

# MODULATION OF ANAEROBIC BIOMARKER AND LUNG FUNCTIONS BY RAJYOGA MEDITATION IN YOUNG BADMINTON PLAYERS

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## ABSTRACT

**Background:** Exercises of different forms, if performed regularly, have a beneficial effect on the various systems of the body. Badminton is claimed to be the world's fastest racket sport. Aside the technical, tactical, and training aspects of modern competitive badminton, the physical demands are continually changing. Relaxation techniques like Rajyoga meditation have been used in sport primarily to enhance recovery from training and competition, manage anxiety and improve performance.

**Aims & Objective:** To compare the efficacy of physical performance in badminton players, before and after with regard to Rajyoga meditation.

**Material and Methods:** 35 male badminton players were studied prospectively before and six months after practicing Rajyoga meditation. Blood lactate concentration and Pulmonary functions were assessed immediately after 10 minutes of exercise. Other Physical Parameters like BMI, pulse rate, blood pressure were also assessed before and after 6 months of meditation and analysed using longitudinal study.

**Results:** Student's paired 't' test was used to compare pre & post interventional results. After the relaxation training, blood lactate concentration after exercise was significantly decreased ( $p < 0.05$ ). All parameters of lung functions showed statistical improvements after meditation, there was significant differences with regard to BMI, blood pressure and pulse rate all were significantly decreased ( $p < 0.05$ ).

**Conclusion:** The results obtained emphasize the beneficial effect of Rajyoga meditation. Finding of the present study suggests that Rajyoga meditation can alter blood lactate levels and pulmonary functions after exercise.

**KEY-WORDS:** Lactate; Rajyoga Meditation; Lung Functions; Anaerobic Biomarker

## Introduction

Exercises in different forms, if performed regularly, have a beneficial effect on the various systems of the body. The modality of exercise that is most beneficial and economic for masses has now become the topic of research.

Badminton is a very popular sport in the world. It is claimed to be the world's fastest racket sport, there are great changes in the playing pattern and speed. It is more skill and technology oriented.<sup>[1]</sup> The increased match duration and work-to-rest ratio after the first game further suggests that contemporary competitive badminton may require different training strategies and preparation. Aside from the technical, tactical, and training aspects of modern competitive badminton, the physical demands are continually changing, with players in action demonstrating

intense rhythmic movement involving shuffling, jumping, twisting, stretching, striking with a combination of superior anticipation, quick reflexes, and superb visual acuity –all in a reactive context.

The conventional exercises (endurance exercises like walking, jogging, running, swimming, cycling, etc.), which give stress on cardiovascular and respiratory systems and test the responses of these systems, are very popular.<sup>[2]</sup>

However, there are not sufficient data on badminton to allow a more realistic assessment of energy expenditure in competitive matches. It is not known which the most important aspects of performance in badminton are, what should be improved to increase playing level, and what factors lead to favourable results. This is compounded by ignorance of certain parameters

of play that can be related to performance in competition and their effect on the final result.<sup>[3]</sup>

Relaxation techniques have been used in sport primarily to enhance recovery from training and competition, manage anxiety, and improve performance.<sup>[4]</sup> Rajyoga is the path of Yoga that focuses on meditation and contemplation.<sup>[5]</sup> Rajyoga meditation of Brahma Kumaris is a behavioural intervention which is simple to practice.<sup>[6]</sup> Relaxation of body mind with positive approach has been successfully achieved by Rajyoga meditation (autogenic relaxation) providing training in realization of true self. Rajyoga is one of the training courses of Rajyoga Education and Research foundation of Brahma Kumaris World Spiritual University.<sup>[7]</sup>

At the onset of the exercise, since ready energy materials are used, lactate is not formed. Later, lactate is formed, since the energy is obtained by breaking down the glycogen without oxygen. Lactate thus formed, is eliminated by the buffer systems of the organism. However, when lactate production is excessive, it accumulates in the muscles and the blood. Lactate measurements during exercise yield information on the intensity of the workload and on its duration.

The lung function tests, like other physiological tests must be of the utmost importance for measuring the fitness of an individual from a physiological point of view. The pulmonary functional capacities of normal sedentary individuals have been studied extensively in India. In the context of an athletic population, such studies are rather scanty and have also been carried out by the researchers on a small sample. Hence, the present study was undertaken with a view to determine the pulmonary functions in badminton players.

Hypothesis: It is hypothesized that there will be significant difference between pre and post intervention parameters in badminton players.

## Objectives

1. The blood lactate levels and pulmonary functions in badminton players before and after Rajyoga meditation.

2. The role of Rajyoga meditation (autogenic relaxation therapy) for modulating physiological parameter.

## Materials and Methods

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### Study Set-Up

The Study was conducted in Research Laboratory Department of Physiology in co-ordination with Department of Biochemistry and with Rajyoga trainer. It is a longitudinal type of study.

### Study Group

35 healthy male badminton players ( $18 \pm 3$  years old) were recruited purely on voluntary basis. These players were playing daily for 1 hr since 6 months and had not received any such relaxation technique prior were enrolled for study based on inclusion and exclusion criteria, and assessed before and six months after practicing Rajyoga meditation. Volunteers had not been engaged in Rajyoga practice nor were they playing badminton at least during 3 years preceding the study as assessed by enquiring in detail. Smokers, alcoholics, subjects who were in non-sedentary occupations, post-operative patients and subjects suffering from any hernia, subjects with history of any cardiovascular disorder, subjects with a history of respiratory tract infection symptoms during previous 6 weeks and subjects suggestive of any active respiratory disorder were excluded by thorough history and clinical examination.

Blood lactate level was assessed with the help of semiautoanalyzer (enzymatic colorimetric method). A randox company kit was used for estimation. Pulmonary functions were assessed by computerized spirometry. Physical parameter like BMI was calculated by weight (kg)/height ( $m^2$ ) ratio. The subjects were asked to relax physically and mentally for 30 minutes in supine position in a silent room. In the same position, the pulse rate and the blood pressure were recorded. The pulse rate in beats per minute was recorded in the right radial artery by palpatory method for whole one minute, blood pressure in millimeter of mercury (Hg) was recorded with a sphygmomanometer (Diamond), in the right upper limb by auscultatory method were taken at an interval of 15 minutes each and average of the

three values calculated, before and after 3 months of meditation.

### Study Protocol

The screening of subjects was done and clearance of Institutional Ethics Committee was obtained. After selection of the subjects, they were explained about the detailed plan of work and aim of present research project. The volunteers were briefed about the study protocol, they were motivated for the training and for compliance needed till the end of the study and written informed consent was obtained from them.

Before the actual meditation given, baseline parameters were recorded. The subjects were motivated for the exercise regimen and meditation they had to follow during the entire 6 month period. After 6 months all the parameters were again studied (it was confirmed that the participants had completed the courses satisfactorily & none of the subjects who met the initial criteria were dropped because of inadequate participation in the training.)

The subjects were instructed not to practice any meditation technique other than the prescribed ones and advised to refrain from other physical exercises during the study. Participants were allowed to do their routine activities during the study period. The subjects were taught Rajyoga meditation techniques and they practiced the same, 6 days/week for 60 min daily morning (6.30 am-7am) and evening (6.30pm-7pm), for a total duration of 6 months. Rajyoga meditation was given by the Rajyoga trainer.

### Manipulation Check

To know the compliance with regard to the practice of the techniques every 15 days subjects were checked. They were also asked if they had experienced specific signs of relaxation during the practice. The latter was performed as an additional compliance control.

### Test Procedure

On the day of recordings, the subjects were familiarized with the laboratory environment and their height, weight, pulse and blood pressure

were recorded. Height was measured by stadiometer (cm), weight was measured by digital scale (kg) and BMI was calculated as weight/height<sup>2</sup> (kg/m<sup>2</sup>). Pulse rate by palpation of left radial artery. Blood pressure was measured by digital sphygmomanometer.

*Lactate Measurements:* Lactate measurements were done Pre meditation (start of study) and post meditation (after six months of meditation). We examined blood lactate after 10 minutes of playing badminton with the subject sitting relaxed in a comfortable chair. 2 ml blood was drawn from the antecubital vein, serum (20 µl) was obtained after centrifugation and was immediately analyzed using the lactate-mediator oxidase color reaction technique with BTR semi auto analyzer.

*Pulmonary Function Tests:* Pre meditation (at the start of study) and post meditation (after 6 months of meditation) lung function measurements were done in the morning about 2 hr after a light breakfast by single investigator. On the day of recording (both pre and post training), badminton and meditation was not done. All the lung function parameters viz. forced vital capacity (FVC), forced expiratory volume at the end of first second to forced vital capacity ratio (FEV<sub>1</sub>/FVC ratio), forced expiratory flow rate (FEV<sub>1</sub>) at one min, were recorded with computerized spirometer (Helios, Recorders and Medicare Systems Pvt. Ltd., Chandigarh, India). The recordings were done during 9.30 to 10.30 a.m. in sitting position by single investigator throughout the study for all the subjects. Recommendations and guidelines of American Thoracic Society for spirometry were followed to avoid measurement bias.<sup>[8]</sup>

### Statistical Analysis

In this study, the values are reported as mean ± standard deviation. The statistical analysis before and after the exercise for badminton players was tested by Student's paired 't' test. The statistical calculation was considered at probability value less than 0.05. The statistical calculations were done using SPSS software version 16.

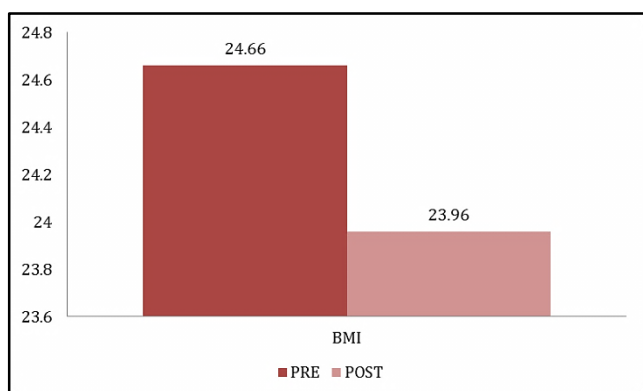
## Results

BMI and parameters like blood pressure, pulse rate showed significant decrease after meditation.

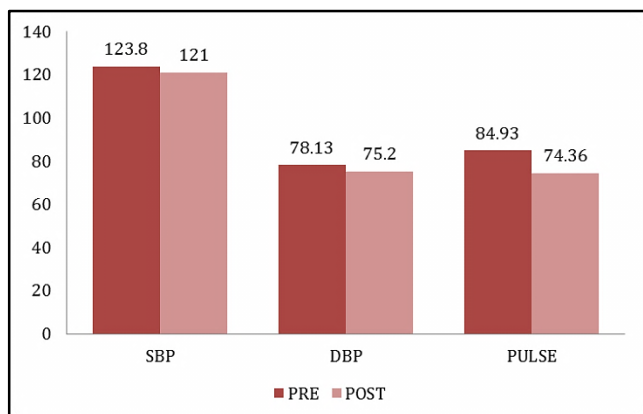
Significant decrease in blood lactate level is observed ( $P < 0.05$ ) after meditation. Pulmonary function like FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, were significantly increased after meditation.

**Table-1: Parameters before the Rajyoga Intervention and After the Intervention**

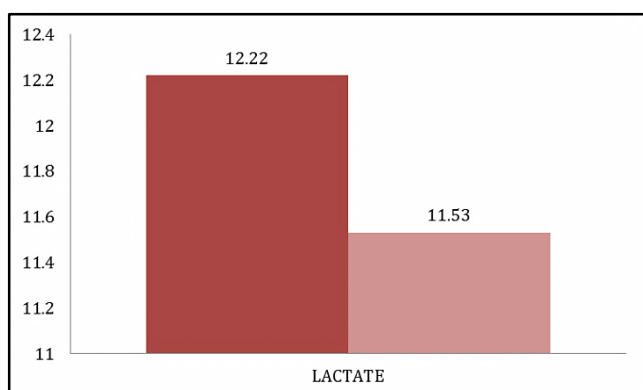
Parameters	Paired Differences					T	df	P value Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference				
				Lower	Upper			
BMI (Pre & Post)	0.700	1.236	0.225	0.238	1.161	3.102	29	0.004
SBP (Pre & Post)	2.800	1.864	0.340	2.103	3.496	8.226	29	0.000
DBP (Pre & Post)	2.933	1.946	0.355	2.206	3.660	8.254	29	0.000
Pulse (Pre & Post)	1.057	3.738	0.682	9.170	11.962	15.480	29	0.000
Lactate (Pre & Post)	0.695	0.339	0.062	0.568	0.822	11.204	29	0.000
FVC% (Pre & Post)	-5.367	5.340	0.974	-7.360	-3.372	-5.505	29	0.000
FEV1 (Pre & Post)	-7.167	5.496	1.003	-9.219	-5.114	-7.141	29	0.000
FEV1/FVC% (Pre & Post)	1.822	2.349	0.428	0.944	2.699	4.247	29	0.000



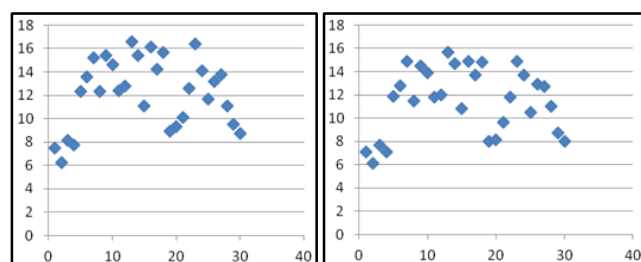
**Figure-1: Comparison of Pre and Post BMI**



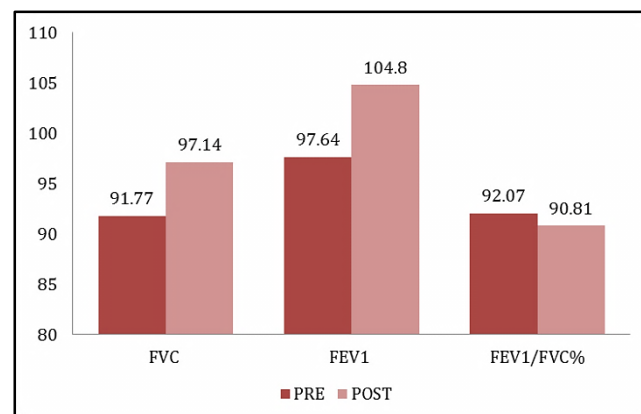
**Figure-2: Comparison of Pre and Post Blood Pressure and Pulse Values**



**Figure-3: Comparison of Blood Lactate Pre and Post Values**



**Figure-4: Blood Lactate Pre and Post Values**



**Figure-5: PFT Pre and Post Values**

## Discussion

The study attempted to compare the influence of Rajyoga meditation on badminton players' performance. Sympathetic arousal is expected to be reduced during Rajyoga practice. Hence the load on heart due to sympathetic arousal is also minimized resulting in an improvement in cardiovascular parameters. Similar findings like in our study were also observed in 23 subjects by Gupta S et al attributing decline in HR, RR and BP to the reduction in the level of sympathetic arousal.

Meditation is believed to gradually reduce the sympathetic dominance resulting in better



balance between sympathetic and parasympathetic. This should bring about a hypometabolic state resulting in decreased heart rate and blood pressure. Lactate concentrations after exercise were significantly reduced after practising meditation. This reduction in lactate after exercise is consistent with previous research showing a decrease in lactate measured at rest shortly after meditation.<sup>[9]</sup> The lower blood lactate observed after meditation may be due to reduced nor-adrenaline (nor-epinephrine), reduction of anxiety caused by relaxation training, or redistribution of blood flow to a more aerobic skeletal muscle metabolism. Other researchers report that red cell glycolysis decreased during meditation.

All PFT parameters were improved significantly by meditation. Statistically better improvement was seen with meditation as compared to before meditation. Similar studies of Rajyoga meditation has shown to decrease resting respiratory rate and increased tidal volume. By modifying the state of anxiety, meditation reduces stress induced sympathetic over activity.<sup>[6]</sup>

Better pulmonary functions in subjects performing yoga as well as swimming are documented (Gupta et al).<sup>[10]</sup> Yoga with its calming effect on the mind can reduce and release emotional stresses, hereby withdrawing the broncho-constrictor effect.<sup>[11,13,14]</sup>

Lung inflation near to total lung capacity is a major physiological stimulus for the release of lung surfactant and prostaglandins into alveolar space, which increases lung compliance and decreases bronchiolar smooth muscle tone, respectively.<sup>[12,14,15]</sup>

## Conclusion

In the present study, the responses to 6 months of regular practice of Rajyoga meditation were assessed on badminton players. Although the present study observed the clear effects of meditation practice, it remains to be assessed whether these changes persist after resuming normal respiration and whether long term practice will lead to stable modifications of cardiovascular respiratory control. Thus in a

nutshell, with this study, it is proved beyond doubt, that regular practice of Rajyoga meditation for minimum of 6 months is beneficial in improving the blood pressure, pulse rate, blood lactate and FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC in badminton players.

Finally, these results and their explanations would justify the incorporation of Rajyoga meditation as part of training in badminton players for promoting health and better performance.

Overall Rajyoga meditation is responsible for maintaining the normal homeostasis in the body. Thus Meditation training may reduce stress reactivity as measured by lactate response and also increases lung functions to a standard bout of exercise. Further studies need to be conducted for a larger sample size and longer duration.

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