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Influence of Specific Yoga Pranayama Practices on Vital Capacity in Sedentary College Students Living in Hostels

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Abstract – The contemporary-day lifestyle, especially inside the hostels of university college students with a sedentary lifestyle, relates to declining respiratory fitness and decreased VC. The objective of this study aimed to assess the effect of specific yoga pranayama practices (Kapalabhati, Bhastrika, Anulom Vilom) on vital capacity in sedentary college students. The study utilized a pretest-post-test control group design, and 40 participants (20 males) were randomly assigned to an experimental group (EG) (n=20) receiving a 6-week pranayama intervention or a control group (CG) (n=20) not engaging in any physical activity except their regular sedentary lifestyle. Pre- and post-intervention records of vital capacity were obtained using a digital spirometer. Statistical analysis between groups showed that an increase in vital capacity was statistically significant in the experimental group over the control group ($p < 0.05$). The experimental group demonstrated a mean post-intervention VC of 4.61 L (±0.45), surpassing the control group's mean of 4.07 L (±0.46), with the intervention explaining 81.4% of the variance in outcomes (Partial Eta Squared = 0.814). The results indicate that regular practice of certain pranayama techniques can improve respiratory performance and help counteract the effects of an inactive lifestyle. It demonstrates the efficacy of an alternate yoga-based regimen for sedentary college students in improving their lung function, significantly in the context of respiratory health.

Keywords – Sedentary lifestyle, College students, Respiratory fitness, Vital capacity, Pranayama, Kapalabhati, Bhastrika, Anulom Vilom, Lung function. Yoga intervention, Digital spirometry

I. INTRODUCTION

The current sedentary behavior (SB) profile, which includes chronic physical inactivity, has been associated with several health problems such as diminished respiratory efficiency and lung function (World Health Organization [WHO], 2020). University students, especially in hostels, generally become sedentary because of study schedule, lack of exercise and poor habits. This physical inactivity can contribute to a decrease in VC, an established measure of respiratory health and general well-being (Caspersen et al., 1985). Vital capacity, or the greatest volume of air that can be expired by the lungs following maximum inspiration, is important to sustaining the level of oxygen carried on a person's body and providing for metabolizing activities (American Thoracic Society, 2005). Preliminary evidence has indicated a promising role for yoga-based interventions to manage the respiratory health issues of these populations, particularly certain pranayama (breathing) techniques (Veerabhadrappa et al., 2011) (Mane et al 2014) (Prakash & Dhungel, 2016) (Xu et al., 2011).

There are numerous health benefits to be gained from practicing yoga, an ancient practice that originated in the Indian subcontinent and has gained popularity worldwide, most notably through its beneficial effects on respiratory function. As can be seen in the work of Joshi et al. (2012) showed the positive impact of pranayama (component of yoga characterized by regulation of breath) on enhanced vital lung capacity, optimal respiratory muscle power and improved pulmonary efficiency. Certain techniques of pranayama such as Kapalabhati, Bhastrika and Anulom Vilom have shown marked effect in enhancing vital capacity and respiratory endurance (Saxena & Saxena, 2009). These practices operate through the mechanisms of achieving more efficient breathing; reducing stress, such that perception of breathlessness is mitigated; and improving lung tissue elasticity (including contribution from the rib cage) (Raghuraj & Telles 2003).

pranayama means control of breath, which in turn is a preliminary step to, and an important part of, the actual meditation practice in yoga. The physiologic impact of slow breathing has been widely documented, being shown to induce activation of the parasympathetic nervous system and enhance cardiovascular and respiratory functions (A et al., 2014) (Russo et al., 2017). Moreover, pranayama techniques practicing regularly has been found to improve pulmonary function, including increased vital capacity. (Mane et al., 2014)

Hostel dwelling college students experience various problems and are likely to develop sedentary behaviour and poor respiratory health. It has been reported that sedentary participants have lower values of VC and worst respiratory function in comparison with physically active volunteers. Consequently, there is an increasing demand to develop efficacious interventions that can improve the respiratory health of such population and also reduce sedentary behaviour implications.

Although there is newly growing evidence on beneficial effects of yoga and pranayama, research in the context of sedentary hostel college students was not abundant. They are, therefore, of greater risk for respiratory impairment with inactivity and competitive stresses associated with the academic environment (Misra & McKean, 2000). It is thus timely to look at the effect of some specific yoga

pranayama practices on vital capacity in this set of population. This research attempts to examine the effectiveness of certain pranayama practices on vital capacity in sedentary college students living in hostels as well as add to the literature on interventions based on yoga for respiratory health.

The purpose of this paper is to study the effect of certain breathing practices from yoga (pranayama) on vital capacity in sedentary college hostellers. The study will evaluate the effects of Kapalabhati, Bhastrika and Anulom Vilom Pranayamas on Spirometric indices of vital capacity.

II. METHODOLOGY

Aim: The aim of the present study is to find out effect of certain Yoga Pranayama practice on vital capacity of sedentary college students living in hostels. Rigor, ethical considerations and feasibility were the basis of this methodology. The following is a comprehensive outline of the approach taken in this study.

III. RESEARCH FRAMEWORK

The study applied a nonequivalent control group before-and-after design. One group of participants were assigned as the experiment group and another one as control groups. The 1 group continued with their sedentary activity as usual unabated and the other group engaged in structured yoga pranayama intervention. The efficacy of pranayama training was measured as VC in both the groups before and after intervention.

3.1 Subject Selection

- Study participants: Healthy, sedentary college students living in the Birla Hostel, Banaras Hindu University (BHU), Varanasi were taken as subjects of the study.
- Sample Size: Forty students were included; twenty each in experimental and control groups.

3.2 Inclusion Criteria:

- Age range: 19 – 23 years.
- Physical inactivity (less than 30 minutes of moderate physical activity on a daily basis).
- No history in any kind of yoga or pranayama.
- No Chronic pulmonary or heart disease.

3.3 Exclusion Criteria:

- Students with any medical or physical condition that might have interfered with the study.

3.4 Group Allocation

Participants were assigned the groups on the basis of Randomize Control Trial (RCT) to either the experimental group or the control group using a simple random sampling technique. This ensured an unbiased distribution of participants across the two groups.

3.5 Intervention Protocol

TABLE 1
PRESENTS THE INTERVENTION PROTOCOL FOR THE EXPERIMENTAL GROUP FOR 6-WEEK YOGA PRANAYAMA TRAINING PROGRAM

Week	Day	Pranayama Techniques	Duration	Total Session Time
Week 1	Day 1–5	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions
Week 2	Day 6–10	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions
Week 3	Day 11–15	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions
Week 4	Day 16–20	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions
Week 5	Day 21–25	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions
Week 6	Day 26–30	Kapalabhati (5 min), Bhastrika (5 min), Anulom Vilom (10 min)	20 minutes	5 sessions

- **Intervention Protocol: Essentials of Intervention Details**

  Frequency: For 5 days a week (Monday - Friday) only.

  Duration per Session: 20–30 minutes.

  Ventilation: All sessions performed with a certified yoga instructor.

  Overall Time Period: 6 weeks (30 sessions).

Table 1 Summary of the pranayama training module for experimental group. Do hit me up if you need more changes, or want some cool detail shots!

3.6 Measurement of Vital Capacity

- **Instrument:** The digital spirometer is a reliable and validated tool for the estimation of lung function, used in this investigation to measure the vital capacity.
- **Methods:** Vital capacity was assessed at baseline for each participant (pre-intervention). Post-intervention was assessed after 6 weeks of the program. Subjects were asked to measure their spirometry in a seated position according to standardized procedures described by the American

Thoracic Society (2005). Three readings were obtained for each participant and the highest pressure was used for analysis.

IV. Data Collection

Two set of data were gained in Pre-test: Prior to the intervention and Post-test: After 6 weeks of intervention respectively. All measurements were registered and saved safely for analyses.

4.1 Statistical Analysis

- Analyses were performed using statistical tools (such as SPSS version 25).
- Descriptive statistics (mean, standard deviation) were calculated for both groups.
- Anova was used as a statistical technique to compare both groups on the given parameters.
- The level of significance was set at **$p < 0.05$**.

V. RESULTS & ANALYTICAL INTERPRETATION

Based on the nature of the collected data, the normality of data between-subject factors, and descriptive statistics, the present status of vital capacity in sedentary hostelers of BHU, Varanasi, was determined.

TABLE: 2

BETWEEN-SUBJECT FACTOR IN RESPECT TO VALUE LABEL AND NO. OF SUBJECTS.

Between-Subjects Factors			
		Value Label	N
GROUP	1.00	control	20
	2.00	experiment	20

This table 2 displays the between-subjects factors in an experimental design along with the number of subjects in each group. The study contains two groups (a control group 1.00 and an experimental group 2.00, N = 20 per group). The second value represents the group names (in the Value Label column) and the third, how many were in each group (the N column). This indicates that the research is using a between-subject design where all participants will only be in either the control group or the experimental group, and this way the outcomes can be compared between conditions.

TABLE: 3

DESCRIPTIVE TABLE OF VITAL CAPACITY.

Descriptive Statistics			
Dependent Variable: POST			
GROUP	Mean	Std. Deviation	N
control	4.0705	.45757	20
experiment	4.6135	.44973	20
Total	4.3420	.52549	40

Descriptive statistics related to the dependent variable POST for both the control and experimental groups are contained in this table 3. On average, the experimental group scored higher with an average of 4.6135 and a standard deviation of.44973 compared to the control group's 4.0705 and.45757. The survey was completed by 40 participants and their average score was.3420 (standard deviation = 0.52549). The experimental condition was superior to control for the dependent measure, indicating that the manipulation may have been effective. The relatively low standard deviations in each group, however, indicate that there is not much variation in the test scores within each group.

TABLE: 4

ANALYSIS OF VARIANCE OF THE MEAN OF PRE AND POST-TEST IN RELATION TO VITAL CAPACITY.

Tests of Between-Subjects Effects						
Dependent Variable: POST						
Source	**Type II Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	10.435[a]	2	5.217	576.487	.000	.969
Intercept	.027	1	.027	2.942	.095	.074
PRE	7.486	1	7.486	827.179	.000	.957
GROUP	1.462	1	1.462	161.576	.000	.814
Error	.335	37	.009			
Total	764.888	40				
Corrected Total	10.769	39				

This table 4 displays the outcome of a Between-Subjects Effects analysis (presumably an ANOVA) regarding the POST-dependent variable. Here's a concise description of the findings:

The Corrected Model demonstrates statistical significance with an F-value of 576.487 and a p-value less than .001 while explaining 96.9% of the variance in POST scores according to the Partial Eta Squared measure.

The PRE variable, which functions as a covariate like the pre-test score, shows a substantial impact on POST scores ($F = 827.179$, $p < .001$) and accounts for 95.7% of the variance.

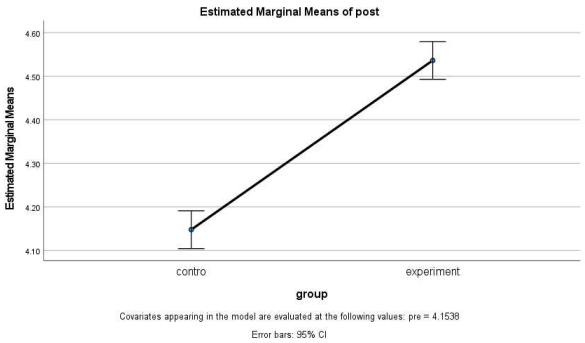
For the POST scores there is a strong effect of the GROUP variable ($F = 161.576$, $p <. 001$) by explaining 81.4% of the variance of work score.

The Intercept is not significant ($p =. 095$), indicating that the baseline mean POST score equals zero even when controlling for other variables.

The error term indicates that unexplained variance remains very low since the Mean Square Error equals .009. The statistical model shows that both PRE covariate and GROUP factor impact POST scores significantly while accounting for 97% of the dependent variable's variance. The experimental manipulation together with the

covariate demonstrates a powerful impact on the overall outcome.

Profile plots



After adjusting for the covariate pre **(4.1538),** the following graph shows the estimated marginal means of post for both Control and Treatment variables: A positive estimated marginal mean **(that is larger in the experimental group compared with controls)** suggests a beneficial effect of the intervention. The error bars indicate a minimum overlap, which demonstrate statistical significance between the groups, and represent a **95% confidence interval (CI).** The experimental condition produced enhanced outcomes when compared to the control condition providing evidence for efficacy. Based on these findings the intervention had a significant effect on the dependent variable.

VI. DISCUSSION

The results of the present study are consistent with earlier reports on positive effects of pranayama techniques in respiratory health. The remarkable improvement in VC among the experimental group may be due to physiological effects of pranayama, such as increase lung elasticity, strengthening of respiratory muscles and encouraging better breathing habits. The study highlights the scope of yoga-based practices to overcome SE among college students staying in hostels.

VII. CONCLUSION

The present study finds that short term yoga pranayama practices like Kapalabhati, Bhastrika and Anulom Vilom can significantly enhance vital capacity in sedentary college going students. The results indicate that the yoga programs should be integrated into sedentary people's daily lives to improve their respiratory health and overall well-being. Future studies should investigate the long-term effects of practice of pranayama in another sedentary future research subjects.

VIII. ACKNOWLEDGMENT:

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