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## Effect of Yogic Practices on Systolic and Diastolic Blood Pressure among Hypertensive Patients

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### **Abstract:**

*This study was conducted to examine the therapeutic effects of yogic practices on selected physiological variable viz., Systolic Blood Pressure and Diastolic Blood Pressure among essential hypertensive patients consist of 45 samples each in experimental and control group, both male and female patients in the age group between 40 years and 60 years with mild and moderate hypertensive patients. From the study, it is observed that the application of yogic practices would reduce Systolic and Diastolic Blood Pressure in case of experimental group compared to control group due to yogic practices between baseline period and different phases of training and follow-up period.*

*In an overall view of the entire period under study of the two groups, on the whole the systolic blood pressure registered a continuous decrease beginning with the sixth month period. This decrease found in the measurement bringing the patients towards improvement was found to be on a continuing track till the end of observation. Diastolic blood pressure did not differ between experimental and control group either at base line, or till the third or the sixth month of the present study. But, significant difference was noted at the end of the ninth and twelfth month as well. It was observed that diastolic blood pressure was found to be lower in the case of experimental group.*

**Keywords:** Hypertension, Systolic Blood Pressure and Diastolic Blood Pressure

### **1. Introduction**

Hypertension is a major public health problem throughout the world. One quarter of world's adult population has hypertension and this is likely to increase to 29% by 2025. The absolute prevalence of hypertension in economically developed nations is 37.3% compared with 22.9% in developing countries. Though the prevalence of hypertension is widespread, majority of patients have mild hypertension or high normal blood pressure (Pre-hypertension). Preventing and controlling hypertension is one of the most cost effective strategies to reduce global burden of cardiovascular disease in the general population. Reducing systolic BP by just 3 mmHg in general population has the potential to reduce stroke mortality by 8% and Coronary Heart Diseases by 5%. Based on Cochrane collaborative databases and recommendation of various societies, lifestyle modification has been considered as the key strategy for prevention and treatment of hypertension. Chronic stress may play an important role in initiating and maintaining hypertension and consideration of stress management is recommended intervention for hypertension.

Yoga, a mind body technique has been shown to be an excellent method of relaxation and stress control. Yoga is a philosophical science, born out of man's seeking to fathom the meaning of existence. Yoga is derived from the Sanskrit word 'Yuj' which means 'union' or to 'join' or 'to yoke'. Yoga is a powerful, internal experience, which integrates the body, the senses and the mind with the self. Sage Patanjali, the Father of Yoga, said in the second sutra of Samadhi Pada, "Citta-Vrtti-Nirodhah" means, "The restraint of the modifications of the mind is yoga".<sup>1</sup> The ultimate aim of yoga is self-evolution. In ancient times, people lived the yogic way and were having good health. In these days when health deteriorated due to man's changing values and lifestyle yoga gained ground in its use as therapy.

According to Medilexicon's medical dictionary, hypertension means high blood pressure. "Blood pressure is defined as the lateral pressure exerted by the column of blood on the wall of arteries. Blood pressure means the arterial pressure. The arterial pressure fluctuates during systole and diastole of the heart"<sup>2</sup>.

Hypertension is classified as either primary (essential) hypertension or secondary hypertension; about 90–95% of cases are categorized as "primary hypertension," which means high blood pressure due to heredity, age, smoking, high fat diet, sedentary life style, temperament and emotions. The remaining 5–10% of cases "secondary hypertension" is caused by other conditions that affect the kidneys, arteries, heart or endocrine system.

<sup>1</sup> Iyengar, B.K.S., 1993. Light on the Yoga Sutras of Patanjali, Harper Collins Publishers, London.

<sup>2</sup> G.K.Pal, Dr. 2009. Text Book of Medical Physiology, 1<sup>st</sup> edition, Ahuja Publishing House, New Delhi.

The present study was undertaken to investigate the therapeutic effects of yogic practices on selected physical & physiological variables among essential hypertensive patients. The Rajah Muthiah Medical College Hospital, Annamalai University, Annamalaiagar, Chidambaram is taken for the experimental research with regard to hypertensive patients with the concurrence of Human Ethical Committee of the University.

## 2. Systolic Blood Pressure

Systolic Blood Pressure is defined as the maximum pressure in the arteries, when occurs near the beginning of the cardiac cycle when the ventricles are contracting.

## 3. Diastolic Blood Pressure

Diastolic Blood Pressure is defined as the minimum pressure in the arteries, which occurs near the end of the cardiac cycle when the ventricles are filled with blood<sup>3</sup>.

## 4. Blood Pressure Levels

Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Optimal blood pressure	<120	<80
Normal blood pressure	<130	<85
High-normal blood pressure	130-139	85-89
Grade 1 hypertension (mild)	140-159	90-99
Grade 2 hypertension (moderate)	160-179	100-109
Grade 3 hypertension (severe)	≥ 180	≥ 110

*Source : British Hypertension Society classification of blood pressure levels (BHS-IV)*

*mm - millimeters of mercury pressure*

*Hg - chemical symbol of the element mercury*

## 5. Objective

To compute and analyze the level of physiological variables – systolic blood pressure and diastolic blood pressure among hypertensive patients of both experimental and control group at four stages from baseline divided as yoga training period; after 3 months & 6 months and follow up periods; 9 months & 12 months.

## 6. Methods

Since the study is experimental in nature, convenient random sampling method was applied. There were 90 subjects who have accepted for the study were divided into experimental and control group consist of 45 samples each, both male and female patients in the age group between 40 years and 60 years with Grade - I (mild) and Grade - II (moderate) hypertensive patients were selected for the study.

The objective is to identify the effect of yogic practices on Systolic and Diastolic Blood Pressure on mild and moderate hypertensive patients. For this situation experimental study is most suitable. For this purpose, two groups viz., experimental and control groups are observed. The observations of various measures are taken at pre test level. Experimental group members are exposed to yogic practices (Asana, Pranayama, Mudras, Relaxation Techniques and Meditation and Diet advice given to all the subjects undertaken for the study by Senior Dietician of Rajah Muthiah Medical College Hospital, Annamalai University) for the period of 6 months along with Drug, six days in a week of one hour duration and follow up period for 6 months, yoga training is given once in a week of one hour duration. They are observed at every three months interval i.e. after 3 months & 6 months and follow up periods; 9 months & 12 months. Similar to experimental group, though they are not exposed to yogic practices but they are taking only drugs and they are also observed at the same interval.

## 7. Results and Discussion

Testing condition	Systolic B.P.		Diastolic B.P.	
	Exp. Group	Control Group	Exp. Group	Control Group
Pre test	153.29	155.09	94.42	93.37
Post test 1	148.20	147.20	87.89	90.42
Post test 2	143.47	143.91	87.62	87.60

<sup>3</sup> G.K.Pal, Dr., 2009. Text Book of Medical Physiology, 1<sup>st</sup> edition, Ahuja Publishing House, New Delhi.

Post test 3	137.78	144.95	85.29	88.53
Post test 4	132.38	147.11	83.64	91.02

Table 1: Mean of Experimental and Control Groups

• **Systolic B.P.**

By observing the mean value of exp. group drastically reduces from the pre test level to last stage. But in control group though the BP level reduces at first, second stage and it starts increasing.

• **Diastolic B.P.**

In the exp. group, the BP level constantly decreases from base line to the various stages viz., 3<sup>rd</sup>, 6<sup>th</sup>, 9<sup>th</sup> and 12<sup>th</sup> month. In the control group, the BP level reduced from base line level in the first two stages. After 6<sup>th</sup> month, it started increasing.

Testing Condition	Experimental group	Control group
Pre test	153.29± 20.88	155.09±16.07
Post test 1	148.20±17.78	147.20±12.54
Post test 2	143.47±15.76	143.91±16.01
Post test 3	137.78±14.61	144.95±16.47
Post test 4	132.38±12.41	147.11±17.24

Table 2: Mean scores and (S.D.) of Systolic Blood Pressure of Experimental and Control Group

Table 2 depicts the mean and standard deviation of systolic blood pressure of both experimental and control group. Pre test level of blood pressure mean values are 153.29 and 155.09 for experimental and control group. By observing the mean values of experimental group drastically reduces from pre test level 153.29 to last stage 132.38. But, in the case of control group, though the blood pressure level reduces at first and at the second stage and it starts increasing. So, it is observed that yogic practice brings down the systolic blood pressure level. The mean data is also presented in the figure 1.

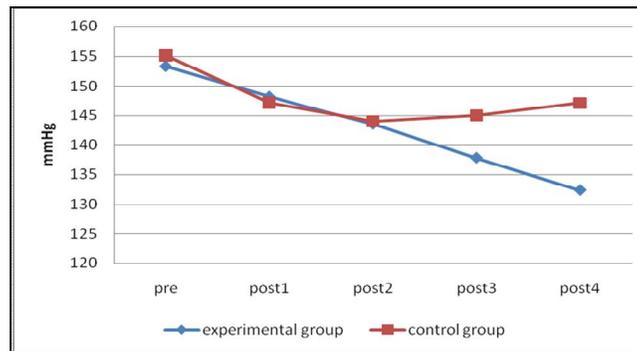


Figure 1: Systolic Blood Pressure of Experimental and Control Groups

To test whether there is variation in blood pressure, ANOVA test was carried out and the result is tabulated below:

Source of Variation	SS	df	MS	F	Sig
<b>Between Ss</b>					
A (Groups: Experimental and Control)	2412.809	1	2412.809	2.232	NS
Ss w. groups (Error I)	95133.049	88	1081.057		
<b>Within Ss</b>					
B (Different phases of testing conditions)	12032.658	4	3008.164	53.893*	0.05
AB	3730.34	4	932.587	16.708*	0.05
B × Ss w. groups (Error II)	19647.796	352	55.818		

Table 3: Summary of ANOVA for 2 × 5 factorial experiments with repeated measures on the last factor on systolic blood pressure  
\*Significant at 0.05 level

The table value required for significance at 0.05 level of confidence with df of 1 and 88 is 3.963; and df of 4 and 352 is 2.37. From the result of ANOVA of systolic blood pressure of experimental and control groups reveals no significant differences, irrespective of different phases of testing conditions as the obtained value 2.232 is less than the required table value of 3.963 at  $\alpha=0.05$  for the df of 1 and 88. Further, the F-value for different phases of testing conditions is 53.893 with  $\alpha$ -value is 0.05. It indicates that there is a significant difference on systolic blood pressure among different phases of testing conditions irrespective of groups. Also there is a

significant difference in systolic blood pressure among the interaction of two groups and different phases of testing conditions as the obtained F-value is 16.708 is greater than the required table value of 2.37 at  $\alpha=0.05$  for the df 4 and 352. Since, it needs to have detail picture of the interaction effect, detailed analysis is made and result is shown in table 4. Test is also carried out to identify whether there is any significant variation at various stages. The result is tabulated below.

Factors	SS	df	MS	F
Groups & Pre test	72.9	1	72.9	1.30
Groups & Post test 1	22.5	1	22.5	0.40
Groups & Post test 2	4.443556	1	4.443556	0.08
Groups & Post test 3	1159.218	1	1159.218	20.76*
Groups & Post test 4	4884.0781	1	4884.0781	85.50*
Tests & Experimental group	3073.717	4	768.4293	13.77*
Test & control group	867.0291	4	216.7573	3.88*
Error	19647.8	352	55.818	

Table 4: Simple effect test on Systolic Blood Pressure

\* Significant at 0.05 level

The table value required for significance at 0.05 level of confidence with df of 1 to 352 is 3.84 and df of 4 and 352 is 2.37. From table 4, it is found that the pre-test value between experimental and control group is 1.30 and it is not significantly different. Similarly the F value is 0.40 and 0.08 is for experimental and control group for 3 months level and 6 months level also not found to differ significantly. But, after 9 months and 12 months the blood pressure level between experimental and control group differs significantly because F values are 20.76 and 85.50. The F value for experimental group stages is 13.77 and control group is 3.88. These values vary significantly. So, the blood pressure values among various stages in experimental and control group differ significantly.

To identify various groups that differ between them Scheffé's Post-hoc was used for experimental group and the results are shown in table 5.

Different phases of testing conditions					MD	CI	%
Pre	Post 1	Post 2	Post 3	Post 4			
153.2889	148.2				5.0889*	4.8495	3.31
153.2889		143.4667			9.8222*	4.8495	6.40
153.2889			137.7778		15.5111*	4.8495	10.11
153.2889				132.3778	20.9111*	4.8495	13.64
	148.2	143.4667			4.7333	4.8495	3.19
	148.2		137.7778		10.4222*	4.8495	7.03
	148.2			132.3778	15.8222*	4.8495	10.67
		143.4667	137.7778		5.6889*	4.8495	3.96
		143.4667		132.3778	11.0889*	4.8495	7.72
			<b>137.7778</b>	<b>132.3778</b>	<b>5.4*</b>	<b>4.8495</b>	<b>3.92</b>

Table 5: Scheffé S test for difference between paired means on Systolic Blood Pressure of Experimental Group

\* Significant at 0.05 level

The systolic blood pressure of experimental group started decreasing from baseline to the end of observation. The decrease percentage is 3.31, 6.40, 10.11 and 13.64 for every three months observation. It is found that the difference between base line with blood pressure level at 3 months, 6 months, 9 months and 12 months differ significantly because the corresponding values 5.0889, 9.8222, 15.5111 and 20.9111 are higher than 4.895.

Similarly comparing the differences between 3 months blood pressure level with 6 months, 9 months and 12 months, it is found the difference between 3 months and 6 months did not vary significantly. But, it varies from 9 months and 12 months blood pressure level with the corresponding value of 10.4222 and 15.8222 which are greater than 4.8495.

Further comparing the differences of blood pressure of 6 months with 9 months and 12 months, it is found that the difference is significant because the values are 5.6889 and 11.0889.

Likewise the systolic blood pressure after yogic practices of 9 months and 12 months also differs significantly at 5 % level because the value is 5.4.

It is observed that the systolic blood pressure in the experimental group between third month and sixth month did vary significantly. It is also observed that blood pressure shows considerable improvement after regular practice. After 6 months, it gives good result. Similarly, the post-hoc test is applied for identifying the paired differences and it is tabulated below:

Different phases of testing conditions					MD	CI	%
Pre	Post 1	Post 2	Post 3	Post 4			
155.0889	147.2				7.8889*	4.8495	5.08
155.0889		143.9111			11.1778*	4.8495	7.20
155.0889			144.9556		10.1333*	4.8495	6.53
155.0889				147.1111	7.9778*	4.8495	5.14
	147.2	143.9111			3.2889	4.8495	2.23
	147.2		144.9556		2.2444	4.8495	1.52
	147.2			147.1111	0.0889	4.8495	0.05
		143.9111	144.9556		-1.0445	4.8495	-0.72
		143.9111		147.1111	-3.2	4.8495	-2.22
			144.9556	147.1111	-2.1555	4.8495	-1.48

Table 6: Scheffé S test for difference between paired means on Systolic Blood Pressure  
\* Significant at 0.05 level

Table 6 indicates that systolic blood pressure mean value of base line with the followed four phases is compared. It is observed that systolic blood pressure during the four phases is less than the base line. The percentage of reduction value during four phases from the base line is 5.08, 7.20, 6.53 and 5.14.

From the table 6, it is observed that the difference between base line blood pressure with 3 months, 6 months and 9 months level are 7.8889, 11.1778, 10.1333 and 7.9778. These differences differ significantly because these values are higher than 4.8495. That implies that base line blood pressure is much more than the other four stages.

Comparing the 3 months blood pressure value of the control group with 6 months, 9 months and 12 months are found to be 3.2889, 2.2444 and 0.0889 which are less than the value 4.8495. So, there is no significant difference in the control group between the 3 months blood pressure level with that of 6 months, 9 months and 12 months.

Similarly, the difference between 6 months blood pressure with 9 months and 12 months in the control group is not significant. Also the blood pressure level in the control group between 9 months and 12 months also does not differ significantly.

Testing Condition	Experimental group	Control group
Pre test	94.42± 12.23	93.37±9.75
Post test 1	87.89±8.47	90.42±7.55
Post test 2	87.62±8.85	87.60±6.51
Post test 3	85.29±8.65	88.53±5.64
Post test 4	83.64±6.31	91.02±5.87

Table 7: Mean and (S.D.) of Diastolic Blood Pressure

In table 7 diastolic blood pressure of both experimental and control group are shown. Base line diastolic blood pressure was 94.42 in the case of experimental and 93.37 in the case of control group. In the experimental group the blood pressure level at periodical testing periods are 87.89, 87.62, 85.29 and 83.64. It is observed that the blood pressure level constantly decreases from base line to the various stages viz., 3 months, 6 months, 9 months and 12 months.

But, in the case of control group the blood pressure level reduced from base line level in the case of first two stages. But, after six months the blood pressure level started increasing. So, the medicine after specific time did not reduce the blood pressure level. The figure 2 shows the levels of diastolic blood pressure in the case of both experimental and control groups at various periods.

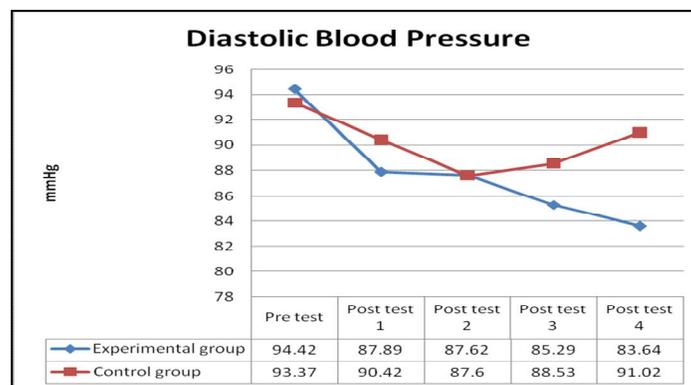


Figure 2: Diastolic Blood Pressure of Experimental and Control Groups

Repeated measure ANOVA of diastolic blood pressure is presented in table-8. Diastolic blood pressure of experimental and control groups reveals no significant difference, irrespective of different phases of testing conditions as the obtained F ratio of 3.679 is less than the required table value of 3.963 at  $\alpha = 0.05$  for the df of 1 and 88.

Source of Variation	SS	df	MS	F	Sig
<b>Between Ss</b>					
A (Groups: Experimental and Control)	657.636	1	657.636	3.679	NS
Ss w. groups (Error I)	15728.622	88	178.734		
<b>Within Ss</b>					
B (Different phases of testing conditions)	2979.258	4	744.814	18.719*	0.05
AB	972.876	4	243.219	6.113*	0.05
B × Ss w. groups (Error II)	14005.467	352	39.788		

Table 8: Summary of ANOVA for 2 × 5 factorial experiments with repeated measures on the last factor on Diastolic Blood Pressure

\*Significant at 0.05 level

The table value required for significance at 0.05 level of confidence with df of 1 and 88 is 3.963 and df of 4 and 352 is 2.37. F-value for the difference between experimental and control group is 3.679 and it is not significantly different.

However, the findings disclose that there is a significant difference on diastolic blood pressure between different phases of testing conditions irrespective of groups, since the obtained F ratio of 18.719 is greater than the required table value of 2.37 at  $\alpha = 0.05$  for the df of 4 and 352. Further, the findings reveals that there is a significant difference on diastolic blood pressure due to the interaction of groups and different phases of testing conditions as the obtained F ratio of 6.113 is greater than the required table of 2.37 at  $\alpha = 0.05$  for the df of 4 and 352. Since, AB interaction is significant simple effect was supplied and presented in table 9.

Factors	SS	df	MS	F
Groups & Pre test	24.54236	1	24.54236	0.61
Groups & Post test 1	144.3962	1	144.3962	3.62
Groups & Post test 2	0.011089	1	0.011089	0.0002
Groups & Post test 3	236.838	1	236.838	5.95*
Groups & Post test 4	1224.718	1	1224.718	30.78*
Tests & Experimental group	758.9714	4	189.7428	4.76*
Test & control group	229.0645	4	57.26613	1.44
Error	14005.47	352	39.788	

Table 9: Simple effect test on Diastolic Blood Pressure

\* Significant at 0.05 level

The table value required for significance at 0.05 level of confidence with df of 1 to 352 is 3.84 and df of 4 and 352 is 2.37.

From the table 9, it is understood that there is no significant difference in diastolic blood pressure irrespective of groups during base line, after 3 and 6 months. The respective obtained F ratio are 0.61, 3.62 and 0.0002, which is less than the required table value of 3.84 at  $\alpha = 0.05$  for the df of 1 and 352. However, irrespective of groups, post test 3 and post test 4 showed significant difference, since the obtained F ratio are 5.95 and 30.78 respectively which is greater than the required table value of 3.84 at  $\alpha = 0.05$  for the df of 1 and 352.

Table 9 also shows that irrespective of different phases of testing conditions the experimental group showed significant difference, since the obtained F ratio is 4.76 which is greater than the required table value of 3.84 at  $\alpha = 0.05$  for the df of 1 and 352. But the control group did not differ among various stages.

Thus, it is concluded that irrespective of groups showed no significant difference at base line 3 months and 6 months stages, there is difference at 9<sup>th</sup> and 12<sup>th</sup> month levels. Only the experimental group there observed significant different but not in the control group. In order to have the depth of the findings Scheffe' S post hoc test was applied.

Different phases of testing conditions					MD	CI	%
Pre	Post 1	Post 2	Post 3	Post 4			
94.4222	87.889				6.5332*	4.0944	6.91
94.4222		87.6222			6.8*	4.0944	7.20
94.4222			85.2889		6.1333*	4.0944	6.49
94.4222				83.6444	10.7778*	4.0944	11.41
	87.889	87.6222			0.02668	4.0944	0.02
	87.889		85.2889		2.6001	4.0944	2.75
	87.889			83.6444	4.2446*	4.0944	4.49
		87.6222	85.2889		2.3333	4.0944	2.47
		87.6222		83.6444	3.9778	4.0944	4.21
			85.2889	83.6444	1.6445	4.0944	1.74

Table 10: Scheffé S test for difference between paired means on Diastolic Blood Pressure of Experimental Group

\* Significant at 0.05 level

From table 10, the Scheffe'S post hoc test showed significant difference in experimental group at different phases of testing conditions at 0.05 level of confidence.

Comparing base line with 3 months, 6 months, 9 months and 12 months status, it is found that the deviations are 6.5332, 6.8, 6.1333 and 10.7778. The blood pressure reduced at all the four stages of experimental group and reduced percentages from base line to every three months stage are 6.91, 7.20, 6.49 and 11.41. The test results imply that base line blood pressure level is found to differ significantly with the four stages of the study in the case of experimental group. Because these values differ significantly at 5% level. Base line value is much higher than the other four stages of study.

Blood pressure level at 3 months level is compared with 6 months, 9 months and 12 months. The deviation values are 0.02668, 2.600 and 4.2446. It is observed from the result that the difference between 3 months and 6 months and 9 months diastolic blood pressure of experimental group did not differ significantly. But, 3 months blood pressure value differ from that of 12 months level at 5% level. 3 months blood pressure level is much higher than 12 months blood pressure level.

Similarly the deviation between 6 month values with respect to 9 months and 12 months were 2.3333 and 3.9778 and these values do not differ significantly.

Also there is no significant difference in the blood pressure level of 9 months with that of 12 months because the deviation value is 1.6445 which is lesser than 4.0944 at 5% level.

So, it is found that the base line diastolic blood pressure level is significantly different with all the four stages of study. And apart from that 3 months level differed only with 12 months level.

Different phases of testing conditions					MD	CI	%
Pre	Post 1	Post 2	Post 3	Post 4			
93.3778	90.4222				5.4889*	4.0944	5.87
93.3778		87.6000			5.7556*	4.0944	6.16
93.3778			88.5333		8.0889*	4.0944	8.66
93.3778				91.0222	9.7334*	4.0944	10.42
	90.4222	87.6000			0.2667	4.0944	0.28
	90.4222		88.5333		2.6	4.0944	2.78
	90.4222			91.0222	4.2445*	4.0944	4.54
		87.6000	88.5333		2.3333	4.0944	2.49
		87.6000		91.0222	3.9778	4.0944	4.25
			88.5333	91.0222	1.6445	4.0944	1.76

Table 11: Scheffé S test for difference between paired means on Diastolic Blood Pressure of Control Group

\* Significant at 0.05 level

From table 11, the Scheffe' S post hoc test showed significant difference in control group at different phases of testing conditions at 0.05 level of confidence. The percentage of changes in diastolic blood pressure in control group from pre test to post test 4 are 5.87, 6.16, 8.66, 10.42. Thus, it is concluded that medication for one year has resulted in a significant reduction in diastolic blood pressure in control group.

The difference between base line blood pressure level with four stages of study period are 5.4889, 5.7556, 8.0889, 9.7334, this is found to differ at 5 % level. So, it is found that base line found to differ significantly from the following four consecutive periods 3 months, 6 months, 9 months and 12months interval. Comparing the mean values, it is found that base line value is much higher than the other four stages.

Comparing the mean level of 3 month diastolic blood pressure level with that of 6 months, 9 months and 12 months, it is found that the deviations are to the extent of 0.2667, 2.6 and 4.2445. It is found that the difference between 3 months level and 12 months level alone differ significantly. Comparing the mean values, it is found that the blood pressure level is higher in the case of 3 months period compared to 12 months level. In the other 2 periods though it is lesser than the third month, blood pressure level the reduction is not significant.

Similarly, the difference between the blood pressure level of 6 months with that of the 9 months and 12 months also did not differ significantly. Finally the blood pressure level of 9 months with that of 12 months also was not found to differ to a significant extent.

In case of diastolic blood pressure also there is significant level of improvement in the blood pressure level in the case of experimental group. But, in the case of control group though there is improvement from that of base line but does not differ significantly after 3 months improvement.

## 8. Findings

### 8.1. Systolic Blood Pressure

At the commencement of the programme, an entry level measurement of the status of each of the patients covered under the study was taken and recorded. Systolic blood pressure of members of both experimental group and control group during base line was found to be at the highest with corresponding mean values ranging between 153.29 and 155.09. In a phased manner spanning over a period of one year, at four points of time, blood pressure was measured and recorded at the end of every three months period. It

was noticed in the observation that the blood pressure periodically got reduced and at the end of one year it had fallen down to an overall average of 132.38 and 147.11 in the experimental and control group respectively.

Further, it is found that the systolic blood pressure did not vary between experimental and control groups. But, yet variation was noticed among various phases of observation. Also, there was iteration effect of groups during different phases of observation.

The data regarding systolic blood pressure recorded during observations revealed the following facts:

There was no significant difference between experimental and control groups regarding the status of their problem either at pre test stage, or after three months or even up to sixth months. But, after six months from the date of commencement of the programme, members of the experimental group showed improvement and that resulted in significant difference at the end of ninth and twelfth month regarding systolic blood pressure level. Further, there was variation in the systolic blood pressure level during the various phases of the period under study among members of experimental group as well as control group.

Systolic blood pressure of members of the experimental group during various phases differed significantly. In general, it was found that base line blood pressure was significantly higher than the measurement taken during the four phases at fixed interval of three months during the one year period under observation. After yogic practice, third month blood pressure was not significantly different from that of the sixth month level while the initial measurement recorded at the entry level was found to be significantly higher when compared with those of the later two stages. Sixth month blood pressure level was significantly higher than ninth and twelfth month systolic blood pressure level; and ninth month systolic blood pressure was significantly higher than twelfth month level. In an overall view of the entire period under study of the two groups, on the whole the systolic blood pressure registered a continuous decrease beginning with the sixth month period. This decrease found in the measurement bringing the patients towards improvement was found to be on a continuing track till the end of observation.

Systolic blood pressure in the case of control group was found to be high at the base line and found to be significantly higher than the four follow up phases during the one year period under observation. Based on the results, it was found that, statistically there was no significant variation in the blood pressure level from the third month till the end of the year. It implies that in the control group, the blood pressure was found to have decreased at the end of third month. But, during the remaining period of the one year under observation, though the blood pressure level showed a decrease, statistically, the difference was not found to be significant to make a mark.

The findings of **Bhavanani, Sanjay and Madanmohan (2011)**<sup>4</sup> shown that there was a significant reduction in systolic blood pressure after the yogic practices. The findings of this research are similar with the findings of Bhavanani et. al.,

#### 8.2. Diastolic Blood Pressure

Diastolic blood pressure was also tested among the members of both the experimental group and control group. The mean value of blood pressure of experimental group was found to be at its highest at base line and periodically got reduced stage after stage. In the case of the control group under observation, the diastolic blood pressure showed a decrease till the end of sixth month from base line but subsequently started increasing and continued an upward mark till the end of the year.

Diastolic blood pressure did not vary between experimental and control group. But, there is considerable value of difference among various phases of observation and also there is iteration effect on various stages of study.

Diastolic blood pressure did not differ between experimental and control group either at base line, or till the third or the sixth month of the present study. But, significant difference was noted at the end of the ninth and twelfth month as well. It was observed that diastolic blood pressure was found to be lower in the case of experimental group.

Diastolic blood pressure of experimental group was at a higher level at baseline and periodically, it was found to be decreasing stage after stage. The difference between base line and every subsequent stage of observation was also found to be statistically significant. Further the diastolic blood pressure at the end of third month was significantly higher when compared to that of the twelfth month alone and not with the other two phases. Similarly there was no significant difference between the sixth month blood pressure level with the following two further stages; and also ninth month level did not vary with twelfth month. So, the improvement after third month as observed was not found to be remarkable.

The findings of **Barbara S. Thomley, Siddiqi H. Ray, Stephen S. Cha, Brent A. Bauer (2009)**<sup>5</sup> shown that there was a significant improvement in diastolic blood pressure after the yogic practices. The findings of this study and the findings of Barbara et. al., are the same

#### 9. Conclusion

Chronic mental stress appears to be an important factor in initiating and maintaining hypertension. Yoga has been shown to be an excellent stress management technique and may help reduce blood pressure. This practice is found to have an impact on keeping good health of an individual in the context of hypertension specifically. Yogic practitioners have given positive opinion about yoga practices and they have experienced a reduction in stress due to yogic practices. This needs to be accepted by individuals and practice it for their self betterment. Yogic practice need to be part of an individual's daily life routines as that of taking food.

<sup>4</sup> Immediate Effect of Sukha Pranayama on Cardiovascular Variables In Patients of Hypertension. *Int J Yoga Therap.*21, pp. 73-76.

<sup>5</sup> Effects of a Brief, Comprehensive, Yoga-Based Program on Quality of Life and Biometric Measures in an Employee Population: A Pilot Study. *The Journal of Science and Healing*, 7(1), pp.27-29.

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