

Impact of Yoga and Exercise Training Interventions on Lungs Capacity in Obese Adults

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Abstract

Obesity remains a global public health concern, with literature indicating that disorders like lungs capacity are increasingly prevalent among obese and overweight individuals, particularly during adolescence and young adulthood. This study evaluated the efficacy of yoga and exercise interventions in managing lungs capacity tendencies among adults. Based on an initial survey, 100 subjects exhibiting obese tendencies were randomly assigned to four equal groups ($n = 25$ per group): Yoga, Exercise, Yoga plus Exercise, and Control. Analysis of Covariance (ANCOVA) followed by Scheffé's post-hoc test demonstrated that the combined "Yoga plus Exercise" intervention significantly reduced lungs capacity problem compared to the other groups ($CD = 0.34, p < 0.05$). While the combined intervention was the most effective, both Yoga and Yoga plus Exercise training independently proved effective in controlling lungs capacity scores. These findings suggest that integrating yoga with structured physical exercise provides a superior therapeutic approach for controlling lowering lungs capacity in young adults.

Keywords: *Yoga, physical exercise, obesity, lungs capacity*

1. Introduction

The global escalation of obesity represents one of the most critical public health crises of the twenty-first century. Characterized by an excessive accumulation of adipose tissue, obesity is a multisystemic metabolic disorder that profoundly affects cardiovascular, endocrine, and musculoskeletal health. However, its debilitating impact on the respiratory system—specifically pulmonary mechanics, lung volumes, and respiratory muscle energetics—remains one of its most pervasive yet frequently underappreciated complications (Lorenzo & Babb, 2013). Among obese adults, excess deposition of adipose tissue around the chest wall, abdomen, and visceral cavities mechanically restricts lung expansion, increases airway resistance, decreases lung compliance, and alters the normal work of breathing. This constellation of pathophysiological changes leads to a restrictive lung pattern characterized by reduced Functional Residual Capacity (FRC), Expiratory Reserve Volume (ERV), Forced Vital Capacity (FVC), and Forced Expiratory Volume in 1 second (FEV_1). To mitigate these adverse pulmonary adaptations, non-pharmacological lifestyle interventions, including structured exercise training and mind-body practices such as Yoga, have emerged as key therapeutic modalities. While aerobic and resistance training have traditionally served as the foundation of pulmonary rehabilitation and weight management, integrative practices including Yoga specifically *Asanas* (postural practices) and *Pranayama* (regulated breathing exercises) offer distinct mechanical and neuro-respiratory mechanisms for improving pulmonary mechanics (Bhagel & Saha, 2021).

2. Objectives of the Study

- To examine the effect of yoga training on lung capacity among obese adults.
- To assess the effect of exercise training on lung capacity among obese adults.

- To compare the effects of yoga, exercise, and combined yoga-plus-exercise training on lung capacity among obese adults.

3. Research Methodology

This is survey-cum-experimental research. The details methodology of survey and experimental research are given below

Method of Survey study: This survey study consisted of a sample of 1200 female students (i.e. 100% of the population), age group between 21-25 yrs (*based on birth certificate*) and they represent all the B.Ed Colleges and general Degree Colleges located in Chandrapura Block (District-Bokaro) in Jharkhand State.

Procedure of Survey: Total 1200 obese students were selected for the survey. Their body fat was measured using a Fat-o-Meter and weighing machine.

Method of Experiment: As per survey data, out of 1200 female subjects only 145 were obese and suffering from the problem lungs capacity. Finally, however, out of 145 subjects only 100 subjects having problems in *lungs capacity* were chosen purposively who were further divided into four groups i.e., 3 groups with special training interventions (Yoga: $n_1=25$; Exercise: $n_2=25$; Yoga plus exercise: $n_3=25$) and one control ($n_4=25$). Thus, each group consisted of 25 subjects. The researcher made sure that the entire subjects were medically fit for going through the experimental requirements. 100 students were included in the study.

Inclusion and Exclusion Criteria: Only female candidates who committed to completing the full experiment were included. Subjects diagnosed with acute health disorders by a medical doctor were excluded.

Drop-outs: During the experiment, 13 participants were dropped due to low attendance, 2 from the exercise group, 1 from the yoga group, 4 from the yoga plus exercise group, and 6 from the control group.

Allocation of training interventions and stages: This study followed a parallel group design i.e., three experimental groups and one control group. All the groups were allotted with specific training programmes viz., **Yoga training** (Gr.A), **Exercise training** (Gr.B), **Yoga plus Exercise training** (Gr.C) while Group D was treated as control. The experiment was conducted considering three phases:

Stage-I: Baseline Assessment: At the baseline, Peak flow meter was administered among all the participants of the four groups, as stated above, to assess the status of *lungs capacity*.

Stage-II: Training Interventions After the baseline testing is over, all the participants of the selected groups (Gr. A, Gr. B & Gr. C) were allowed to participate in respective training interventions, whereas the Gr. D was involved in some recreational activities. The group-wise training interventions were imparted in the afternoon daily 30 minutes except Sundays and holidays for a total duration of 8 weeks (i.e., 2 months). All these training programmes were given by professionally qualified experts. Importantly, in case of *Yoga plus exercise* training, the stimuli viz., yoga and exercise practices were imparted separately in alternate days.

Stage-III: Final assessment Finally, at the end of the eight-week treatment or training period, all the subjects in the experimental and control groups were assessed for the selected variables (*lungs capacity*) like baseline assessment.

Statistical Analysis: Preliminary data analysis was performed using descriptive statistics (Mean and SD). For inferential analysis, Analysis of Covariance (ANCOVA) was applied, followed by Scheffe's post-hoc test (Rothstein, 1985).

4. Results and Discussion

Indicates the results concerning the central values and degree of dispersion among the groups (yoga, exercise, yoga plus exercise, and control) in **Lungs Capacity** variables. The result revealed that the **pre-test** mean scores (Lit./min) of *yoga, exercise, yoga plus exercise, and control groups* were 307.2 (± 79.19), 259.96 (± 94.78), 259.96 (± 94.78) and 270.80 (± 91.62) respectively. Whereas mean post scores (Lit./min) of **Lungs Capacity** among the groups viz, *yoga, exercise, yoga plus exercise, and control* were 344.00 (± 75.56), 278.80 (± 96.67), 278.80 (± 96.67) and 282.20 (± 92.53) respectively. This result indicates that pre-test scores are among the groups were found different. Therefore, post test scores can't be compared for a

significant result. This suggests that there is a need of pre-post mean recovery using ANCOVA (Analysis of co-variance)

Table 1: Mean and Standard deviation of different Groups in Anorexia Nervosa (pts.)

Group	Pre-test M ($\pm$ SD)	Post test M ($\pm$ SD)
Yoga	307.20 ($\pm$ 79.19)	344.00 ($\pm$ 75.56)
Exercise	259.96($\pm$ 94.78)	227.80 ($\pm$ 96.67)
Yoga+Exercise	259.96 ($\pm$ 94.78)	278.80($\pm$ 96.67)
Control	270.80($\pm$ 91.62)	282.20 ($\pm$ 92.53)

The results of inferential statistics i.e., ANCOVA as presented in Table 2 indicate that in case of **within group** comparison, Yoga intervention had statistically significant effects in changing the status of **Lungs capacity** ($F=20.41$, $p<0.001$). Similarly, in case of Exercise training ($F=65.77$, $p<0.005$) and Yoga plus exercise training interventions ($F=48.29$, $p<0.001$), the significant change in the variable is also evident. Finally, the result of interaction of these groups on **Lungs capacity** is significantly different ($F=20.41$, $p<0.005$). It seems all the training interventions had statistically significant effects in **Lungs capacity** variable. Thus, result of ANCOVA presented in table 4 indicates that there might be significant difference between **Exercise group** in lungs capacity. However, the changes, therefore, have been discriminated further by using Scheffe's post hoc test.

Table 2: Result of ANCOVA among the training intervention groups in Anorexia Nervosa

Source of variation	Type III Sum of Squares	df	MS	F
Total	212029.761	8034.13		
Yoga (A)	26977.010	15	4970.646	20.41**
Exercise (B)	74559.690	1	36081.567	65.77*
Yoga plus exercise (C)	36081.567	1	36081.567	48.29**
Control (D)	36348.283	1	36348.283	4.45
Intercept	36525.494	1	36525.494	20.41*
Error	1501.717	1444.183	187.715	
* $p<0.05$, ** $p<0.01$				

Further, the result of adjusted mean recovery in the scores in lungs capacity (Lit./min.) indicates that adjusted mean scores in pre-test among yoga group, exercise group, yoga plus exercise group and control group were 285.24, 290.06, 280.13 and 287.20 respectively. Similarly, the adjusted mean scores in post-test among yoga group, exercise group, yoga plus exercise group and control group were 362.87, 357.65, 398.20 and 275.53 respectively (Table 3).

Table 3: Recovered Mean in Lungs capacity

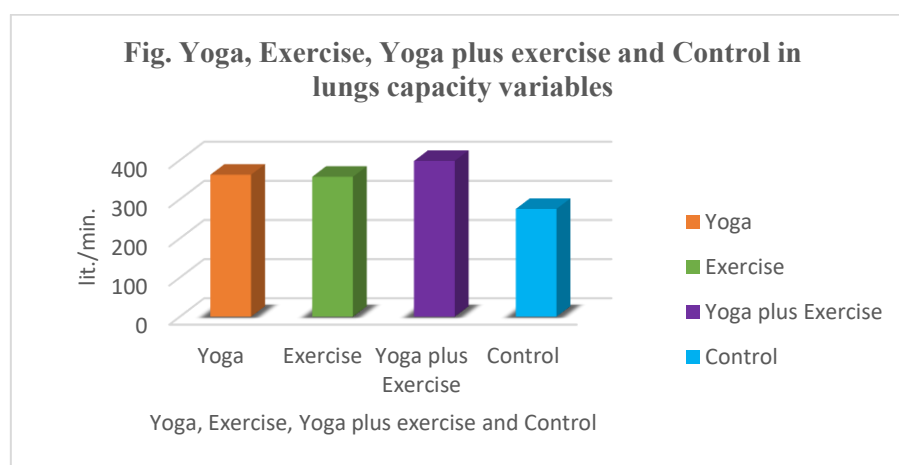
Groups	Recovered Mean in Lungs capacity (lit./min.)	
	Pre-test	Post-test
Yoga	285.24	362.87
Exercise	290.06	357.65
Yoga plus exercise	280.13	398.20
Control	287.20	275.53

The comparative result of Scheffe's post hoc test indicates that (Table 4) are: Yoga training helped to improve level of Lungs capacity as compared to the Control group (CD=0.48, $p<0.01$). This result is statistically significant at the 0.01 level. Exercise training could also help to improve Lung's capacity level as compared to the Control group (CD=0.44, $p<0.01$). This result is not statistically significant even at the 0.01 level. Yoga plus exercise training could maximally help to improve Lung's capacity level as compared to the Controls (CD=0.53, $p<0.01$). This result is statistically significant at the 0.01 level. Yoga training was found better in improving level of Lungs capacity as compared to the Exercise training (CD=0.32, $p<0.05$). This result is statistically significant at the 0.05 level. Yoga training was found inferior to Yoga plus exercise training in enhancing Lungs capacity (CD=0.28, $p<0.05$). This result is statistically significant at the 0.05 level. Further, Yoga plus exercise training was significantly better than Exercise training in reducing Lungs capacity (CD=0.34, $p<0.05$). Thus, the result revealed that control group could not improve Lungs capacity; however, other training interventions (i.e., yoga, exercise and Yoga plus exercise training) contribute to improve the level of Lungs capacity. The result further indicates that yoga plus exercise training was found superior to yoga and exercise training interventions in improving Lungs capacity level among the obese females.

Table 4: Ordered Treatment Means (after Mean Recovery) followed by Scheffe's post hoc test in Lungs capacity

Groups	3 (Yoga+Ex)	2 (Ex)	1 (Yoga)
4 (Cont)	0.53**	0.44**	0.48**
3 (Yoga+Ex)	--	0.34*	0.28*
2 (Ex)		--	0.32*
1 (Yoga)			--
* $p<0.05$, ** $p<0.01$			

Where, a = Yoga group, b = Exercise group
c = Yoga plus Exercise group, d = Control group



The result further indicates that yoga training was found better in improving level of Lungs capacity as compared to the Exercise training (CD=0.32, $p<0.05$). Yoga training was found inferior to Yoga plus exercise training in enhancing Lungs capacity (CD=0.28, $p<0.05$). Further, Yoga plus exercise training was significantly better than Exercise training in reducing Lungs capacity (CD=0.34, $p<0.05$). Thus, the result revealed that control group could not improve Lungs capacity; however, other training interventions (i.e., yoga, exercise and Yoga plus exercise training) contribute to improve the level of Lungs capacity. The appearance of such results seems to be justified because yoga training in combination with proper exercise might have worked as a composite capsule in improving pulmonary parameters and respiratory mechanics (Abel et al., 2013; Birkel & Edgren, 2000). Moreover, lung capacity is one of the

crucial attributes of cardiorespiratory fitness that appears mostly compromised among adults who are prone to physical inactivity or high body mass index (BMI). The results as presented above indicate that almost all the selected training interventions were found more or less effective in improving lung capacity. The results are plausible and logical because, compromised pulmonary function is characterized by a low forced vital capacity (FVC), reduced chest wall expansion, shallow breathing patterns, and impaired ventilation-perfusion matching (Chanavirut et al., 2006). Estimated prevalence of poor respiratory efficiency is high in sedentary adult populations, and up to a significant percentage of this demographic may be affected. Therefore, adult subjects were experimented in this study. The results of this study are akin to be appropriate, as most individuals engaging in structured breathwork and aerobic conditioning show significant pulmonary improvements, while sedentary controls retain static baseline levels (Prakash et al., 2015). Individuals with reduced respiratory function are at increased risk of reduced exercise tolerance and metabolic conditions later in life (Sengupta, 2012).

5. Conclusion

The study concludes that lung capacity concerns were observed among a relatively small proportion of the female students surveyed, with approximately 16% showing lung capacity-related problems associated predominantly with obesity. The intervention findings further indicate that yoga training was beneficial in improving lung capacity-related outcomes among the participants. Moreover, the combined intervention of yoga and exercise demonstrated comparatively better results, suggesting that integrating yoga with structured exercise may provide a more effective approach for improving respiratory functioning and managing lung capacity concerns among individuals with obesity.

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