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Study the Impact of Yoga on Body Composition and Cardio-Pulmonary Functions of 14–16 Years Girls

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Abstract – The present examination was expected to discover the impacts of yoga on body composition and cardio-pulmonary capacities on female volunteers. For this reason ninety eight female volunteers (age 14–16 yrs) were screened haphazardly from Midnapore District, West Bengal, India. Every one of the volunteers experienced a therapeutic examination performed by Physicians. Thirty eight volunteers were prohibited and the staying sixty (n = 60) volunteers were arbitrarily partitioned into two groups: (a) Yoga Group (n = 30) and (b) Control Group (n = 30). Yoga preparing - 60 min/d, 06 d/wk for 12 wks was followed in yoga bunch with no yoga preparing in control gathering. Noteworthy decrease (P<0.05) in body fat, body mass, SBP, RHR and RR; and increment (P<0.05) in FVC, FEV1, PEFR, MVV and BHT were noted in the yoga bunch following 12 weeks of yoga preparing when contrasted with pattern information. Further, the control gathering had essentially (P<0.05) higher body fat, body mass, SBP, RHR and RR; and (P<0.05) lower FVC, FEV1, PEFR, MVV and BHT when contrasted with yoga bunch following 12 weeks of study. It very well may be proposed that yoga practice may diminish body fat and the danger of cardio-pulmonary diseases.

Keywords - Yoga, Body Composition, Blood Pressure, Pulmonary Function

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I. INTRODUCTION

Physical inertia prompts weight and builds the hazard for cardio-pulmonary diseases [1, 2]. Then again, physical movement passes on various health advantages including diminished rates of coronary supply route infection, hypertension, non-insulin subordinate diabetes mellitus, osteoporosis, colon malignant growth, tension and depression, just as diminished danger of in general mortality [1, 2]. Yoga, with sources in antiquated India has a few sub-types, and joins asana (pose physical exercise), pranayama (breathing activity) and meditation (a way to deal with preparing the psyche or concentrating mind on a specific item). Yoga and reflection as adjunctive treatments for advancing and keeping up health offer a phenomenal case of the mind-body association at work. Yoga makes balance, physically and inwardly, by utilizing stances, or asanas, joined with breathing systems, or pranayama. Contemplation bolsters the physical and passionate work being finished by the stances and breathing, they open the way to self-realization to make the ideal association of the psyche, body, and soul [3]. Notwithstanding low obstructions to get to, the logical method of reasoning for yoga impacts on the psyche is very solid. The all encompassing objective of yoga to advance physical and mental health, and furthermore be profoundly and socially cognizant, may advance both to purchasers and suppliers who are worried about the indication decrease based focal point of psychopharmacology and finding internal harmony [4].

Rehearsing yoga, with yogic disposition causes a few changes in body physiology. In our past investigations it has been noticed that standard routine with regards to yoga improves wellness and co-appointment to mind and solid exercises [5]. Customary yoga practice keeps up typical healthy way of life and physical wellness which is shown by diminishing body fat, blood weight, pulse and keeping up lipid profile [6]. Further, it has been seen that yoga exercise improves oxidative pressure markers and cancer prevention agent status in healthy members [7]. The pulmonary capacities have been distinguished as an indicator for by and large survival rates just as an apparatus all in all health appraisals [2]. Numerous investigations are accessible appearing ideal impact of yoga on pulmonary capacity tests [8, 9]. The unpleasant working conditions and physical latency may prompt different diseases. In this way decreasing the quantity of working days, efficiency and improve the use towards prescription. These force a colossal weight on the businesses and the nation on the loose. Based on the abovementioned, the present examination was

intended to discover the impacts of transient yoga practice on cardio-pulmonary factors of youthful female volunteers who are the future working power of our nation.

II. MATERIALS AND METHODS

2.1. Subjects and group:

For the present investigation, Ninety Eight (n = 98) healthy young ladies inside the age gathering of 14–16 years were screened arbitrarily from the Midnapore District, West Bengal, India. Subjects had not been occupied with yoga practice or any physical exercise at any rate two years going before the investigation were viewed as qualified for this examination. Subjects without history of ailment and sickness were incorporated. This choice depended on the restorative examination performed by Physicians. Participants were rejected from the examination on the off chance that they had a background marked by infection and disease for in any event 03 months before the initiation of the investigation. Every one of the volunteers experienced a restorative examination performed by Physicians. Thirty Eight [n = 38 (Not meeting the consideration criteria, n = 05; decrease to partake, n = 09; failure to perform yoga, n = 11; and unfit to pursue the timetable, n = 13)] volunteers were excluded. The staying sixty (n = 60) volunteers were arbitrarily separated into two groups: (a) Yoga Group (YG: n = 30) and (b) Control Group (CG: n = 30).

2.1.1. *Experimental Design:*

Yoga preparing was given in the yoga gathering, while no yoga preparing was given to the control gathering. Yoga preparing was given by qualified yoga educator for 60 min/day, 06 days/week for 12 weeks term following a standard convention [10]. The detail of yoga convention is displayed in Table 1. Evaluation of body composition and cardio-pulmonary capacities were performed in both the groups at multi week and after 12 weeks. The participant stream during the investigation is appeared in Figure 1.

2.1.2. *Ethics:*

The volunteers were educated about the reason and the potential complexities of the examination, and composed assents were taken from them. The volunteers were approached to forgo smoking and liquor all through the examination. The yoga bunch participants were educated not to include in some other physical action during the whole time of the investigation. The participants were approached to keep up their typical diet. The experimental convention was endorsed by the Institutional Ethical Committee (Human Studies) (Ref No. MC/IEC (HS)/PHY/FP 02/2016; date: 07.06.2016).

Table 1: Types of Yoga Exercises Practiced by the Volunteers

Yogic Training Schedule	Duration of each session (min)
Prayer	02
Om chanting	02
Gayatri Mantra	02
Yogic SukshmVyayam	10
Surya Namaskar	12
Yogasana (i) Shavasana (ii) Supt Pawan Muktasana (iii) Kandrasana (iv) Makarasana (v) Shalabhasana (vi) Bhujangasana (vii) Mandukasana (viii) Usharasana (ix) Gomukhasana	10
Pranayama (i) Kapal Bhati (ii) Mahabandh (iii) Laybadh Shvas Prashwas (iv) Nadi Shodhan (v) Ujjayi & Bhramari Pranaya	15
Meditation	05
(i) Ajpa Jap (ii) Shanti Mantra	02
Total	60

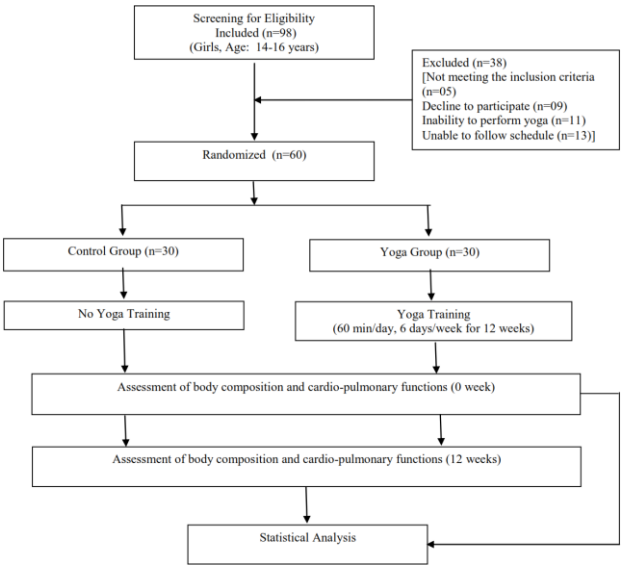

Fig 1: Consort flow chart

2.2 Measurements:

Estimation of height (stature) and body mass: The height was estimated by the stadiometer (Seca 220, UK) with a precision recorded to the closest 0.5 cm. The subject stood shoeless, and erect with heels together and arms hanging normally by the sides. The heels, rear end, upper piece of the back and as a rule yet not really, the back of the head were in contact with the vertical wall. The subject looked straight ahead and took a full breath during estimation. The separation from the standing stage, to the most astounding position of head (vertex) was estimated with the assistance of stadiometer, which demonstrates the subjects' height [11]. The stature was recorded in centimeters. The body mass was taken on a standard electronic gauging machine (Seca Alpha 770, UK), having an exactness recorded to the closest 50 gm. The subject was inspected in

apparel of realized load so as to record naked weight 12 hours after the last feast. The subject remained at the focal point of the gauging machine looking straight. The body mass was recorded in kilograms [11].

2.2.2. Assurance of body mass index and body surface area:

Body mass index (BMI) and Body surface area (BSA) were gotten from the standard condition [11].

BMI = Weight (kg)/Height (m2)

BSA (sq m) = Weight (kg) 0.425

Height (cm) 0.725

71.84/10000

2.2.3. Appraisal of percent body fat and slender body mass:

A skin fold calliper (Holtain Limited, UK) was utilized to evaluate the body fat following standard technique [12]. The instrument comprises of precisely adjusted dial which shows the thickness of the skin crease in millimeters (mm) when the skin overlay is held by the open jaws. The skin overlay was taken from four unique sites of the body (biceps, triceps, sub-scapular and suprailiac) utilizing the skin fold calliper on the correct side of the body. The thickness of the skin and subcutaneous fat was gotten a handle on between the thumb and index finger. To evaluate the blunders, perusing was made somewhere in the range of three and four seconds when basically all compressions have occurred and the estimations were built up.

Calculation of Body density (BD): Body density was determined by the standard formulae for female [13]. The skin fold thickness at the site of biceps, triceps, sub-scapular and suprailiac was utilized to figure the body density.

BD = 1.1549 - 0.0678 log (Biceps + Triceps + Sub scapular + Suprailliac)

Calculation of Percent Body fat was inferred utilizing the standard condition [12].

Body fat (%) = (495/Body density) – 450

Calculation of Lean body mass (LBM) was inferred by subtracting fat mass (FM) from complete body mass [12] utilizing the accompanying condition.

LBM (kg) = Body mass – Fat mass

FM (kg) = [Body mass (kg)

Body fat (%)]/100

2.2.4. Appraisal of cardiovascular capacities:

The subject was approached to take rest for 15 minutes resting pulse (RHR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded utilizing standard method [14].

2.2.5. Appraisal of Pulmonary Functions:

The forced expiratory volume in 1st second (FEV1); forced vital capacity (FVC); peak expiratory flow rate (PEFR); maximum ventilatory volume (MVV) was estimated utilizing an electronic spirometer (Spirobank II, MIR, USA) following a standard method [15]. Respiratory rate (RR) was recorded by watching stomach wall development in sitting position after adequate rest. Breath holding time (BHT) was estimated in seconds from the season of holding breath after quit lapse till the limit of the held breath by utilizing a stop watch in open to sitting position in which subjects were approached to hold breath by shutting both nostril deliberately by squeezing nose between his/her thumb and index finger and shut mouth.

2.3 Statistical Analysis:

To see if information were normally distributed, Shapiro–Wilk typicality test was performed. Every one of the information of was communicated as mean and standard deviation (SD). ANOVA and post hoc tests was performed to discover the significant distinction in intragroup and intergroup variables. For each situation, the significant dimension was picked at 0.05 dimensions. All the statistical analysis was performed by SSPSS 20 (IBM, USA).

III. RESULTS

3.1. Impact of yoga practice on body composition:

The body composition variables demonstrated that there was significant decrease ($P<0.05$) in level of percent body fat, all out fat mass, body mass and BMI in the yoga group following 12-weeks of yoga training when contrasted with 0- week. Nonetheless, there was no significant contrast in height, BSA and LBM in the yoga group following 12-weeks of training when contrasted with 0-week. In the control group no such changes were seen following 12-weeks of study. Further, it was seen that the control group had significantly ($P<0.05$) higher percent body fat, complete fat mass; body mass and BMI when contrasted with yoga group following 12-weeks of study (Table 2).

Table 2: Body Composition Variables of Yoga and Control Group Subjects

Groups	Yoga Group		Control Group	
Parameters	0 Week	12 Weeks	0 Week	12 Weeks
Height (cm)	153.1 + 3.58	153.1^{NS} + 1.58	153.7 + 1.58	153.7 ^{NS} + 1.58
Body mass (kg)	46.4 ± 2.4	43.1$^{*\#}$ ± 2.1	45.8 ± 2.5	46.7 ^{NS} ± 2.3
BMI (kg m^{-2})	19.6 ± 1.3	18.4$^{*\#}$ ±1.2	19.4 ± 1.1	19.8 ^{NS} ± 1.2
BSA (m^2)	1.41 ± 0.44	1.36 ^{NS} ± 0.43	1.40 ± 0.47	1.42 ^{NS} ± 0.45
Body Fat (%)	17.6 ± 2.3	14.8$^{*\#}$ ±1.8	17.2 ± 1.8	17.8 ^{NS} ± 2.1
Fat mass (kg)	8.2 ± 0.81	6.4$^{*\#}$ ± 0.89	7.9 ± 0.75	8.3 ^{NS} ± 0.83
LBM (kg)	38.2 ± 2.7	36.9 ^{NS} ± 2.8	37.9 ± 2.7	38.4 ^{NS} ± 2.9
Data presented as mean ± SD; ANOVA with repeated measured followed by multiple comparison (post hoc) tests were performed; n= 30. *P<0.05 compared to 0-week; # P<0.05 compared to CG; NS= non-significant.				

3.2. Impact of yoga practice on cardiovascular functions:

A significant decrease (P<0.05) in systolic blood pressure (SBP) and resting pulse (RHR) were noted in the yoga group following 12-weeks of yoga training when contrasted with 0-week. In any case, there was no significant change in diastolic blood pressure (DBP) in the yoga group following 12-weeks of training. In the control group no such changes were seen following 12 weeks of study. Further, the control group had significantly (P<0.05) higher SBP and RHR when contrasted with yoga group following 12-weeks of study (Table 3).

Table 3: Blood pressure and heart rate response of yoga and control group subjects

Groups	Yoga Group		Control Group	
Parameters	0 Week	12 Weeks	0 Week	12 Weeks
SBP (mmHg)	115.5 ± 4.7	110.1$^{*\#}$ ± 4.5	116.9 ± 4.6	116.4 ^{NS} ± 4.2
DBP (mmHg)	75.8 ± 3.1	74.1 ^{NS} ± 3.5	76.4 ± 3.7	75.7 ^{NS} ± 3.6
RHR (beats/min)	81.9 ± 3.3	76.5$^{*\#}$ ± 3.4	79.6 ± 3.7	78.8 ^{NS} ± 3.5
Data presented as mean ± SD; ANOVA with repeated measured followed by multiple comparison (post hoc) tests were performed; n= 30. *P<0.05 compared to 0-week; # P<0.05 compared to CG; NS= non-significant.				

3.3. Impact of yoga practice on pulmonary functions:

It has noticed that there was significant increment (P<0.05) in FVC, FEV1, PEFR, MVV and BHT among the yoga group subjects following 12-weeks of yoga training when contrasted with 0-week. In any case, there was significant decrease (P<0.05) in RR among the yoga group subjects following 12-weeks of yoga training. In the control group no such changes were seen following 12-weeks of study. Further, the control group had significantly (P<0.05) lower FVC, FEV1, PEFR, MVV and BHT; and higher (P<0.05) RR when contrasted with yoga group subjects following 12-weeks of study (Table 4).

Table 4- Pulmonary Functions of Yoga and Control Group Subjects

Groups	Yoga Group		Control Group	
Parameters	0 Week	12 Weeks	0 Week	12 Weeks
FVC (L)	1.86 ± 0.06	1.92$^{*\#}$ ± 0.04	1.76 ± 0.05	1.78 ^{NS} ± 0.07
FEV1 %	81.1 ± 4.1	84.9$^{*\#}$ ±4.3	80.1 ± 4.2	81.3 ^{NS} ± 4.5
PEFR (L/Sec.)	3.45 + 0.15	3.68$^{*\#}$ ± 0.14	3.41 ± 0.17	3.47 ^{NS} ± 0.18
MVV (L/min)	65.5 ± 2.6	69.6$^{*\#}$ ± 2.4	64.2 ± 2.5	65.1 ^{NS} ± 2.4
BHT (sec.)	18.8 ± 1.5	21.5$^{*\#}$ ± 1.6	19.3 ± 1.6	19.8 ^{NS} ± 1.7
RR (breath/min)	19.6 ± 1.8	17.2$^{*\#}$ ± 1.9	19.0 ± 2.1	18.6 ^{NS} ± 2.0
Data presented as mean ± SD; ANOVA with repeated measured followed by multiple comparison (post hoc) tests were performed; n= 30. *P<0.05 compared to 0-week; # P<0.05 compared to CG; NS= non-significant.				

IV. DISCUSSION

Yoga has a job in keeping up great health and physical fitness. In the present investigation, significant decrease in body fat was noted following 12 weeks of yoga work out. The decrease in body fat may be because of the way that the volunteers experienced an abnormal state of yogic exercise over some stretch of time, which brought about bringing down of body fat rate. Yoga includes profound nostril breathing, adaptability of limbs and extending of various body parts, which may be the reason for decrease of body fat of the volunteers rehearsing yoga. The decrease of body fat may impact the body mass and thus in the present examination significant decrease of body mass was noted among the volunteers rehearsing yoga. Comparable perceptions were noted by numerous creators where decrease in body fat was noted after yoga training [6, 16-18]. Then again, no significant contrast was seen in LBM among the subjects following 12 weeks of yoga training program. This may be because of inappropriate improvement of the training load as well as brief span of the yoga training. Increment in body fat can raise the risk factors for weight, cardiovascular disease, diabetes and numerous different complexities [6, 16-18]. Standard yoga practice may lessen body fat, which is basic for disease free life.

Pulse and blood pressure are fundamental for surveying cardiovascular fitness. The cardiovascular reaction in yoga was contemplated in the present analysis and it has been seen that there was significant decrease in systolic blood pressure and resting pulse with no change in diastolic blood pressure among the yoga group following 12 weeks of yoga training when contrasted with basal information. Comparable perceptions were noted by numerous analysts where decrease in blood pressure and pulse was noted after yoga training [1, 6, 19, 20]. It very well may be expressed that yoga includes profound nostril breathing, adaptability of limbs and extending of various body parts which may be the reason for lower systolic blood pressure and pulse rate of the subjects. Decrease in pulse and blood pressure show a move in the adjusting segments of autonomic nervous system towards the parasympathetic action [6, 19, 20]. This autonomic nervous system action may have been realized through the molding impact of yoga on autonomic functions and interceded through the limbic

framework and higher territories of central nervous system [21]. Standard routine with regards to yoga builds the baroreflex affectability and diminishes the sympathetic tone; accordingly reestablishing blood pressure to normal dimension in patients of hypertension [22]. Meditation by adjusting the condition of nervousness lessens pressure – actuated sympathetic over action consequently diminishing blood vessel tone and peripheral opposition, and bringing about diminished diastolic blood pressure and pulse, this guarantees better peripheral course [23] and blood stream to the tissues [24]. Rise in pulse and blood pressure variables demonstrate the risk factors for cardiovascular disease. Standard yoga practice may reestablish normal pulse and blood pressure which are fundamental to keep up disease free life.

Pulmonary functions are fundamental for surveying the respiratory status of the subject. The pulmonary functions in light of yoga was examined in the present analysis and it has been seen that there was significant increment in FVC, FEV1, PEFR, MVV and BHT and significant decrease in RR among the yoga group subjects following 12 weeks of yoga training when contrasted with basal information. It very well may be expressed that yoga includes Asana (pose physical exercise), Pranayama (breathing activity) and meditation (a way to deal with training the brain or concentrating mind on a specific item) which may be the reason for increment in FVC, FEV1, PEFR, MVV and BHT and decrease in RR after yoga training. Yoga exercise and stances include isometric constriction which may build quality of respiratory muscles including stomach, intercostals muscles, and muscular strength and consequently the expansion in FVC, FEV1, PEFR, MVV and BHT and decrease in RR was seen after yoga training. Comparative perceptions have been accounted for by numerous analysts [8, 9, 24]. A previous examination detailed that normal Yoga practice brought about decline in resting respiratory rate [25], improvement in BHT and MVV [26]. Kapalbhati in which compelling exhalation was performed by getting the abdominal muscles, with no undue developments in the chest and shoulder area, and the inward breath is uninvolved. This produces short ground-breaking strokes of exhalation one after another with constriction of abdomen and diaphragm muscles which prepares the subject to utilize diaphragm and abdominal muscles in breathing [27]. Therefore yoga training may improves the quality of respiratory muscles execution which may thusly expanded FEV1 in yoga group subjects. Anulom-vilom (Nadi Shodhan) interchange nostril breathing system a piece of pranayama expands the obstruction of respiratory muscles which may build crest expiratory stream rates and FEV1 because of fortifying of respiratory muscles in yoga group subjects. During yoga practice diverse breathing methods may make the respiratory mechanical assembly vacant and fill rapidly, totally and effectively which may elevate forced vital capacity (FVC) [27, 28]. During pranayama every one of the moves for example profound motivation up to TLC and delayed termination up to leftover volume, are done through nostrils which offer opposition by methods for diminished cross sectional region and disturbance. Yoga with its quieting impact on the brain can diminish and discharge enthusiastic burdens, therefore pulling back the broncho-constrictor impact [26, 27]. By rehearsing pranayama, the different reflex components that control respiratory focus in bulbopontine territory might be adjusted or changed by creating a solid cortical power along these lines expanding the breath holding time or diminishing the resting respiratory rate [26, 27, 28]. In this manner normal yoga practice may improve the pulmonary functions which are fundamental to keep up disease free way of life.

V. CONCLUSIONS

Standard routine with regards to yoga keeps up ordinary healthy way of life and physical fitness which is shown by improving body composition, cardiovascular and pulmonary functions. The discoveries of the investigation show the viability of yoga practice on body composition, cardiovascular and pulmonary functions in healthy subjects. The discoveries of the present investigation recommend that yoga can be utilized as a compelling way of life methodology to decrease the opportunity of CVD and pulmonary diseases. Therefore normal routine with regards to yoga might be useful to lessen blood pressure and keep up disease free way of life. As youngsters are the future working power of the nation, in this way ordinary routine with regards to yoga may expand the quantity of working days, efficiency and diminish the use towards drug by keeping up the disease free way of life.

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