



## Effect of Yoga Training on Cardio-respiratory Parameters and Electrocardiogram Recording

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### Abstract

#### Background:

In modern life everyone experiences stress because of highly competitive and challenging lifestyle. Yogic practices results in an overall improvement of the various physiological functions of the body.

#### Aim:

To determine whether Yoga training improves cardio-respiratory function

#### Methods:

The study was a prospective study conducted on fifty healthy subjects of age group 15-50 years (inclusive of both males and females) where the study parameters were assessed before the start of Yoga training and after 3 months of Yoga training under expert guidances. Heart rate, blood pressure, RR ratio, Valsalva ratio and respiratory function tests including FVC, FEV<sub>1</sub>, PEFR and FEF<sub>25-75%</sub> were assessed. Statistical analysis was done by using T test.

#### Results:

There is decrease in heart rate (HR) and blood pressure (BP) while there is increase in RR ratio and Valsalva ratio after Yoga training. And the changes are more significant in younger age group. There is significant increase in mean FVC, FEV<sub>1</sub>, PEFR, FEF<sub>25-75%</sub> and significant decrease in ST segment in the ECG findings after Yoga training.

#### Conclusion:

There is improvement in the cardio-respiratory function after Yoga training. The greater improvement in the cardiovascular function in younger age group show that practice of Yoga at younger age is more beneficial before the cardiovascular changes due to aging, have sets in. The finding will have significant impact on physical health among the people of Manipur.

**Key words:** Yoga training, cardiovascular changes, electrocardiogram, respiratory function

### INTRODUCTION

Yoga is a discipline which seeks to bring the internal environment of an individual under his control, thereby making a good adjustment of the individual with his surrounding.<sup>1</sup> The psychosocial stressful situation activates hypothalamo-pituitary-adrenal

gland axis, glucocorticoids and aldosterone level in the plasma increases causing salt and fluid retention which increases blood volume and blood pressure imposing severe strain on the heart. By giving rest to the mind and body, yoga can shake off many disorders of psychosocial origin.<sup>2</sup> Practice of Yoga asanas and pranayama result in overall improvement

in cardiorespiratory function and physical fitness which improves ones tolerance to stressors.<sup>3</sup> One simpler and inexpensive method of overcoming the stress and stress induced cardiovascular complication is the practice of Yoga.<sup>4,5</sup> The present study is undertaken to extend the application of Yoga training as an alternative therapy or as adjunct to conventional therapy of diseases and to help in the recommendation of Yoga for any health benefit programme.

## MATERIAL AND METHODS:

The study was a prospective study conducted in the Department of Physiology, RIMS, and Imphal in collaboration with Yoga Training and Research Centre, Imphal (registration no. 38 of 1987). Fifty (50) healthy subjects of age group 15-50 years (inclusive of both males and females) who had never undergo Yoga training were include in the study. An

a) On Monday, Tuesday, Thursday and Friday:

Breathing practices- 5 mins  
Instant relaxation technique – 1 min  
Loosening exercise – 10 mins  
Quick relaxation technique -5 mins  
Surya namaskar - 3 mins  
Asanas- 30 mins  
Deep relaxation technique - 6 mins

b) On Wednesday

Loosening exercise - 7 mins  
Surya namaskar - 3mins  
Pranayama - 50 mins

c) On Saturday

Loosening exercise - 30 mins  
Quick relaxation technique - 5 mins  
Surya namaskar - 5 min  
Deep relaxation technique - 20 mins

Parameters studied were:

- Baseline Heart rate (HR) and Blood Pressure (BP)
- ECG
- BP response to standing (RR ratio)
- HR response to Valsalva manoeuvre (Valsalva ratio)
- Respiratory function test includes FVC, FEV<sub>1</sub>, PEF and FEF<sub>25-75%</sub>

The following test parameters were performed in the specific sequence as given below.

informed written consent was obtained from the participants after explaining the purpose of the study. The control group was formed by the subjects before the yoga training and the study group was formed by the same subject after 3 months of Yoga training. Those who are having active sports training, past Yoga training, pregnancy, smoking and alcohol consumption were excluded from the study.

On the day of the test, the procedure was explained to the subject and were asked to relax mentally and physically for 30 minutes. The subjects were made to wear loose clothing and metallic objects were not allowed to wear. The resting time after each test was 5-10 minutes.

All the subjects were given regular Yoga training by an expert for a period of 3 months for 1 hour daily in between 7 to 8 am for 6 days per week. The schedule is listed here:

1) Resting heart rate

- Apparatus: Electrocardiograph (Cardiart 108T/MK-ECG machine).
- Procedure: Lead II of ECG was selected for recording heart rate. Calibration was done and maintained throughout the procedures. Tracing speed was 25 mm/sec. HR was recorded in supine position by conventional method during normal quite breathing for a period of 1 minute. The average RR interval was measured, manually and HR was calculated (HR= 1500/RR interval).

2) Resting blood pressure (systolic and diastolic BP)

- Apparatus: Mercury sphygmomanometer (Diamond), stethoscope (Microtone)
- Procedure: BP was recorded with a mercury sphygmomanometer in supine position in right upper limb by auscultatory method using astethoscope. Three (3) readings were taken at an interval of 15 minutes each and average of the three values was taken.

3) ECG recording

A twelve leads ECG in supine position was recorded by means of Cardiart

108T/MK, BPL limited. The voltage and duration of P wave, QRS complex, T wave as well as PR interval and ST segment were recorded.

4) RR ratio

- a. Apparatus: ECG machine (Cardiart 108T/MK), timer
- b. Procedure: After a complete rest of 10 minutes in supine position, the ECG recording was started and the subject assumed erect posture as quickly as possible within 3 seconds with continuous ECG recording.
- c. Calculation: The ratio of the longest RR interval around 30<sup>th</sup> beat after standing to the shortest RR interval around 15<sup>th</sup> beat after standing were calculated for the result of RR ratio.

5) Valsalva ratio

- a. Apparatus: ECG machine ( Cardiart 108 T/MK), timer, modified mercurial sphygmomanometer ( in which a mouth piece and a body tube of a 50 ml disposable hypodermic syringe in place of the air pump is connected to tube leading to mercury bulb with a small leak in the mouth piece)
- b. Procedure: The test was done after another 5 mins interval of rest in sitting position. The subject was

instructed to exhale forcefully through the mouth piece of the modified mercurial sphygmomanometer and to maintained pressure in the manometer upto 40 mmHg for 15 seconds. ECG recording was taken during the manoeuvre and continued for about 30 seconds after the performance. The manoeuvre was repeated for 3 times with a 5 minutes time interval of rest.

- c. Calculation: The ratio of the longest RR interval after blowing, to the shortest RR interval during blowing or immediately after blowing was calculated. The highest ratio of the 3 manoeuvres was used as the result of Valsalva ratio (VR).

6) Respiratory function tests

Parameters were recorded by means of a Medspiror ( Recorders and Medicare System, Chandigarh) in the laboratory of Department of Physiology, RIMS, Imphal. Three consecutive tests were taken with a rest of 10 – 15 minutes between two spirometric sessions. The best result among the three were recorded.

Statistical analysis was done by using software SPSS 13 and t test was used to analyze the data and to determine the p value.

**RESULTS**

The result obtained are expressed as mean±standard deviation. The age of the subject ranges from 15-50 years with a mean age of 32.5 years.

**Table 1: Cardiovascular changes**

Tests	Age group (years)	No. of cases	Before yoga (mean ) A	After yoga (mean) B	Mean difference (B-A)	p-value
HR (Beats/min)	<40	32	76.06	69.59	9.469	0.078
	≥40	18	78.11	71.39	6.722	

SBP (mmHg)	<40	32	124.25	115.63	8.625	0.502
	≥40	18	127.89	118.44	9.444	
DBP (mmHg)	<40	32	80.25	73.25	7.000	0.751
	≥40	18	83.44	76.00	7.444	
RR ratio	<40	32	1.163	1.325	-0.1625	0.143
	≥40	18	1.126	1.218	-0.0927	
Valsalva ratio	<40	32	1.372	1.649	-0.2768	0.026*
	≥40	18	1.221	1.380	-0.1588	

\*indicates significant (p<0.05) value

Table 1 shows that decrease in HR in age <40 years after yoga training is greater than that of ≥40 years although this change is statistically insignificant. The decrease in SBP and DBP after yoga training is more in age ≥ 40 years than that of the <40 years which is statistically insignificant. RR ratio increases after yoga training but greater increase is seen in < 40 years which is statistically insignificant. Valsalva ratio increases significantly after yoga training in both the age and the increase is greater in < 40 years.

**Table 2: ECG finding before and after yoga training**

Parameters	Before yoga (mean±SD)	After yoga (mean±SD)	p-value
P wave (duration in ms)	0.056±0.013	0.058±0.014	0.261
P wave (voltage in mV)	0.157±0.134	0.143±0.06	0.473
QRS (duration in ms)	0.066±0.024	0.08±0.104	0.348
QRS (voltage in mV)	0.892±0.194	0.938±0.211	0.214
T wave (duration in ms)	0.124±0.038	0.119±0.034	0.119
T wave (voltage in mV)	0.291±0.192	0.274±0.082	0.569
PR interval (ms)	0.145±0.019	0.139±0.018	0.066
ST segment (duration in ms)	0.135±0.020	0.130±0.017	0.022*

\*indicates significant (p<0.05) value

Table 2 shows that after yoga training there is no significant change in ECG finding except significant decrease in ST segment duration ( $p=0.022$ )

**Table 3: Respiratory function before and after yoga training**

Parameters	Before yoga (mean±SD)	After yoga (mean±SD)	p-value
FVC (litre)	2.426±0.538	3.716±0.891	<,0.000**
FEV1 (litre)	2.177±0.428	2.929±0.69	<0.000**
PEFR (L/sec)	6.856±2.327	8.679±1,70	<0.000**
FEF <sub>25-75%</sub> (L/ sec)	3.376±0.975	3.955±0.870	<0.000**

\*\*indicates highly significant ( $p<0.05$ ) value

**Table 3 shows there is statistically significant improvement in the respiratory function after yoga training.**

#### DISCUSSION:

In the present study it is found that there is reduction in HR, SBP and DBP in both the age groups (<40 years and  $\geq 40$  years) after yoga training.<sup>6,7,8,9</sup> And the reduction in HR and BP is greater in younger age group of age <40 years although it is not statistically significant.<sup>10</sup> RR ratio show insignificant increased after yoga training in both age groups.<sup>9,11</sup> And the increase in RR ratio is more in age <40 years than  $\geq 40$  years. Valsalva ratio increases significantly in both the age groups and the increase is greater in age <40 years.<sup>7,9,12,13</sup> There is statistically significant improvement in the respiratory function after yoga training.<sup>14,15,16</sup> There is no significant changes in ECG finding after yoga training which is almost similar with the finding of Maini S et al<sup>17</sup> except for the significant decrease in ST segment duration.

#### CONCLUSION:

The study suggest that yoga training has great values in improving cardio-respiratory health. And it is found to be more beneficial in younger people before the age related cardio-respiratory changes sets in. Moreover yoga training can be recommended as an alternative or as adjunct to conventional therapy of diseases.

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