



## Effects of Pranayama on mental and physical health Parameters in University-level Sportspersons

Abhishek Anand<sup>1</sup>, Dr. Kishor patwardhan<sup>2</sup>, Dr. R.N. Singh<sup>3</sup>, Prof. H.H. Awasthi<sup>4</sup>

<sup>1</sup>Research Scholar, Department of Rachana Sharir, Faculty of Ayurveda, IMS, BHU, Varanasi, India.

<sup>2</sup>Associate Professor, Department of Kriya Sharir, Faculty of Ayurveda, IMS, BHU, Varanasi, India.

<sup>3</sup>Deputy Director Physical Education, Intitute of Medical Sciences, BHU, Varanasi, India.

<sup>4</sup>Professor, Department of Rachana Sharir, Faculty of Ayurveda, IMS, BHU, Varanasi, India.

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### Abstract

Background: Sports-training in Indian universities is mostly aimed at performance-enhancement while physical and mental health aspects are often overlooked in such a setup. Even sports psychology is mostly aimed at performance enhancement.

Objective of the study: To see if Pranayama can be developed as an economical intervention to improve physical and mental health parameters among university level sportspersons in Indian setup.

Methods: One hundred eight adult volunteers of university-level sportspersons of both gender were included the study. Their age ranged between 17 to 28 years. The selected subjects were divided into two groups, experimental- and control- with fifty-four (54) subjects in each group. The Anuloma-viloma Pranayama & Bhastrika Pranayama training period for experimental groups was of twelve weeks. Muscular Endurance, Flexibility, Pulse rate, Respiratory rate, Lung Capacity, Weight, Height, Mental Health were taken as physical health parameters. The mental health was tested with the Mental Health Inventory Questionnaire. Control groups did not undergo Pranayama.

Results: The experimental group showed significant improvement in most of the physical and mental health parameters after twelve weeks of Pranayama practice on regular basis. The control group showed no significant improvement in these variables.

Conclusion: Anuloma-Viloma and Bhastrika Pranayama appear to be economical, less time-consuming and easily learnable interventions that could be used as a planned intervention to improve physical and mental health parameters among the sportspersons of university-level.

**Key Words:** Breathing Techniques, Yoga, Students, Sportspersons, Indian Universities.

### **Introduction:**

Sports-training in Indian universities is mostly aimed at performance-enhancement while physical and mental health aspects are often overlooked in such a setup. Even sports psychology is mostly aimed at performance enhancement. Sport activity being physically and mentally challenging, often leads to competitive stress. However, good studies reporting the status of physical and mental health parameters among the sportspersons of University level students are not available. These health- related approaches are apparently neglected in routine sports training protocols / programmes in Indian universities.

Pranayama is one of the methods that has been advocated by the science of Yoga for maintaining mental and physical health and this includes some unique breathing techniques. (1) There are many studies suggesting the beneficial effects of this technique. This technique is easy to learn, inexpensive and time-saving intervention and if proven effective in the context of university level sportspersons, will prove to be of much help. Therefore, we decided to evaluate the effect of methodically administered Pranayama in healthy university-level sportspersons as an intervention for twelve weeks.

The objective of the study was to see if Pranayama can be developed as an economical intervention to improve physical and mental health parameters among university level sportspersons in Indian setup.

**Research Process and Methodology**

One hundred eight adult subjects were included in the study. All Subjects were sportspersons, of both gender and their age ranged between 17 to 28 years. The selected subjects were divided randomly into two groups with fifty-four (54) subjects in each group. To generate a random sequence, MS-Excel worksheet was used with R and = () function. Group-I was designated as the experimental group of sportspersons and Group-II as the Control group of sportspersons. Muscular Endurance, Flexibility, Pulse rate, Respiratory rate, Lung Capacity, Weight, Height, Mental Health were taken as physical health parameters. (2, 3, 4) The mental health was tested with a validated Mental Health Inventory Questionnaire constructed by Jagdish and Srivastava. (5) All the responses were then converted into scores following the guidelines. The experimental group was subjected to Anuloma-viloma Pranayama & Bhastrika Pranayama five days a week for twelve weeks each session lasting for thirty to forty five (30 - 45) minutes. Control group was not subjected to any intervention.

**TABLE-1 DESCRIBES THE DETAILS OF INTERVENTION.**

<b>Table-1 Distribution of 30 to 45 Minutes <i>Pranayama</i> training programmed</b>				
<b>Weeks</b>	<b>Duration</b>	<b>Distribution of time</b>	<b>Training</b>	<b>Rounds/Sets</b>
<b>I to III</b>	10 Minutes	04 Minutes	<i>Anuloma-viloma</i>	<b>Two</b>
		02 Minutes	Break between rounds	
		04 Minutes	<i>Anuloma-viloma</i>	
	06 Minutes		Rest ( <i>Savasana</i> )	<b>One</b>
	07 Minutes	02 Minutes	<i>Bhastrika Pranayama</i>	<b>Two</b>
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
07 Minutes		Rest ( <i>Savasana</i> )	<b>One</b>	
<b>Total duration of Training – 30 Minutes</b>				
<b>IV to VI</b>	13 Minutes	05 Minutes	<i>Anuloma-viloma</i>	<b>Two</b>
		03 Minutes	Break between rounds	
		05 Minutes	<i>Anuloma-viloma</i>	
	05 Minutes		Rest ( <i>Savasana</i> )	<b>One</b>
	12 Minutes	02 Minutes	<i>Bhastrika Pranayama</i>	<b>Three</b>
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
05 Minutes	03 Minutes	Break between rounds	<b>One</b>	
	02 Minutes	<i>Bhastrika Pranayama</i>		
	05 Minutes	Rest ( <i>Savasana</i> )		
<b>Total duration of Training – 35 Minutes</b>				
<b>VII to IX</b>	13 Minutes	05 Minutes	<i>Anuloma-viloma</i>	<b>Two</b>
		03 Minutes	Break between rounds	
		05 Minutes	<i>Anuloma-viloma</i>	
	05 Minutes		Rest ( <i>Savasana</i> )	<b>One</b>
	17 Minutes	02 Minutes	<i>Bhastrika Pranayama</i>	<b>Four</b>
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
05 Minutes	03 Minutes	Break between rounds	<b>One</b>	
	02 Minutes	<i>Bhastrika Pranayama</i>		
	05 Minutes	Rest ( <i>Savasana</i> )		
<b>Total duration of Training – 40 Minutes</b>				

X to XII	05 Minutes	<i>Anuloma-viloma</i>	Two	
	13 Minutes	03 Minutes Break between rounds		
	05 Minutes	<i>Anuloma-viloma</i>		
	05 Minutes	Rest ( <i>Savasana</i> )	One	
	22 Minutes	02 Minutes	<i>Bhastrika Pranayama</i>	Five
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
		03 Minutes	Break between rounds	
		02 Minutes	<i>Bhastrika Pranayama</i>	
05 Minutes	Rest ( <i>Savasana</i> )	One		
<b>Total duration of Training – 45 Minutes</b>				

Table-2 describes the parameters recorded.

Table-2 Details of Test Selection & Assessment Methods			
S. No.	Parameters	Method	Units
1.	Muscular Endurance	Sit ups (Bent Knees)	Counts/minute
2.	Flexibility	Sit & Reach Box	Centimetres
3.	Pulse rate	Digital pulse rate Monitor	Count/minute
4.	Respiratory rate	Inspiration & Expiration	Counts / Minute
5.	Lung Capacity	Spirometry	L / minute
6.	Weight	Digital weighing machine	Kilogram
7.	Height	Stadiometer	Centimetres
8.	Mental Health	Mental Health Questionnaire	Score

In order to test the effect of training, the data collected from the two groups, before and after intervention on the physical and mental health variables were statistically analysed by Paired t-test, Unpaired t-test, Wilcoxon signed rank test, Mann-Whitney test and Chi-Square test were applied by using SPSS-16 (Statistical Package for the Social Science) Software. In all the cases, the level of confidence was fixed at 0.05 to be considered as significant.

**Observations:**

Table-3 shows the pre- & post test results of lungs capacity (FVC observed) within and in between experimental & control groups of sportspersons.

Table-3 showing the pre- & post results of lungs capacity (FVC observed) within and in between experimental & control groups of sportspersons.			
Groups	Forced Vital Capacity - FVC (L) Observation Mean ± SD		Within the group comparison Paired t-test Pre-Post
	Pre	Post	
<b>Group-1- EGSP (n=54)</b>	3.1123 ± 0.61381	3.1927 ± 0.61694	-0.08041 ± 0.20488 <b>t=2.884 p=0.006</b>
<b>Group-2 – CGSP (n=54)</b>	3.1454 ± 0.77116	3.1780 ± 0.80768	-0.03259 ± 0.21923 <b>t=1.092 p=0.280</b>
<b>Between the group comparison</b>			
<b>Unpaired t-test</b>			
<b>Gr.1 ves. Gr. 2</b>	<b>t=0.247 p=0.806</b>	<b>t=0.107 p=0.915</b>	

The data shows that a small increase in mean lungs capacity FVC was observed in both the groups after intervention. This increase was statistically significant in group 01 but not statistically significant in group 02.

**Table-4** shows the pre- & post test results of lungs capacity (FEV<sub>1</sub> observed) within and in between experimental & control groups.

**Table-4 showing the pre- & post results of lungs capacity (FEV<sub>1</sub> observed) within and in between experimental & control groups.**

Groups	Forced Expiratory Volume in first second - FEV <sub>1</sub> (L) Observed Mean ± SD		Within the group comparison Paired t-test Pre-Post
	Pre	Post	
<b>Group-1- EGSP (n=54)</b>	2.7828 ± 0.60189	2.8689 ± 0.60547	-0.08611 ± 0.16651 <b>t=3.800 p&lt;0.001</b>
<b>Group-2 – CGSP (n=54)</b>	2.7600 ± 0.71977	2.8487 ± 0.77526	-0.08870 ± 0.28065 <b>t=2.323 p=0.024</b>
<b>Between the group comparison Unpaired t-test</b>			
<b>Gr.1 ves. Gr. 2</b>	<b>t=0.178</b>	<b>p=0.859</b>	<b>t=0.151 p=0.880</b>

The data shows that an increase in lungs capacity (FEV<sub>1</sub> observed) was recorded in both the groups which were statistically significant.

**Table-5** showing the pre & post test results of the number of sit-ups per minute within and in between experimental & control groups.

**Table-5 showing the pre & post results of Sit-ups within and in between experimental & control groups.**

Groups	Sit ups Mean ± SD		Within the group comparison Paired t-test Pre-Post
	Pre	Post	
<b>Group-1- EGSP (n=54)</b>	27.46 ± 9.916	32.33 ± 8.576	-4.870 ± 3.475 <b>t=10.299 p&lt;0.001</b>
<b>Group-2 – CGSP (n=54)</b>	26.09 ± 7.656	27.94 ± 7.032	-1.852 ± 2.023 <b>t=6.728 p&lt;0.001</b>
<b>Between the group comparison Unpaired t-test</b>			
<b>Gr.1 ves. Gr. 2</b>	<b>t=0.804</b>	<b>p=0.423</b>	<b>t=2.908 p=0.004</b>

The data shows that an increase in the mean number of sit-ups per minute in both the groups was recorded which was statistically significant. The intergroup comparison of the mean number of sit-ups per minute at the post-test measurement was also found to be significant.

**Table-6** shows the pre- & post test results of Sit and Reach test within and in between experimental & control groups.

**Table-6 showing the pre- & post results of Sit and Reach test within and in between experimental & control groups of sportspersons.**

Groups	Sit and Reach Test Mean ± SD		Within the group comparison Paired t-test Pre-Post
	Pre	Post	
<b>Group-1- EGSP (n=54)</b>	29.47 ± 10.154	32.59 ± 9.195	-3.120 ± 3.318 <b>t=6.911 p&lt;0.001</b>
<b>Group-2 – CGSP (n=54)</b>	27.13 ± 9.519	27.76 ± 9.084	-0.630 ± 1.906 <b>t=2.427 p=0.019</b>
<b>Between the group comparison Unpaired t-test</b>			
<b>Gr.1 ves. Gr. 2</b>	<b>t=1.237 p=0.219</b>	<b>t=2.748 p=0.007</b>	

The data shows an increase in the mean values of Sit and Reach test in both the groups and this increase is statistically significant. The intergroup comparison of mean Sit and Reach test values at post-test reading was also found to be statistically significant.

Table-7 shows the pre- & post test results of respiratory rates within and in between experimental & control groups of sportspersons.

**Table-7 showing the pre- & post results of respiratory rates within and in between experimental & control groups of sportspersons.**

Groups	Respiratory Rate Mean ± SD		Within the group comparison Paired t-test Pre-Post
	Pre	Post	
<b>Group-1- EGSP (n=54)</b>	21.63 ± 4.253	18.78 ± 3.840	2.852 ± 3.584 <b>t=5.847 p&lt;0.001</b>
<b>Group-2 – CGSP (n=54)</b>	20.87 ± 3.582	20.74 ± 3.476	0.130 ± 1.245 <b>t=0.765 p=0.447</b>
<b>Between the group comparison Unpaired t-test</b>			
<b>Gr.1 ves. Gr. 2</b>	<b>t=1.003 p=0.318</b>	<b>t=2.785 p=0.006</b>	

As the table shows, there was a decrease in mean respiratory rate in group 01 which was statistically significant however the difference in group 02 was not significant. The intergroup comparison of mean respiratory rate after the intervention too showed a statistically significant difference (p=0.006).

Table-8 shows the pre- & post test scores of Mental Health Inventory within and in between experimental & control groups of Sportspersons.

**Table-8 showing the pre- & post score of Mental Health Inventory within and in between experimental & control groups of Sportspersons.**

Sportspersons Groups	Grade	Score of Mental Health Inventory (Number of subjects)				Within the group comparison Wilcoxon signed rank test	
		Pre		Post		Pre – Post Male	Pre – Post Female
		Male	Female	Male	Female		
<b>Group-01- EGSP (n=54)</b>	<b>1. Very Good</b>	01	01	06	05	<b>z=5.477 p&lt;0.001</b>	<b>z=4.359 p&lt;0.001</b>
	<b>2. Good</b>	06	04	10	06		
	<b>3. Average</b>	09	06	12	09		
	<b>4. Poor</b>	13	10	05	01		
	<b>5. Very Poor</b>	04	00	00	00		
<b>Group-02 – CGSP (n=54)</b>	<b>1. Very Good</b>	01	00	04	01	<b>z=4.845 p&lt;0.001</b>	<b>z=3.873 p&lt;0.001</b>
	<b>2. Good</b>	05	01	10	00		
	<b>3. Average</b>	10	00	15	06		
	<b>4. Poor</b>	11	12	04	14		
	<b>5. Very Poor</b>	06	08	00	00		
<b>Between the group comparison Chi-Square test</b>		$\chi^2=0.095$ p=0.757	$\chi^2=11.7$ <b>p=0.001</b>	$\chi^2=0.244$ p=0.621	$\chi^2=11.7$ <b>p=0.001</b>		

The table shows that in experimental group of sportspersons initially (pre-test) 17 males and 10 females were in 'poor' or 'very poor' category of Mental Health Inventory. However, after intervention only 05 males and 01 female remained in these categories. These changes were statistically significant for males as well as females.

### Discussion:

As the data in our study shows, Anuloma-Viloma and Bhastrika Pranayama appear to have a positive effect on most of the physical and mental health parameters that were studied. An increase in Forced Vital Capacity, Forced Expiratory Volume in first second and a decrease in respiratory rate are indicative of betterment in cardio-respiratory functions. An increase in mean sit-ups per minute, and sit-and-reach values is indicative of an improvement in musculoskeletal functioning. An improvement in almost all domains of mental health is indicative of the positive effects of the intervention on mental health parameters. The Pranayama has been hypothesized to be acting on multiple systems in the human body through various mechanisms such as modulating autonomic responses, inducing intermittent mild hypoxia, modulating the cortical functioning, increasing breath holding time etc. (6, 7, 8, 9, 10, 11) These responses are likely to have further impacts on physical and mental health. In our study, the experimental group showed significant improvement on the selected participants who were involved in sports not only on physical variables such as muscular strength, muscular endurance, flexibility, etc., but also on mental variables such as mental health inventory, autonomy, environmental mastery, perception of reality, group oriented attitudes, etc., as a result of twelve weeks of *Pranayama* practice on regular basis. The control group had no significant improvement on these selected physical as well as mental health variables as they were not provided with any sort of *Pranayama* practices for sportspersons.

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### Corresponding Author:

#### Abhishek Anand

Research Scholar,  
Department of Rachana Sharir,  
Faculty of Ayurveda,  
IMS, BHU, Varanasi, India.