



The Beneficial Effects Of Yoga Therapy On Cardio-Autonomic Function And Mental Well-Being In Overweight Subjects.

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Abstract

Background-: Obesity is the most hazardous condition in modern scenario which is linked with various diseases. Main reason of this condition is improper life style and stress. Yoga is one of the effective therapy to provide benefits and relief from many of the health problems.

Aim and objectives-: To assess the beneficial effects of 12 weeks yoga practice on cardio-autonomic functions and mental wellbeing in overweight medical students between the age group 18-24 years.

Material and Methods: In present study, 60 overweight (BMI \geq 25 - 29.9Kg/m²) medical students were enrolled. They were further classified into 2 groups, yoga group (N=30 who were willing to participate in yoga) Control group (N=30 who were not willing to participate in yoga). Anthropometric, sympathetic, parasympathetic parameters and mental wellbeing scores were recorded in both groups at baseline, after 6 weeks and 12 weeks. Statistical analysis were done by using one way ANOVA and impaired t Test.

Results: Present study showed statistically significant change in BMI, weight, heart rate, SBP, DBP and WHO well-being score after yoga practice. There was also less rise in SBP and DBP with hand grip and cold pressure test were noted. A significantly higher mean value of E:I ratio and 30:15 ratio after yoga practice were observed.

Conclusion: Our study shows that yoga practice has beneficial effects on reduction of body weight, strengthening autonomic nervous system and improvement of mental well being.

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Keywords: Yoga, Autonomic Nervous System, Body mass index, Mental Well Being.

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INTRODUCTION:

The prevalence of obesity in young adults is increasing at an upsetting rate in India and other South Asian countries; 30 to 65 % of Indian population are overweight or obese. Overeating and a sedentary lifestyle have led to an epidemic of obesity all over the world. According to Epidemiologists, the young people are prone to obesity and are at risk for a series of lifestyle diseases. Obesity may cause worst health situa-

tion and increases the risk of morbidity from several pathologies and it's the 5th leading risk for death globally¹. Obesity is the most hazardous condition in modern scenario. It is linked with various diseases such as cardiovascular diseases, Type-2 Diabetes Mellitus, Obstructive sleep apnea, certain types of cancer, osteoarthritis etc. Main reason of this condition is improper life style and stress². Thus, regular physical activity is recommended in medical guidelines as the most

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significant treatment preference in non-morbid overweight or obesity; as well as a preventive intervention³. The report of several studies says, autonomic dysregulation as a significant moderator in the development of obesity and its co-existing morbidities. Due to rising prevalence of obesity, it is important to know the mechanism linking obesity and autonomic nervous system function⁴. Autonomic imbalance is characterized by a hyperactive sympathetic system and a hypoactive parasympathetic system and is associated with various pathological conditions⁵. The exploration of alternative forms of exercise for weight associated outcomes seems necessary. One such different form of physical activity that is gradually more used for health purposes is yoga. Yoga is most often associated with physical postures (Asana), breath control (Pranayama), and meditation (Dhyana) and is fast increased popularity as a curative method for various health issues⁶. The word 'yoga' means "to join or Yoke together". It brings the body and mind together to become a pleasant experience. Yoga is a method of knowledge that aims at balancing "Mind, Body and Spirit". Yoga is usually acknowledged as an ancient tradition that incorporates postures, breathing techniques, meditation, and moral and ethical principles⁷. In the today's scenario, human beings are under risk from many chronic diseases, life style disorders and non-communicable diseases etc. Improper lifestyle and stress were found to be a major cause of all these diseases. One of the known causes is excessive stress that contributes for hormonal imbalances and chemical imbalances in human body. It disturbs the metabolic activities and causes improper coordination of the metabolic and bio-chemical functions⁸. Stress contributes to 80% of all diseases and illnesses. The scenario of stress, strain and depression, in human being is far greater than before due to advancement of mechanization and modernization. As a result of which, various psychosomatic disorders are rising up⁹. Research shows that yoga improves cardiovascular health, decrease blood pressure and the heart rate. It may also affect quality of life in those with atrial fibrillation, a common heart rhythm disorder¹⁰. Yoga and meditation diminish stress by declining activity in the sympathetic nervous system, otherwise known as the "fight or flight" response, which is classically responsible for constricting blood vessels and raising blood pressure and the heart rate. Practicing yoga helps

individuals to maintain normal BMI, lipid profile, and blood pressures. Further, yoga practice reduce the symptoms of obstructive airway diseases by significantly improving oxygen delivery¹¹. Yoga provides great relief in a number of chronic physical, psychological, and psychosomatic diseases. Studies have shown that Yoga has major effects on positive mental health by lowering stress hormones in our bodies while at the same time increasing beneficial brain chemicals like endorphins and GABA (gamma-aminobutyric acid). These feel-good chemicals help decrease anxiety and improve mood^{12, 13}.

The curative medicines used for many disorders are not long term effective and give temporary relief. Yoga is one of the non-pharmacological, preventive, curative and cost effective therapy to provide benefits and relief from many of the health problems. So, the final objective of our study is to assess the beneficial effects of 12 weeks yoga practice on cardio-autonomic functions and mental well-being in overweight medical students between the age group 18-24 years.

MATERIALS & METHODS

Study Subjects

This prospective observational study was carried out in the Department of Physiology, Faculty of Medicine and Health Sciences, SGT (Shree Guru Gobind Singh Tricentenary) University Gurugram, Haryana in collaboration with the Department of Physiology, GS Medical College & Hospital Pilkhuwa Hapur. After obtaining the institutional ethical committee approval, 60 overweight (BMI ≥ 25 - 29.9Kg/m²) medical students between 18-24 years of age were enrolled. They were further classified into 2 groups, yoga group (N=30 who were willing to participate in yoga) Control group (N=30 who were not willing to participate in yoga) (**Figure 1**). Before enrollment into the study informed and written consent was taken from all the students. All the individual from yoga group were subjected to yoga practice for 45 minutes for 6 days in a week between 7 am to 8am for a period of 3 months under the direct supervision of a trained yoga expert (**Table 1**). All parameter was recorded in both groups at moderate temperature of 25 to 28^oc in the Department of Physiology at 8:00 am at baseline, after 6 weeks and 12 weeks.



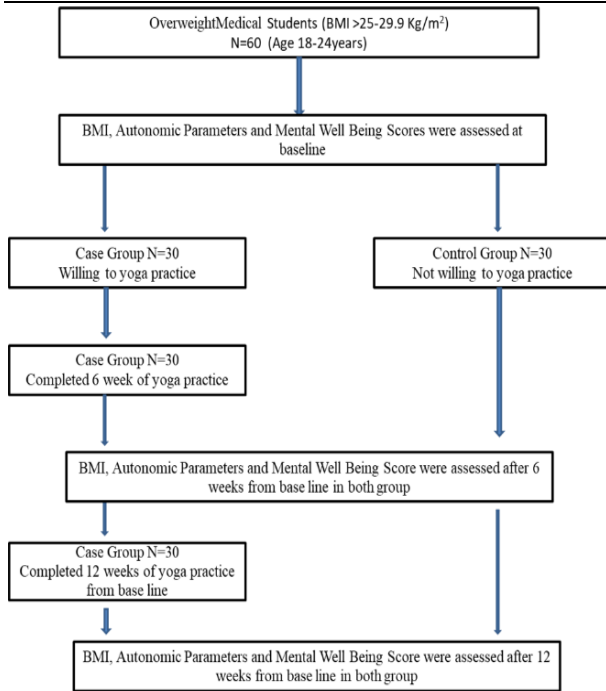


Figure 1: Subject Disposition Chart

Table No 1: Yoga Asanas:

Duration of Asana	Time (Minutes)	Total Duration (min.)
Yogasana		
Standing series of Asanas		
1. Suryanamaskar	10 (5 Rounds)	25
2. Ardachakrasana		
3. Trikonasana (Triangular pose)		
Supine series of Asanas		
1. Uttitapadasana	1	
2. Vipareetakarani	1	
3. Naukasana	1	
4. Pavanamuktasana	1	
5. Shavasana	5	
Prone series of Asanas		
1. Bhujangasana	1	
2. Shalabasana	1	
3. Dhanurasana	1	
4. Navasana	1	
Pranayama		
1. KapalBhati	3	14
2. Bhastrika	3	
3. Alternate nostril breathing	5	
4. Right nostril breathing	3	
Meditation		
1. Om chanting	5	5

Anthropometric Measurements¹:

Body weight of the individuals was recorded by using Omron digital body weighing scale, HN-283 model to the nearest 0.1 kg. Height was recorded by using a fixed stadiometer manufactured by Easy Care Model to the nearest 0.1 cm. Using Quetelet's Index formula, BMI was calculated by

weight (kilograms) divided by the square of the height (meters) which is expressed as kg/m².

Clinical assessment:

Resting Heart Rate (HR), Resting Systolic (SBP) and Diastolic Blood Pressure (DBP):

After asking the subject to lie down in supine position for 15 min, continuous ECG was recorded by means of ECG machine. The resting HR was measured by counting number of R waves within one minute period. Blood pressure (BP) was recorded from left brachial artery after rest of 10 minutes by mercury sphygmomanometer (HEM- 8712) three times with a gap of 5 minutes and lowest value was considered as final reading.

Autonomic function Test¹⁴

I. Sympathetic reactivity Test

a. Blood pressure changes due to isometric hand grip exercise (HGT):

After recording resting blood pressure and heart rate, IHG exercise was done with Hand Grip Dynamometer INCO, Ambla, India). The subjects were asked to hold the dynamometer in right hand and pull the grip with maximum tension. After three successive trials, the highest value of three contractions was taken as maximum voluntary contractions (MVC). Following this, hand grip was maintained steadily by the subject at 30% of MVC for 2 minutes. Both SBP and DSP were recorded every 30 seconds in the non-exercising arm. The maximum rise in SBP and DSP was taken as final value during 2 minutes of sustained handgrip. After that the subject was asked to discontinue the exercise.

b. Blood pressure changes due to cold pressor test (CPT):

After recording baseline blood pressure in sitting position, subject was asked to immerse his/her hand in a plastic bucket of cold water at 4 degrees Celsius. SBP and DSP was recorded from the other arm at 30 seconds and 60 seconds of immersion of the limb than subject is asked to remove the hand from water. The maximum rise in SBP and DSP was taken as final value.

II. Parasympathetic Reactivity Tests

a. Expiration-Inspiration Ratio (E: I ratio): is the ratio of longest R-R interval during expiration to the shortest R-R interval during inspiration. The subject breathes deeply and steadily at six



breaths per minute. The E: I ratio was calculated from the formula given below:

E: I ratio = Longest R-R interval during Expiration divided by Shortest R-R interval during Inspiration.

b. 30:15 ratio:

It is the ratio of R-R interval corresponding to the 30th and 15th heart beat upon standing from supine position. It was calculated by following formula:

30:15 ratio= R-R interval at beat 30 after assuming erect posture divided by R-R interval at beat 15 after assuming erect posture

Psychological assessment:

Table No 2: WHO Well-being Index Scale

	Over the last two weeks	All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
1	I have felt cheerful and in good spirits	5	4	3	2	1	0
2	I have felt calm and relaxed	5	4	3	2	1	0
3	I have felt active and vigorous	5	4	3	2	1	0
4	I woke up feeling fresh and rested	5	4	3	2	1	0
5	My daily life has been filled with things that interest me	5	4	3	2	1	0

Statistical Analysis:

Data were prepared in Excel sheet and coded numerically to maintain confidentiality of the subjects. Statistical evaluation were performed by using Statistical Package of Social Sciences (SPSS) system 20.0. Intra-group comparison of parameters was done by one way ANOVA. Significant difference among two groups case and control groups were assessed by unpaired student t-test. P<0.05 was considered as significant, P<0.001 highly significant.

Results:

BMI, Autonomic parameters and mental well-being scores of all 60 overweight medical students were followed at baseline, at 6th week and at 12th week are shown in (Table 3&4). The present study showed that the overweight yoga group subjects significantly reduced their Body Weight and BMI after yoga practice when compared to that before the yoga practice. Significant changes in mean value of BMI was also noticed in yoga group when compared with control group (p≤0.05). (Table No 4&5).

Mental Wellbeing was measured by WHO-5 Well-Being Scale

World Health Organization-5 (WHO-5) Well-Being Index is a short self- reported measure of current mental wellbeing¹⁵. (Table 2). Subjects indicated for each of the five statements. Each statement measures the tested domain on the weighted scores of responses from 5 to 0 ranging from “all time” to “never” response. Questionnaires were scored by adding the weighted (5 to 0) scores of each statement. This score was multiplied by 4 to obtain score in percentage. A percentage score of 0 represents worst possible, whereas a score of 100 represents best possible quality of life.

Mean value of resting cardiovascular parameters like heart rate (p≤0.05), SBP (p≤0.05), DBP (p≤.05) were significantly less in yoga group after yoga practice when compared from baseline (Table No 3). Significant changes were also seen in heart rate after 12 weeks and in DBP after 6 and 12 weeks in yoga group when compared with control group. (Table No 5)

Sympathetic reactivity test:

Within yoga group blood pressure response to hand grip test showed significantly less rise in DBP (p≤.001) after yoga practice when compared from baseline where as no change in SBP was observed. Similarly, there was significantly less rise in the DBP with cold pressor test after yoga practice whereas no significant change in SBP was observed. (Table No 3)

It was also shown that in yoga group blood pressure rise in response to hand grip test was significantly less in SBP after 6 week and 12 weeks and in DBP only after 12 weeks when compared with control group. Similarly, blood pressure rise in response to cold pressure test



was significantly less for SBP ($p \leq .05$) and for DBP ($p \leq .001$) in yoga group when compared with control subjects. **(Table No 5)**

Parasympathetic reactivity test:

Assessment of parasympathetic system showed that mean value of E:I ratio ($p \leq .001$) and 30:15 ratio ($p \leq .001$) was significantly higher after yoga practice when compared from baseline. When yoga group was compared with control group a significant rise in E:I ratio ($p \leq .001$) was observed after 6 weeks and 12 weeks of yoga practice.

However significant rise in 30:15 ratio ($p \leq .001$) was seen in yoga group only after 12 weeks of yoga practice. **(Table No 3&5).**

Mental well-being assessment:

(Table No 3&5) shows that there were significantly higher scores of WHO well-being index after yoga practice when compared from the baseline in yoga group. On comparing yoga and control group a significant rise in score ($p \leq .05$) of well-being was observed only after 12 weeks of yoga practice.

Table No 3: Comparison of mean values of cardio-autonomic parameters of yoga and control group between baseline, 6th and 12th week (N=30).

Parameters	Yoga Group				Control Group			
	Baseline	6 th Week's	12 th Week's	Significant	Baseline	6 th Week's	12 th Week's	Significant
HR	77.13±8.92	74.33±8.93	69.46±6.31	0.002	0.23±10.65	79.13±10.04	79.43±8.32	0.903
SBP	125.33±6.60	123.93±6.40	121.53±5.45	0.060	124.33±7.68	124±6.84	124.53±6.12	0.956
DBP	81.07±5.37	78.60±4.30	77.07±3.51	0.003	81.73±5.60	81.93±4.05	82.13±4.23	0.947
SBP (Hand Grip Test)	18.13±4.81	17.07±5.32	16.00±4.89	0.263	19.87±5.58	21.20±5.13	20.80±4.77	0.594
DBP (Hand Grip Test)	14.67±3.45	13.27±3.03	10.67±1.98	0.000	13.47±4.57	13.13±4.15	13.60±2.69	0.892
SBP (Cold Pressor Test)	15.53±4.68	13.73±4.97	12.53±4.60	0.054	16.47±4.77	17.60±5.15	16.67±4.99	0.643
DBP (Cold Pressor Test)	11.67±3.11	10.27±3.43	7.73±1.87	0.000	11.20±4.08	10.60±3.75	10.40±3.16	0.684
Expiration: Inspiration Ratio	1.13±0.05	1.19±0.06	1.22±0.05	0.000	1.09±0.06	1.10±0.05	1.10±0.04	0.455
30:15 Ratio	1.13±0.05	1.13±0.05	1.21±0.06	0.000	1.13±0.05	1.11±0.04	1.10±0.36	0.117
WHO 5-mental wellbeing scale	58.80±22.01	63.33±17.35	70.80±15.33	0.044	59.47±20.49	61.07±17.79	61.8±16.43	0.875

Table No: 4: Comparison of mean values of weight and BMI of yoga and control group between baseline, 6th and 12th week (N=30).

Parameter	Yoga Group				Control Group			
	Baseline	6 th Week's	12 th Week's	Significant	Baseline	6 th Week's	12 th Week's	Significant
Weight	76.26	74.06	71.26	0.029	26.55	25.77	24.80	0.988
BMI	26.55	25.77	24.80	0.001	26.70	26.65	26.75	0.987

Table No-5: Comparison of mean values of anthropometric, cardio-autonomic parameters and WHO Well-being Scale between yoga group and control at 6th and 12th week (N=30).

Parameter	Baseline			6 th Week's			12 th Week's		
	Yoga	Control	Significant	Yoga	Control	Significant	Yoga	Control	Significant
Weight	72.59±8.13	71.27±8.02	0.416	70.56±8.12	71.30±8.03	0.6	67.90±7.84	71.410±8.2	0.032
BMI	26.42±1.44	26.66±1.39	0.40	25.67±1.50	26.65±1.44	0.01	24.713±1.4	26.694±1.531	0.0001
HR	77.13±8.92	0.23±10.65	0.22	74.33±8.93	79.13±10.04	0.05	69.46±6.31	79.43±8.32	0.00
SBP	125.33±6.60	124.33±7.68	0.59	123.93±6.40	124±6.84	0.96	121.53±5.45	124.53±6.12	0.05
DBP	81.07±5.37	81.73±5.60	0.64	78.60±4.30	81.93±4.05	0.003	77.07±3.51	82.13±4.23	0.000
SBP (Hand Grip Test)	18.13±4.81	19.87±5.58	0.05	17.07±5.32	21.20±5.13	0.00	16.00±4.89	20.80±4.77	0.00
DBP (Hand Grip Test)	14.67±3.45	13.47±4.57	0.25	13.27±3.03	13.13±4.15	0.88	10.67±1.98	13.60±2.69	0.00
SBP (Cold Pressor Test)	15.53±4.68	16.47±4.77	0.44	13.73±4.97	17.60±5.15	0.005	12.53±4.60	16.67±4.99	0.002
DBP (Cold Pressor Test)	11.67±3.11	11.20±4.08	0.62	10.27±3.43	10.60±3.75	0.72	7.73±1.87	10.40±3.16	0.000
Expiration: Inspiration Ratio	1.13±0.05	1.09±0.06	0.009	1.19±0.06	1.10±0.05	0.000	1.22±0.05	1.10±0.04	0.000
30:15 Ratio	1.13±0.05	1.13±0.05	1.00	1.13±0.05	1.11±0.04	0.05	1.21±0.06	1.10±0.36	0.00
WHO 5-mental well being scale	58.80±22.01	59.47±20.49	0.904	63.33±17.35	61.07±17.79	0.619	70.80±15.33	61.8±16.43	0.034



Discussion:

The present study demonstrates beneficial effects of yoga practice as a conventional modality of management on body weight, BMI, cardio-autonomic imbalances and mental well-being status in overweight subjects.

Yoga practice can be one of the secret keys for gaining holistic well-being, as it guides us in bringing our minds, soul and body back to a state of natural calm, resting state and balance. Yoga practice improve our immune system, reduce stress and anxiety, increase flexibility as well as mental peace. Various studies all over the world have shown that regular yoga practice radically optimizes body functions like respiration, heart rate, blood pressure, chronic back pain or joint pain along with other key physical benefits. There was improvement in the WHO Well-being Index Scale in yoga group as compare to control group which is accordance with other studies¹².

The present study depicts significant reduction in body weight and BMI in overweight subjects practicing yoga, which is similar to earlier studies that shows a 6 days yoga practice led to decreased body mass index (BMI), waist and hip circumference, fat free mass, total cholesterol, high-density lipoprotein and fasting serum leptin levels^{8,16}

We observed a statistically significant decrease in Systolic BP, Diastolic BP and heart rate after 12 weeks of yoga training. This may possibly due to dominance of parasympathetic over sympathetic system in yoga group. The findings of our study are similar to those by other researchers^{9, 17}. Research also shows that yoga improve cardiovascular health, lowering blood pressure and the heart rate. It may also affect quality of life in those with atrial fibrillation, a common heart rhythm disorder¹¹. Decrease in heart rate and blood pressure point out a shift in the balancing mechanism of autonomic nervous system towards the parasympathetic activity which was reported by other studies^{18, 19}.

The earlier studies show a statistically significant association between mental health and obesity. There are also links between stress, anxiety and depression, and obesity²⁰. Meditation trim down the anxiety levels by minimizing the sympathetic hyperactivity induced by stress. Decreased sympathetic activity led to reduce catecholamine

secretion which results to peripheral vasodilatation and improvement in peripheral circulation⁹.

The results of Handgrip test are in line with the studies^{9, 21, 22}. Observation of cold presser test are similar with the results of other researchers^{9,23}. Yoga and Meditation causes decreased sympathetic activity and increased vagal tone. Due to this reason there is less increase in BP in yoga group with HG and CP test. The raise in 30:15, and E:I ratio in yoga group indicates raise in parasympathetic activity in yoga group than control group. The conclusion of our study is same as other studies^{9,22,23}.

The yoga practicing can really influence mood, behavior and on the whole mental health in various ways. Daily Yoga practice benefits to students or working profession by increasing concentration, relaxation and peace of mind. It also helps to relieve symptoms of anxiety, stress, and so on. It gives remarkable levels of mental intelligibility and peace only by practicing an integration of meditation and yoga consistently. Besides, sense of feeling better, gratefulness and well-being are enhanced by regular yoga practice. Regular yoga practice helps public in uplifting mindfulness, self-awareness and harmony, and develops our ability to focus and stay happy throughout the day²⁴.

CONCLUSION:

Our study shows that yoga practice has beneficial effects to combat the disorders linked with obesity. Yoga practice may have protective and therapeutic effects on obesity and cardio-autonomic dysfunction. Yoga therapy in addition to standard medical therapy reduces HR, blood pressure. Thus, it is concluded that there is a sense of balance between the sympathetic and parasympathetic components of the autonomic nervous system in persons who practice yoga. Yoga is one of the non-pharmacological, preventive, curative and cost effective therapy to provide benefits and relief from many of the health problems.

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