
“Effect of practice of Pranayama on blood pressure parameters among the hypertensive patients”

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Abstract:

‘Pranayama’, one of the ‘angas’ of ‘Ashtanga yoga’ is the practice and control of breathing. Pranayama is said to be the control of the ‘Prana’, the vitality or vital force of the body. In other words ‘Pranayama is said to be the control of the ‘Prana’, the vitality or vital force of the body in other words ‘Pranayama’ is the control of ‘Oxygen’ in the body. Practitioners of ‘Pranayama’, and yogis claim that one can completely control all the forces of the universe and the mind. Further, they also claim that one who practices pranayama will have a good appetite, cheerfulness, a handsome figure, good strength, courage, and enthusiasm, a high standard of health, vigorous, vitality, and good concentration of mind. A total of 38 adults, (36 men and 2 women) in the age range of 39 to 72 years served as subjects for the study. Except for the control group, the subjects volunteered for the study. Subjects for the control group were randomly selected. All subjects in the control group were normal adults without a history of hypertension. All the subjects in the treatment condition underwent the yoga practice. *The yoga and pranayama practice continued for days a week and for 45 days. A trained medical practitioner (MBBS) measured and recorded the diastolic and systolic blood pressures of all subjects in a supine lying position. The hypertensive patients witnessed a significant reduction in all three parameters of blood pressure viz systolic, diastolic, and pulse pressure than the subjects in the control group. The normal subjects showed a change in their blood pressure.

Keywords:Pranayama, hypertension, and oxygen.

Introduction:

Oxygen is the most important nutrient of all organisms. One can live for weeks without food for days without water and only for a few minutes without oxygen. In the absence of oxygen all vital organs start degenerating all organs brain require the most oxygen. Lack of oxygen to the brain results in mental sluggishness, depression, and visual and auditory impairment. It is oxygen, which releases energy contained in the food. Therefore, it is vital to the organism.

Breathing is the chief mechanism by which oxygen is supplied to the organic systems, tissues, and ultimately to cells, the basic unit of living organisms. Breathing also disposes of the waste in the cells and tissues. Which turn into toxins, when accumulated.

‘Pranayama’, one of the ‘angas’ of ‘Ashtanga yoga’ is the practice and control of breathing. Pranayama is said to be the control of the ‘Prana’, the vitality or vital force of the body. In other words ‘Pranayama is said to be the control of the ‘Prana’, the vital or vital force of the body in other words ‘Pranayama’ is the control of ‘Oxygen’ in the body. Practitioners of ‘Pranayama’, and yogis claim that one can completely control all the forces of the universe and the mind. Further, they also claim that one who practices pranayama will have good appetite, cheerfulness, a handsome figure, good strength, courage, and enthusiasm, a high standard of health, vigorous, vitality, and good concentration of mind. Though we cannot reject these claims as unfounded, they are subjective experiences of those who practice ‘Pranayama’.

Nevertheless, improper breathing resulting in diminished oxygen supply results in diminished mental ability, diminished organic efficiency, and increased fatigue-both mental and physical.

Reciprocally, mental tension produces restricted breathing when confronted with a perplexing problem. A person tends to lean forward, draw his arms together, and bend his head down resulting in reduced lung capacity. Increased toxin in the muscles of the breathing apparatus due to increased focus and mental tension reduced lung capacity resulting in shallowness coupled with increased frequency of breath.

Because of the complexity of modern life bad breathing has become a habit. Unless the process is reversed the problems usually conformed. Therefore, it is necessary to become aware of the problem and recognize the need for cultivating good breathing habits. Once the awareness is

created, the remedy could include deep breathing exercises, stretching of the muscles of the respiratory apparatus, and those activities, like sports, and brisk walking which stimulate and/or induce deep breathing. ‘Pranayama, one of the deep breathing exercises, holds the key to problems.

Pranayama insists on nasal breathing. Nasal breathing has many advantages. Nasal breathing filters out impurities warms the air to the desired level of temperatures to facilitate efficient gaseous exchange, moisturizes the air and finally but most importantly, through sense of smell detects poisonous gases that may injure the health of the organism. Pranayama also insists on rhythmic, deep, and slow breathing. Irregularities in breathing may disrupt another organic system including that of the brain. Pranayama helps re-establishes regular breathing patterns, and natural relaxed rhythms of body and mind. Deep breathing also increases the absorption of Oxygen (Prana) enhancing dynamism, vitality, and general wellbeing.

Materials and methods

A total of 38 adults, (36 men and 2 women) in the age range of 39 to 72 years served as subjects for the study. Except for the control group, the subjects volunteered for the study. Subjects for the control group were randomly selected. All subjects in the control group were normal adults without a history of hypertension. The scholar approached three centers, one each at Gadag, Katkol, and Dharwad when yoga camps were scheduled and caught the participant’s cooperation.

Treatment Protocol

All the subjects in the treatment condition underwent the yoga practice as follows:-

- 1) Yoga postures (asanas) for 15 minutes as preparation for ‘Pranayama’
- 2) Kapala bhati to calm respiratory centers
- 3) Pranayama (Anuloma_ Vilona)
- 4) Bhramari Pranayama
- 5) Nadi-shodhana Pranayama
- 6) Udyana Bandha (for only normal subjects)

The yoga and pranayama practice continued for days a week and for 45 days.

Measurement Protocol: All the subjects including a control group, were measured before the start of the yoga camp activities, and after 45 days of the camp the following tests were administered.

1. Blood pressure- Trained medical practitioners (MBBS) measured and recorded diastolic and systolic blood pressures of all subjects in a supine lying position.

Statistical Analysis: Before subjecting the data to statistical analysis, pulse pressure was derived by subtracting diastolic pressure from systolic pressure independently for those of pretest and post-test. Secondly gain scores of systolic, diastolic, and pulse pressure were calculated (post-test minus pre-test). The gain scores as dependent variable, were subjected to analysis of variance (ANOVA). The parameters, systolic pressure diastolic pressure, and pulse pressure mm of Hg were entered independently to derive an independent 'F' ratio upon significant F-ratio ($P < .05$) the variables were subjected to post-hoc analyses.

Results and discussion:

Pre and post-test scores were converted to gain scores which were subjected to 'Analysis of Variance' (ANOVA). The results of the analysis are furnished in the following sections.

Table 1 represents the number of subjects from various centers scoring in experimental and control groups.

Table 1 Members of hypertensive and normal subjects

Groups	Gadag	Katkol	Dharwad	Total
Hypertensive	06	04	-	10
Normal	05	08	03	16
Control	-	-	12	12
Total	11	12	15	38

Presented in the table 2 are the means and standard deviations of diastolic blood and systolic blood pressures and pulse pressure of pre-test of hypertensive, normal and control group subjects.

Table 2 Pretest Means \pm and of systolic pressure, diastolic, and pulse pressures of Hypertensive, normal, and control subjects

Groups	Systolic BP	Dias BP	Pulse Pressure
Hypertensive	188.80 \pm 11.77	93.10 \pm 2.77	95.70 \pm 1053
Normal	120.00 \pm 00.00	80.00 \pm 00.00	40.00 \pm 00.00
Control	142.00 \pm 29.39	83.58 \pm 5.48	58.42 \pm 29.14

It may be observed that before ‘Pranayama’ treatment the hypertensive patients (HTP) had the highest values on all blood pressure parameters while the normal subjects (NS) had the least.

Presented in Table 3 are means and standard deviations of post-test scores of systolic, diastolic, and pulse pressures of TP, NS, and control subjects (CS).

Table 3 Post-test Means \pm SIs of Systolic, Diastolic, and Pulse pressures of Blood pressure patients, Normal subjects, and Control subjects.

Groups	Systolic BP	Dias BP	Pulse Pressure
BP.P	138.00 \pm 08.49	80.50 \pm 1.58	53.50 \pm 08.24
Normal	120.00 \pm 00.00	80.00 \pm 00.00	40.00 \pm 00.00
Control	147.33 \pm 29.63	82.83 \pm 09.04	64.50 \pm 34.00

It is evident from table 3, that the values of blood pressure parameters of blood pressure patients has considerable reduced, even below those of control group. While comparisons of values in table – 2 and table – 3 provide for an interview judgments of improvements before and after as well as those of blood pressure patients normal subjects and control subjects. Information of actual gain scores (post test scores - pretest score) provides more objective judgments of improvements.

Similarly Anurag et al., 2017 studied experimental group namely *Kapalbhati* group, *Pranayama* group and control group exhibited similar mean values from the pre-test to post test in regard to systolic and diastolic blood pressure variable .The post testing systolic blood pressure mean and

S.D. values of *Pranayama* Group, *Kapalbhati* Group and the Control Group were found to be 119.200±6.500, 122.100±5.582, and 123.060±7.487 respectively. The post testing diastolic blood pressure mean and S.D. values of *Pranayama* Group, *Kapalbhati* Group, and the Control Group were found to be 75.180±4.968, 74.360±4.968, and 73.360±5.454 respectively. Hence *Kapalbhati* group, *Pranayama* group, and control group were not significantly affected by systolic blood and diastolic blood pressure variables

Furnished in Table 4 are the means and standard deviations of gains scores of systolic, diastolic, and pulse pressure of HTP, NS, and CS, groups.

Table –4 Pre-test to post-test gain scores of systolic pressure, diastolic pressure, and pulse pressure of BP Patients, normal Subjects, and control subjects.

Groups	Systolic BP	Dias BP	Pulse Pressure
BP.P	138.00 ± 08.49	80.50 ± 1.58	53.50± 08.24
Normal	120.00± 00.00	80.00± 00.00	40.00± 00.00
Control	147.33± 29.63	82.83± 09.04	64.50± 34.00

It is very obvious from Table – 4 that it is the blood pressure patients who have gained the most, in blood pressure parameters compared to control subjects as well as the normal subjects. Though the gain scores provide a better picture of the effect of treatment, it is necessary to see whether these observed differences between groups are real difference see whether these observed differences between groups are real difference by statistical analysis. Therefore all three variables were subjected to one-way (ANOVA) analysis of variance and the results are presented in the following sections. Similarly Bhargava et al., (1988) have shown that four weeks of Nadinshadhan pranayama resulted in reduced heart rate and blood pressure.

Presented in Table – 5 is the summary of ANOVA of gain scores of systolic blood pressure.

Table –5 Table 5 Summary of the Analysis of Variance of systolic blood pressure gain

Sources	SS	df	Ms	F	Prob
Between	242207.102	2	12103.551	24.226	.000
Within	17486.267	35	499.608		
Total	41693.368	37			

The obtained omnibus F -ratio is significant beyond the $\alpha=.05$ level of significance. Therefore the data was subjected to post hoc analysis (LSD) the results of which are presented in Table- 6

Table –6 Summary of the posthoc analysis of systolic gain scores of BP.P. Patients, Normal Subjects, and Control Subjects

	B.P. Patients	Normal	Control
BP Patients	-	-	-
Normal	54.80*	-	-
Total	60.13*	-5.33	-

* $P<.05$

It is clear from table –6 that the HTP significantly reduced their systolic blood pressure more than both NS and CS, However the observed difference in gain scores of systolic pressure between normal and control subjects was not significant but due to error.

Anurag et al (2017), post hoc comparison among the means, the difference between *pranayama* group and *kapalbhati* group were -2.990^* ($p<.05$), the difference between *pranayama* group and control group were -3.138^* ($p<.05$) and the difference between *kapalbhati* group and control

group were -0.148 ($p > .05$). Hence *Kapalbhati* group, *Pranayama* group, and control group were no significantly affected of systolic blood pressure variable, and also strongly supported by the identical findings of **Kuna *et.al.*** (1991), **R. Nagaratnana** (1986).

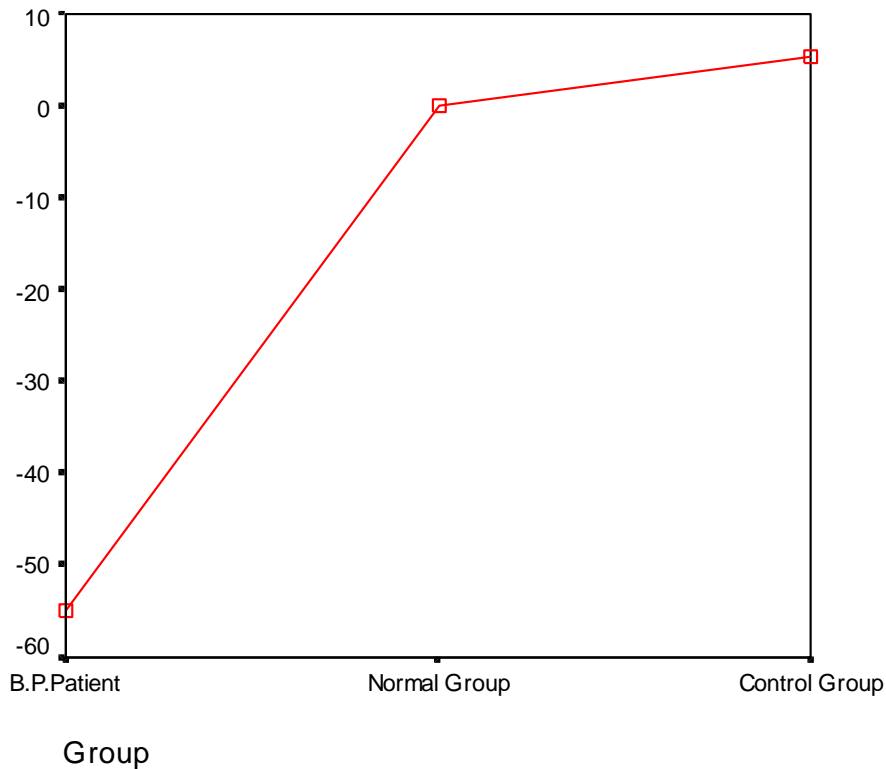


Figure 1. Means of systolic pressure gain scores of B.P. patients, Normal subjects and control group

Presented in Table 7 is the summary of ANOVA of gain scores of diastolic blood pressure.

Table – 7 Summary of analysis of variance of diastolic bloodPressure gain scores

Sources	SS	df	Ms	F	Prob
Between	1114.745	2	557.372	32.263	.000
Within	604.650	35	17.27		
Total	1719.395	37			

The obtained omnibus F-ratio is significant beyond $\alpha = .05$ level of significance. Therefore, post-hoc analysis, (LSD) of the data was resorted to enable the scholar to observe differences between any given two groups that were significant. The results of the post-hoc analysis are presented in Table 8.

Table – 8 Summary of the post hoc analysis of diastolic pressure gain scores of BP patients, normal subjects, and control subjects

	B.P. Patients	Normal	Control
BP Patients	-	-	-
Normal	- 12.06*	-	-
Total	- 11.85*	0.75	-

* P<.05

It is once again evident from Table 8 that the practice of ‘Pranayama’ resulted in significantly reduced diastolic blood pressure than normal or control groups did. However, the observed difference in gain scores between the control and normal groups was only due to chance and not a real difference.

Anurag et al (2017), post hoc comparison among the means, the difference between *pranayama* group and *kapalbhati* group was .373 ($p>.05$), the difference between *pranayama* group and control group was 1.885 ($p>.05$) and the difference between *kapalbhati* group and control group was 1.512 ($p>.05$). Hence *Kapalbhati* group, *Pranayama* group, and control group were no significantly affected of diastolic blood pressure variable, and also strongly supported by the identical findings of **Kuna et.al.** (1991), **R. Nagaratnana** (1986).

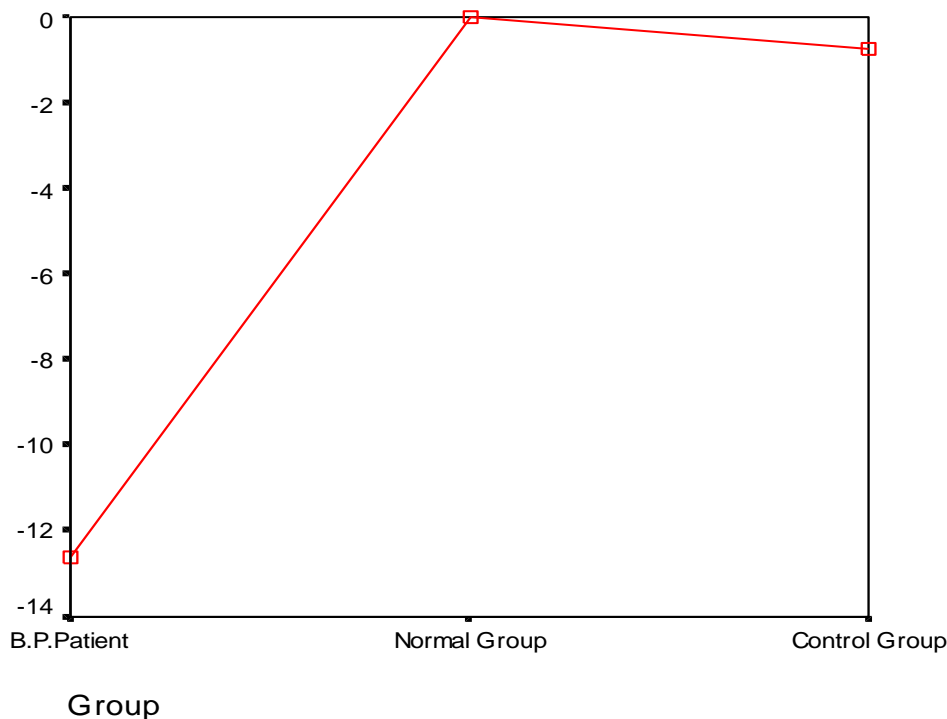


Figure 2. Means of diastolic pressure gain scores of BP patients, Normal subjects, and control group.

Pulse pressure is the difference between systolic pressure and diastolic pressure. Normal pulse pressure is 40mm of Hg. The gain score in pulse pressure was also subjected to ANOVA, the results of which are summarized in Table –9

Table – 9 Summary of analysis of variance of pulse pressure gain scores

Sources	SS	df	Ms	F	Prob
Between	15047.194	2	7523.597	14.611	.000
Within	18022.517	35	514.929		
Total	33069.711	37			

Once again the obtained omnibus F ratio was found to be significant beyond $\alpha = .05$ level of significance. Therefore the post-hoc analysis of the data was inevitable, the summary of which is presented in Table 10.

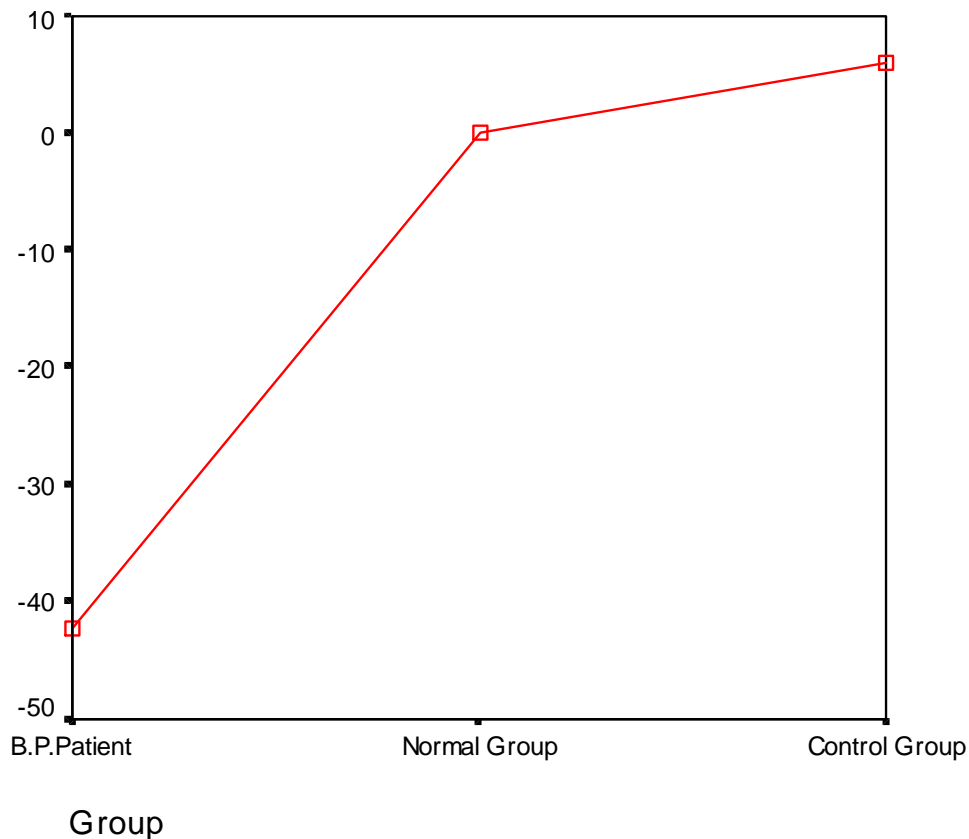
Table 10 Summary of posthoc analysis of gain scores of pulse pressure

	B.P. Patients	Normal	Control
BP Patients	-	-	-
Normal	- 42.02*	-	-
Control	- 48.28*	6.08	-

* P<.05

The post hoc analysis, as expected once again yielded similar results. The gain score of B.P. patients was significantly greater than either normal or control group.

Figure 3. Means of pulse pressure gain scores of BP patients, Normal subjects and control group.



RESULTS

The results of Analyses of Variance of Systolic, diastolic, and pulse pressure supported both hypotheses. The hypertensive patients witnessed a significant reduction in all three parameters of blood pressure systolic, diastolic, and pulse pressure than the subjects in the control group. The normal subjects showed a change in their blood pressure.

In so far concerned both BP patients and normal subjects who took part in the pranayama camp significantly improved compared to control group subjects.

DISCUSSION

The results of the present investigation restated the results, of the earlier studies. In the hypertensive patients, blood pressure reduced after three weeks of pranayama while the patients in the control group showed no improvement. The values of a normal group of individuals who participated in the pranayama camp showed no change, as they all had normal values of 120-80. Perhaps, the hypertensive individuals learned to relax thus reducing peripheral resistance. As mentioned by some of the research reports, the sympathetic discharges among BP patients were reduced. As expected the forced inspiration and retention (rechaka and Rumbhaka) of pranayama forced open the dormant alveoli increasing the long volume of the vital capacity. Both normal individuals and BP patients improved their vital capacity.

CONCLUSION

Pranayama relaxes the state of mind & parasympathetic nervous system and improves blood pressure parameters of blood pressure patients and all the adults who take part in the Pranayama.

RECOMMENDATIONS

1. The present study suggests the health benefits of yoga and pranayama particularly for hypertensive individuals. The hypertensive individuals are recommended the practice pranayama along with their prescribed medications.
2. The hypertensive individuals, in the control group were not specially, rectified all of them were treated as normal individuals. Therefore similar study be undertaken with two subsets in the control group one BP Patient and normal subjects enabling better interpretation of the results.
3. A similar study may be undertaken with hyperglycemic (Type-II Diabetes Mellitus) patients.

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