hold time	Nostril clip	In sec.

2.2 Training Schedule

Table 1: Training Schedule

Name of Asana	Week	Total no. of Asana	Monday	Wednesday	Friday	Saturday
Chakrasana, Poschimottasana, Ushtrasana, Sarvangasana, Dhonurasana, Karnopithasana, Vujangasana, Halasana, Ardhachandrasana, Shirshasana	1st	8	Exer.15min. 35min asana	Exer.15min. 35min asana	Exer.15min. 35min asana	Exer.15min 35min asana
	2nd	10	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min 40min asana
	3rd	10	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min 40min asana
	4th	10	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min 40min asana
	5th	10	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min 40min asana
	6th	10				
			Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min. 40min asana	Exer.10min 40min asana

2.3 Training Protocol: The following training protocol was followed b\y the researcher during the training session.

Table 2: Show training session

Frequency	04 days in a week
Duration	50 minutes
Time	2:30 pm to 3:20pm

2.4 Statistical procedure

Analysis of covariance (ANCOVA) was employed to analysis the data statistically at 0.05 level of significance and to identify the significance differences on experimental and control groups the mean critical difference was used as a post-hoc test.

3. Results and Discussion of Findings

Table 3: Analysis of covariance of experimental and control group on respiratory rate

Test	Control Group Mean	Treatment Group Mean	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test	20.3000	20.1333	Between	0.4167	1	0.4167	0.0436
			Within	553.7667	58	9.5477	
Post Test	20.9000	17.6333	Between	160.0667	1	160.0667	14.559*
			Within	637.6667	58	10.9943	
Adjusted Post Test	20.8438	17.6895	Between	149.131	1	149.131	22.026*
			Within	385.931	57	6.771	

*Significant at 0.05 level of confidence

The table value required for significance at 0.05 level of confidence for df(1,58) & (1,57)=4.01

Table 4: Post HOC Test for the Difference between the Adjusted Post Test Means on Respiratory Rate

Group	Adjusted Means	Mean difference	Critical difference
Experimental Group	17.6895	3.1543*	1.343
Control Group	20.8438		

*Significant at 0.05 level

The above table no. -3 depicts that the descriptive statistics of Respiratory rate as mean and standard deviation of control group and experimental group were 20.30±2.87 and 20.13±3.30 in pre-test and in post-test were 20.90±3.80 and 17.63±2.75 respectively. Table no.-3 also shows that there was no significant difference between control group and experimental group in pre-test as it indicates that both groups were in homogeneous in nature. However in post-test and adjusted post-test significant differences were found in similar table as calculated 'F' ratio in both cases were higher than table value. The table regarding Post Hoc test also supported the similar result. So, we can conclude that the training programme regarding yoga asana in present study is able to decrease the respiratory rate.

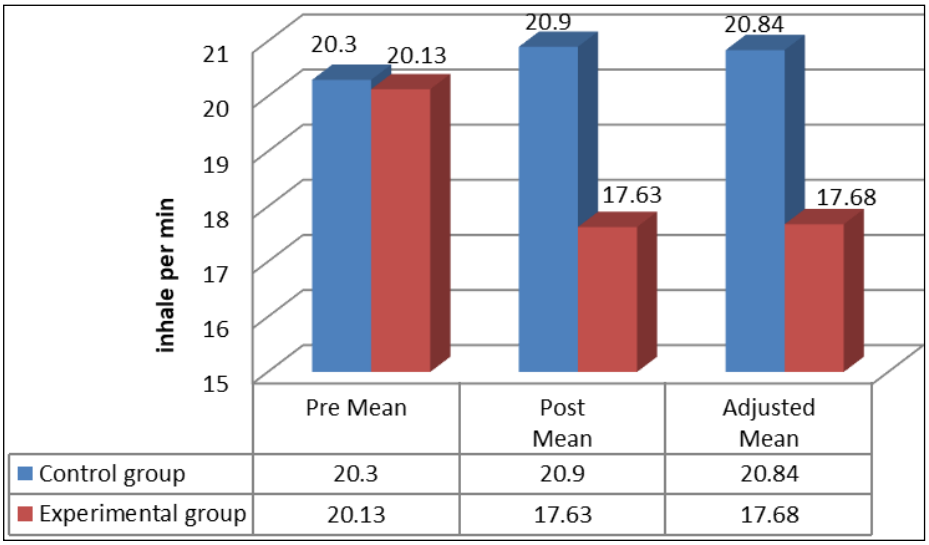

Fig 1: Graphical Presentation of Respiratory Rate Regarding Mean of Control Group and Experimental Group in Pre and Post Phases

Table 5: Analysis of Covariance of Experimental and Control Group on Heart Rate

Test	Control Group Mean	Treatment Group Mean	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test	72.2000	71.9000	Between	1.3500	1	1.3500	0.129
			Within	607.5000	58	10.4741	
Post Test	72.8000	70.0000	Between	117.6000	1	117.6000	20.132*
			Within	338.8000	58	5.8414	
Adjusted Post Test	72.7241	70.0759	Between	104.969	1	104.969	32.614*
			Within	183.455	57	3.219	

*Significant at 0.05 level of confidence.
The table value required for significance at 0.05 level of confidence for df (1,58) & (1,57) = 4.01

Table 6: Post HOC Test for the Difference between the Adjusted Post Test Means on Heart Rate

Group	Adjusted Means	Mean difference	Critical difference
Experimental Group	70.0759	2.6482*	0.926
Control Group	72.7241		

*Significant at 0.05 level

The above table no.-5 depicts that the descriptive statistics of heart rate as mean and standard deviation of control group and experimental group were 72.20±3.63 and 71.90+2.78 in pre-test and in post-test were 72.80 ± 2.57 and 70.00+2.24 respectively. Table no.-5 also shows that there was no significant difference between control group and experimental group in pre-test as it indicates that both groups were in homogeneous in nature. However, in post-test and adjusted post-test significant differences were found in similar table as calculated 'F' ratio in both cases were higher than table value. The table regarding Post Hoc test also supported the similar result. So, we can conclude that the training programme regarding yoga asana in present study is able to decrease the heart rate.

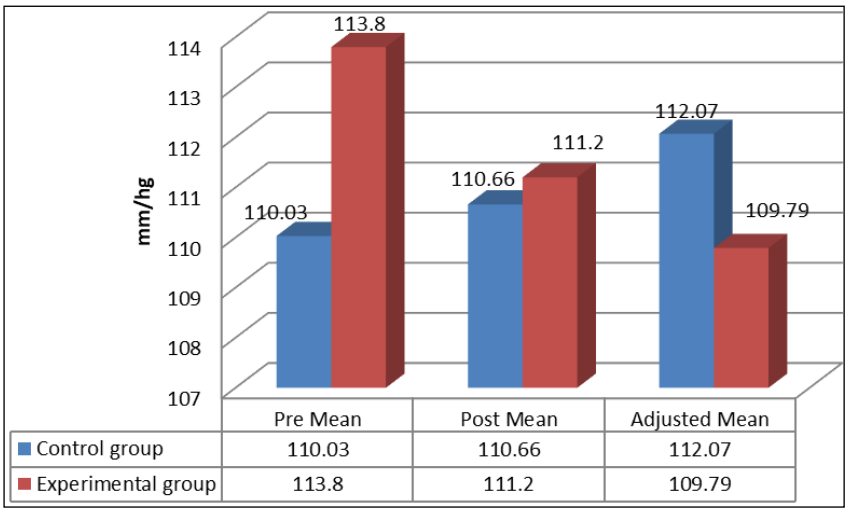

Fig 2: Graphical Presentation of Heart Rate Regarding Mean of Control Group and Experimental Group in Pre and Post Phases

Table 7: Analysis of Covariance of Experimental and Control Group on Systolic Blood Pressure

Test	Control Group Mean	Treatment Group Mean	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test	110.033	113.80	Between	212.8167	1	212.8167	1.584
			Within	7793.7667	58	134.3753	
Post Test	110.666	111.20	Between	4.2667	1	4.2667	0.0479
			Within	5161.4667	58	88.9908	
Adjusted Post Test	112.076	109.790	Between	76.301	1	76.301	5.470*
			Within	795.143	57	13.950	

*Significant at 0.05 level of confidence
The table value required for significance at 0.05 level of confidence for df (1,58) & (1,57) = 4.01

Table 8: Post HOC Test for the Difference between the Adjusted Post Test Means on Systolic Blood Pressure

Group	Adjusted Means	Mean difference	Critical difference
Experimental Group	109.790	2.286*	1.928
Control Group	112.076		

*Significant at 0.05 level

The above table no.-7 depicts that the descriptive statistics of systolic blood pressure as mean and standard deviation of control group and experimental group were 110.03±9.55 and 113.80±13.32in pre-test and in post-test were 110.66±9.22 and 111.20±9.63 respectively. Table no.-7 shows that there was no significant difference between control group and experimental group in pre-test and post-test. However, in adjusted post-test significant difference was found in similar table as calculated 'F' ratio was higher than table value. The table regarding Post Hoc test also supported the similar result. So, we can conclude that the training programme regarding yoga asana in present study is capable to minimize the systolic blood pressure.

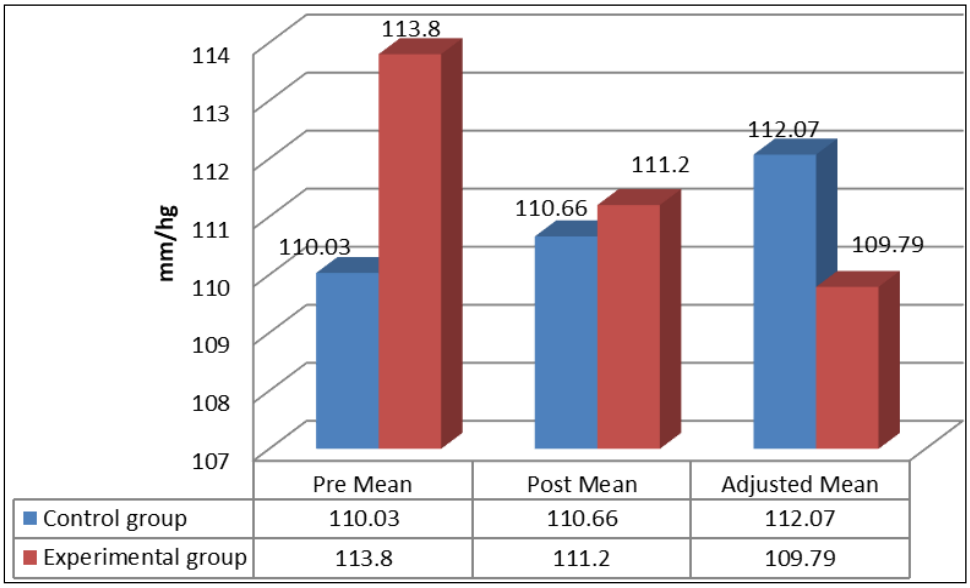

Fig 3: Graphical Presentation of Systolic Blood Pressure Regarding Mean of Control Group and Experimental Group in Pre and Post Phase

Table 9: Analysis of Covariance of Experimental and Control Group on Diastolic Blood Pressure

Test	Control Group Mean	Treatment Group Mean	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test	69.2333	71.0000	Between	46.8167	1	46.8167	0.694
			Within	3911.3667	58	67.4374	
Post Test	69.8667	69.0000	Between	11.2667	1	11.2667	0.246
			Within	2651.4667	58	45.7149	
Adjusted Post Test	70.4421	68.4246	Between	60.333	1	60.333	3.468
			Within	991.968	57	17.398	

*Significant at 0.05 level of confidence

The table value required for significance at 0.05 level of confidence for df (1,58) & (1,57) = 4.01.
The above table no.-9 depicts that the descriptive statistics of Diastolic Blood Pressure as mean and standard deviation of control group and experimental group were 69.23+6.67 and 71.00+9.50 in pre-test and in post-test were 69.87+6.57 and 69.00+6.94 respectively. Table no.-9 shows that there was no significant difference between control group and experimental group in pre-test, post-test and adjusted post-test as calculated 'F' ratio in all cases were lesser than the table value. The table regarding Post Hoc test also revealed that insignificant differences existed between control group and experimental group. So, we can conclude that the training programme regarding yoga asana in present study is not able to make any changes in diastolic blood Pressure.

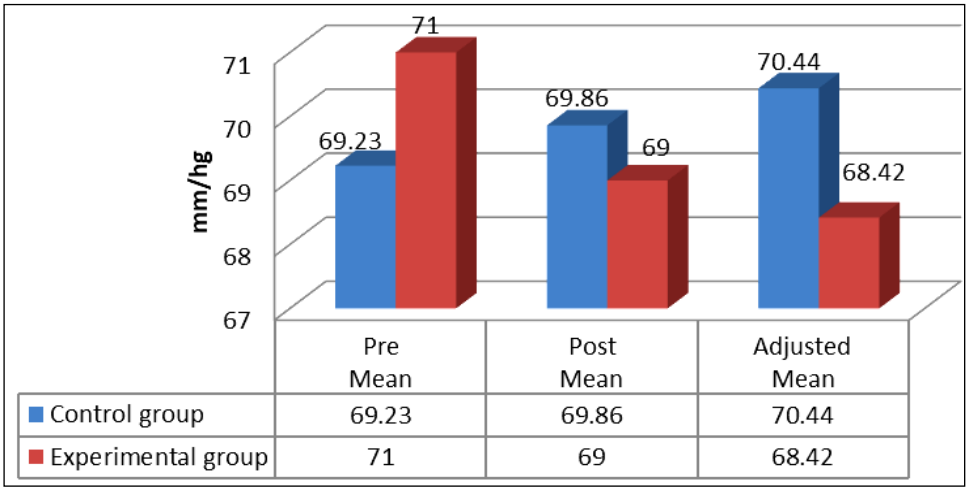

Fig 4: Graphical Presentation of Diastolic Blood Pressure Regarding Mean of Control Group and Experimental Group in Pre and Post Phases

Table 10: Analysis of Covariance of Experimental and Control Group on breath Hold Time

Test	Control Group Mean	Treatment Group Mean	Source of Variance	Sum of Squares	DF	Mean Squares	F-ratio
Pre-Test	34.577	35.506	Between	12.927	1	12.9270	0.217
			Within	3460.206	58	59.6587	
Post-Test	36.343	44.491	Between	995.930	1	995.9300	13.375*
			Within	4318.673	58	74.4599	
Adjusted Post-Test	36.809	44.025	Between	778.108	1	778.108	53.628*
			Within	827.026	57	14.509	

*Significant at 0.05 level of confidence.
The table value required for significance at 0.05 level of confidence for df (1,58) & (1,57) = 4.01.

Table 11: Post HOC Test for the Difference between the Adjusted Post Test Means on breath Hold Time

Group	Adjusted Means	Mean difference	Critical difference
Experimental Group	44.025	7.216*	1.966
Control Group	36.809		

*Significant at 0.05 level

The above table no.-11 depicts that the descriptive statistics of Breathe Hold time as mean and standard deviation of control group and experimental group were 34.57+7.16 and 35.51+8.24 in pre-test and in post-test were 36.34+7.94 and 44.49+9.27 respectively. Table no.-11 shows that there was no significant difference between control group and experimental group in pre-test as it indicates that both groups were in homogeneous in nature. However, in post-test and adjusted post-test significant differences were found in similar table as calculated 'F' ratio in both cases were higher than table value. The table regarding Post Hoc test also supported the similar result. So, we can conclude that the training programme regarding yoga asana in present study is able to improve the breathe hold time.

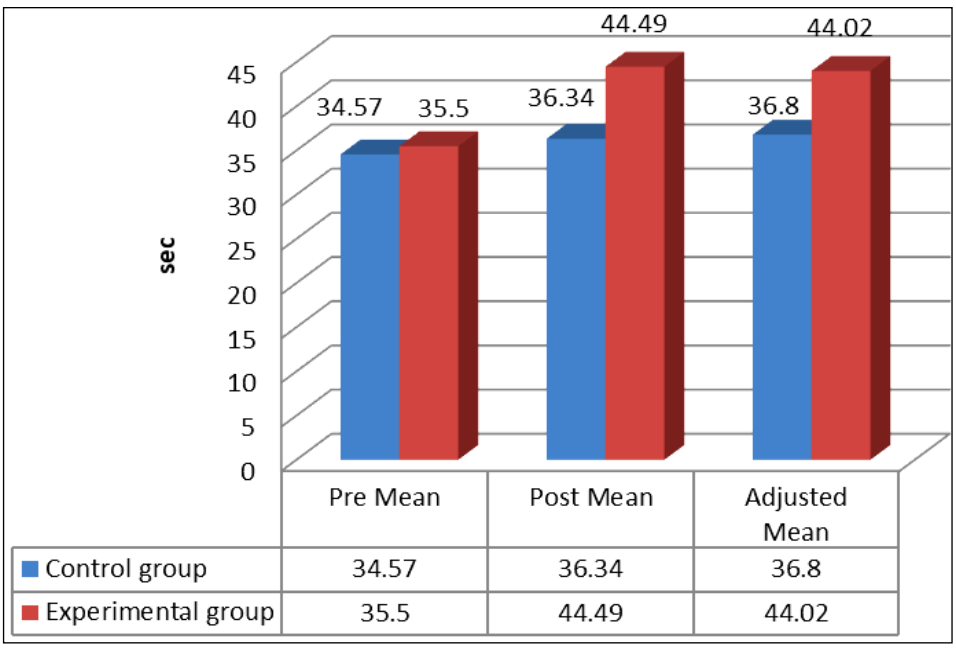

Fig 5: Graphical Presentation of Breath Hold Time Regarding Mean of Control Group and Experimental Group in Pre and Post Phases

Divya *et al*. (2017) [4] found similar results and according to them such results were attributed due to modulation of autonomic activity where there is a parasympathetic predominance. The modulation is mediated through modification of breathing patterns, which triggers various central and autonomic mechanisms along with mechanical and hemodynamic adjustments causing both tonic and phasic changes in cardiovascular functioning.

4. Conclusions

On the basis of the finding the following conclusions have been drawn:

1. Decrease in respiratory rate was observed due to six weeks training programme of yoga asana.
2. Decrease in resting heart rate was observed due to six weeks training programme of yoga asana.
3. Decrease in systolic blood pressure was observed due to six weeks training programme of yoga asana.
4. There was no positive effect found after six weeks yoga asana training programme on diastolic blood pressure.
5. There was an improvement found after six weeks yoga asana training programme on breathe hold time.

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