YOGA – MODULATING COLD PRESSURE RESPONSE (CPR) IN MIDDLE-AGED MEN

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ABSTRACT

This study was conducted to show effects of yoga on cold pressor response (sympathetic function) in middle-aged men. Objective of study is to assess cold pressor response in study and control groups. We selected 90 healthy volunteers between age group 35 – 50 years and divided into 2 groups. (1) Study group – 45. (2) Control group – 45.

Control group does not perform any yoga or exercise during one year period, whereas yoga group (study group) performs yoga for one year under supervision of yoga expert in yoga centre. In both the groups, cold pressor response was recorded at 0, 6 and 12 months. In control group, cold pressor response shows no significant change whereas study group showed significant reduction in rise from 18.13±2.97 to 13.55 ± 2.00 at 6 months and 13.11 ± 1.76 at 12 months showing F value – 65.33 (P value<0.001) which is highly significant. Rise in DBP also decreased from 15.11± 2.97 to 11.15 ± 1.83 at 6 months and 11.11 ± 1.82 at 12 months showing F – value 45.75 (P<0.001) which is also highly significant in study group. In conclusion, yoga done regularly for longterm improves sympathetic functions (CPR).

KEYWORDS
Yoga Exercises, Cold Pressor Response (CPR).

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INTRODUCTION: The modern medical system has replaced all the traditional system of medicine. It has proved itself more effective in saving man from the fatal hands of contagious and infectious diseases. However, rapidly increasing incidence of stress related ailment is posing a great challenge to modern medical system. It is here that yoga appears to make a vital contribution to the modern medical system.

Medical sciences try to achieve optimum, physical and mental wellbeing of the individual through preventive and curative means. Yoga practices mainly stresses on primitive aspects although some yogic methods are prescribed for curative purpose.[1] Yoga produces consistent physiological changes, extensive studies on yoga claim that it increases longevity. It has a therapeutic and rehabilitative effect [2] The vasomotor response to peripheral blood vessel to both heat and cold showed reduction with age.[3] Baroreflex sensitivity decreases with increasing age.[4] Physical activity is perhaps the most obvious of variable which might reduce overall life morbidity in aged.[5]

Yogasana and Pranayama has beneficial effect on different systems of body thereby increasing longevity, bringing equipoise between psychic and somatic aspect of bodily function, helping in clearing certain diseases and thus prolong life.[6]

Extensive studies are available on yogic asanas and pranayam all over the world. But comparatively very few researches have been made on middle-aged men as well as relatively lesser work has been found on yoga in this region with respect to sympathetic function.

MATERIAL AND METHODS: The present study was conducted in the Department of Physiology, Jawaharlal Nehru Medical College, Sawangi (M), Wardha on 90 male volunteers of middle-aged group. A routine health examination was performed before the study was started. All the subjects were healthy and free from any health problems.

The subjects were briefed about the study protocol and consent was obtained from them for the above study. The clearance (permission) of Institutional Ethical Committee of JNMC was obtained.

Selection of Subject: Study group was selected from yoga centre (Anekant Swadhyay Mandir, Ramnagar, Wardha) and from other yoga center in Wardha city who were enrolled for yogic exercise for the first time under the supervision of yoga experts. Study group consisted of forty five volunteers of middle aged (35-50 years). Control group also consisted of forty five subjects who were not practicing yoga or any other type of physical exercise and were selected from non-teaching staff of Jawaharlal Nehru Medical College and also from the general population of same age group (i.e. 35 to 50 years) from Wardha.

Inclusion Criteria of Study Group:

- Men in age group of 35-50 years.
- Not doing any exercise and yoga practice previously.
- Enrolled for yogic exercise under the supervision of yoga experts for the first time.
- Written consent obtained for participation in the study.

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Inclusion Criteria for Control Group:

- Mean in age group 35-50 years.
- Not doing any exercise or yoga practice.
- Consent to participate in the study was obtained.

Exclusion Criteria for Both Groups:

- Previous yoga practitioner (Those who practiced yoga).
- Smokers.
- With H/O chronic respiratory diseases or cardiovascular diseases.

Parameter: All subjects were assessed (both study group and control group) for cold pressor response (CPR) at 4^0C water.

METHOD: All the subjects were called to the Department of Physiology at 10 a.m. Routine medical examination was done. Detailed history was obtained. All the subjects were found healthy and not suffering from any illness. Name, age, bio-data of each subject was recorded and physical characteristics were determined such as weight and height. BMI was then calculated. Control group consisted of subjects who did not perform any physical exercise or yoga practice. Study group was trained by yogic expert (in yoga centre) in different yoga exercises and pranayam. In yoga centre, yoga classes were held early in the morning in two batches. All the subjects performed yoga for one hour daily for 12 months. The yogic exercises included are following.

I. Pranayam:

1. Anuloma –Viloma Pranayam.
2. Kapalbhati.

II. Asanas:

1. Tadasana.
2. Pawanmuktasana.
3. Bhujangasana.
4. Vajrasana.
5. Shalabhasana.
6. Makarasana.
7. Shavasana.

Physical Characteristics:

- Age was taken to nearest year.
- Height was measured by measuring tape to nearest cm with subject standing barefooted.
- Weight was taken on standard weighing machine to the nearest of kg (in light cloth and without footwear), BMI was calculated by the formula.

$$\text{BMI} = \frac{\text{Weight in kilogram}}{\text{Height in meter}^2}$$

Suppose weight is 60 kg. and height 1.65 metre, then his BMI will be:

BMI= [60/ 1.65^2]
BMI= 22.05 kg/m^2

Methods of Investigation:

Cold pressor response: Resting blood pressure was recorded after 15 minutes of rest given to the subjects. Then one hand of subject was dipped in cold water at 4^0C temperature to a point just above the wrist for 60 seconds. At the end of this, the blood pressure was again recorded and hand was removed from cold water (subjects were instructed to relax, breathe quietly during immersion). Then, again blood pressure (both systolic and diastolic) was recorded every minute till it came back to the initial level (we recorded the blood pressure at 0 (resting), 1, 2, 3 and 4 minutes' duration). The difference between reading at 1^{st} minute and resting blood pressure (0 minutes) reading taken as a rise in systolic and diastolic blood pressure.

STATISTICAL ANALYSIS: Appropriate statistical analysis was done using one way ANOVA test.

OBSERVATIONS: Cold pressor responses were studied in 90 subjects. They divided into two groups (i) study group (ii) control group. Both groups were free from illness and from same region. All subjects were between ages 35 to 50 years. Age, height, weight were noted and BMI calculated. All observation at 0, 6 and 12 months in control and study group is given in the master chart.

Sl. No.	Age range in years	Control Group		Study Group		x^2-value
		No. of cases	%	No. of cases	%	
1	35-40	15	33.33	13	28.88	1.24
2	41-45	17	37.77	14	31.11	p-value=0.53
3	46-50	13	28.90	18	40.01	Not-Significant
Total		**45**	**100.00**	**45**	**100.00**	p>0.05

Table 1: Showing Distribution of Cases According to Age

Table 1 showed the number of cases in five years group in control and study group. The difference is not-significant.

Parameters	Initial Reading (0 months)	Second Reading (6 months)	Third Reading (12 months)	F-value	p-value
Age (Years)	42.97±4.34	43.42±4.35	43.97±4.34	0.59	0.55 NS, p>0.05
Height (cm)	165.08±4.52	165.08±4.52	165.08±4.52	NA	
Weight (kg)	63.40±6.20	63.73±5.70	63.97±5.56	0.11	0.89 NS, p>0.05
BMI (kg/m^2)	23.26±2.22	23.32±2.05	23.48±1.96	0.13	0.87 NS, p>0.05

Table 2: Comparison of Various Parameters at Various time Intervals in Control Group

CPR	Initial Reading (0 months)	Second Reading (6 months)	Third Reading (12 months)	F-value	p-value
Systolic Blood Pressure					
Resting	130.44±8.9	131.77±8.57	132.93±7.65	0.98	0.37 NS,p>0.05
1 min.	148.02±8.95	149.04±7.91	149.84±7.43	0.56	0.56 NS,p>0.05
2 min.	135.40±9.51	136.02±9.16	137.22±8.23	0.47	0.62 NS,p>0.05
3 min.	130.08±9.02	131.68±8.70	133.06±7.78	1.37	0.25 NS,p>0.05
4 min.	129.02±8.78	130.62±8.31	132.15±7.91	1.58	0.20 NS,p>0.05
Rise	17.58±2.68	17.27±2.87	17.24±3.29	0.14	0.86 NS,p>0.05
Diastolic Blood Pressure					
Resting	86.93±5.14	87.24±5.34	88.08±4.45	0.64	0.52 NS,p>0.05
1 min.	101.77±5.56	101.60±5.58	102.00±5.00	0.06	0.94 NS,p>0.05
2 min.	90.55±5.43	91.17±5.83	91.64±4.51	0.48	0.62 NS,p>0.05
3 min.	86.88±5.14	86.97±5.67	87.84±4.40	0.48	0.61 NS,p>0.05
4 min.	85.60±5.21	85.84±5.93	87.24±4.41	1.29	0.27 NS,p>0.05
Rise	14.84±2.71	14.35±2.82	13.91±2.25	1.43	0.24 NS,p>0.05

*NS-Not significant.

In table 2, all the parameters showed non-significant differences in baseline (Ist reading), six months (2nd reading) and 1 year (3rd reading) with p>0.05 by using one way ANOVA in control group.

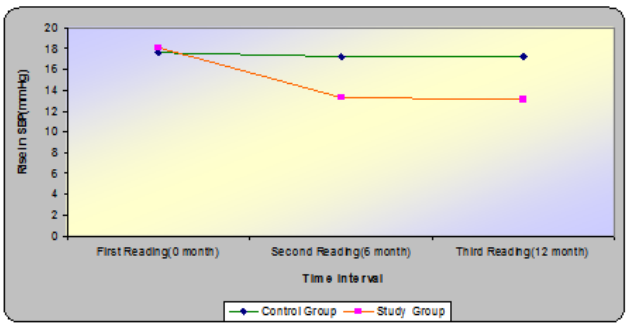
Parameters	Initial Reading (0 month)	Second Reading (6 months)	Third Reading (12 months)	F-value	p-value
Age (Years)	43.73±4.74	44.20 ±4.78	44.73±4.74	0.49	0.60 NS, p>0.05
Height (cm)	165.60±5.16	165.60±5.16	165.66±5.16	NA	
Weight (kg)	65.84±9.95	65.24±9.19	65.08±9.51	0.078	0.92 NS, p>0.05
BMI (kg/m^2)	23.95±3.00	23.73±2.72	23.71±2.90	0.091	0.91 NS, p>0.05

Table 3: Comparison of Various Parameters at Various Time Intervals in Study Group

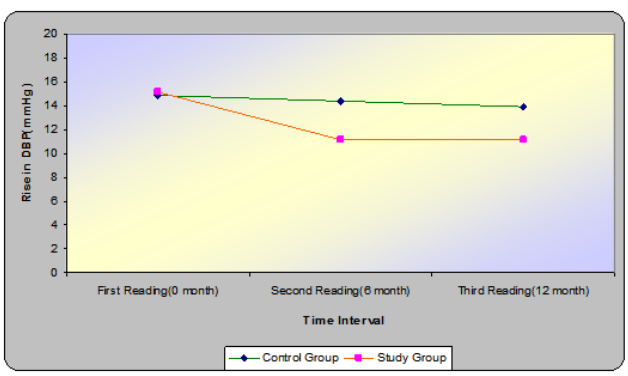
CPR	Initial Reading (0 months)	Second Reading (6 months)	Third Reading (12 months)	F-value	p-value
Systolic Blood Pressure					
Resting	128.00±7.66	120.97±4.21	120.48±3.86	26.08	0.000 HS,p<0.001
1 min.	145.95±6.98	134.57±3.72	133.55±3.66	84.05	0.000 HS,p<0.001
2 min.	132.60±8.51	122.84±4.56	122.40±4.08	40.80	0.000 HS,p<0.001
3 min.	127.95±7.70	120.73±4.37	119.44±3.59	31.09	0.000 HS,p<0.001
4 min.	126.68±7.50	120.04±4.41	118.73±3.73	27.34	0.000 HS,p<0.001
Rise	18.13±2.97	13.55±2.00	13.11±1.76	65.33	0.000 HS,p<0.001
Diastolic Blood Pressure					
Resting	84.48±5.22	80.53±3.44	80.53±2.53	15.43	0.000 HS,p<0.001
1 min.	99.60±5.50	91.64±3.52	91.46±2.59	58.84	0.00 0 HS,p<0.001
2 min.	88.44±5.72	82.33±3.58	82.44±2.71	31.11	0.000 HS,p<0.001
3 min.	82.82±12.54	80.53±3.44	79.55±2.29	2.17	0.11 NS,p>0.05
4 min.	83.55±5.15	79.73±3.55	78.97±2.58	17.70	0.000 HS,p<0.001
Rise	15.11±2.97	11.15±1.83	11.11±1.82	45.75	0.000 HS,p<0.001

* i) NS - Not significant; ii) S - Significant; iii) HS - Highly significant.

Table 3 showed a high rise in systolic blood pressure and diastolic blood pressure at 0, 6 and 12 months interval. The rise was decreased or blunted at 6 and 12 months reading which is statistically highly significant by one way ANOVA test in study group.



Graph 1: Comparison of Rise in SBP (mmHg) in Cold Pressor Response at Various Time Intervals (0, 6, 12 months) in both the Groups



Graph 2: Comparison of rise in DBP (mmHg) in Cold Pressor Response at Various Time Intervals (0, 6, 12 months) in both the Groups

DISCUSSION: Ninety normal healthy male subjects with age group 35-50 years were selected for the study and were divided into two groups. Control group consisted of 45 subjects which were non-exercising and non-yogic. Study group consisted of 45 subjects who were asked to perform yogic practices under supervision of yoga expert for one year and comparative study between both groups regarding changes in cold pressor response was carried out at 0, 6 and 12 months. Study revealed important and significant results.

Physical Characteristics: Weight and BMI in table 2 and 3 shows insignificant change in study group and control group as seen by one way ANOVA test.

Cold Pressor Response (CPR at 4^0C water): In present study, table 3 shows mean value of rise in systolic blood pressure, decreases from 18.13±2.97 to 13.26±2.74 at 6 months and to 13.11±1.76 at 12 months showing F-value 65.33 ($p<0.001$) which is highly significant in study group. Rise in diastolic blood pressure also decreases from 15.11±2.97 to 11.15±1.83 at 6 months and 11.11±1.82 at 12 months showing F-value 45.75 ($p<0.001$) which is highly significant in study group. Whereas table 2 shows rise in systolic and diastolic blood pressure in control group. Rise in SBP is 17.58±2.68 at baseline reading, 17.27±2.87 at 6 months and 17.24±3.29 at 12 months showing F-value 0.14 ($p>0.05$). Rise in DBP is 14.84±2.71 at 0 months, 14.35±2.82 at 6 months and 13.91±2.25 at 12 months showing F-value 1.43 ($p>0.05$) which is not significant. Mean value of SBP and DBP returned to normal, (resting value) is also less in duration in study group than in control group. Similar studies were carried out by Datey K.K., 1980[7]; Selvamurthy W., 1998[8]; Sharma Gitanjali, 2007[9]; Madan Mohan, 2002.[10] They also found blunting effect in rise in blood pressure which supported our finding.

Author	Year	First Reading (rise in mm of Hg)	Second Reading (rise in BP mm of Hg)	Third Reading (rise in BP mm of Hg)	p-value
Selvamurthy W[8]	1998	34±3.1 in SBP 27.0±1.3 in DBP	22±2.0 in SBP 18±2.2 in DBP		<0.00 <0.01
Present Study	2007	18.13±2.97 in SBP 15.11±2.97 in DBP	1 3.26±2.74 in SBP 1 1.15±1.83 in DBP	13.11±1.76 11.11±1.82	<0.001 <0.001

The cause of blunting effect of rise in present study might be due to reduced sympathetic activity and increased parasympathetic activity due to yogic practices.[7] also found blunting effect of rise in blood pressure by biofeedback training. They suggested that the effect of stress is modified by biofeedback training and relaxation. Yogic exercise relieves the stress-induced sympathetic activity, thereby restoring the blood pressure.[8]

CONCLUSION: CPR shows significant decrease in rise or rise was blunted in SBP and DBP in study group. While in control group raise in SBP and DBP shows no significant changes. Thus, Yoga improves autonomic function by decrease in sympathetic function as seen in study which is supported by work of many researchers.

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