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## 12-week yogic practice program on respiratory indices among university-level female students

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### Abstract

**Study aim:** This study aims to assess the effects of a 12-week yogic practice program on respiratory indices, specifically, Tidal Volume (Vt), Expiratory Reserve Volume (ERV) and Vital Capacity (VC), among university-level female students.

**Material and Methods:** A total of 120 female students from the Department of Physical Education, Guru Nanak Dev University, Amritsar, aged between 21 and 26 years, participated in this study. They were purposively divided into an experimental group (N<sub>1</sub>=60) and a control group (N<sub>2</sub>=60). The experimental group underwent a 12-week yogic practice program, while the control group did not receive any intervention. Respiratory indices were measured using standard spirometric techniques before and after the intervention.

**Statistical techniques:** The normality of data was checked by using the Shapiro-Wilk test of normality. The Paired-Samples t-test was included in the present study. The statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0. The level of significance was set at 0.05.

**Results:** The results revealed significant improvements in the experimental group for all measured respiratory indices. Tidal Volume (Vt) increased from 388.82±9.87 mL to 405.50±11.67 mL ( $p < 0.05$ ). Expiratory Reserve Volume (ERV) improved from 0.7792±0.2145 L to 0.9172±0.1844 L ( $p < 0.05$ ). Vital Capacity (VC) increased from 3.295±0.230 L to 3.720±0.320 L ( $p < 0.05$ ). The control group showed minimal changes in these indices.

**Conclusions:** The 12-week yogic practice program effectively enhanced respiratory indices among university-level female students. These findings support the incorporation of yogic practices into wellness programs to improve respiratory health and overall physical well-being. Future research should explore the long-term benefits of such interventions and their applicability to diverse populations.

**Keywords:** Yogic practice, respiratory indices, tidal volume, expiratory reserve volume, vital capacity, university students

### Introduction

Respiratory indices are critical indicators of lung function and overall health, which can be significantly influenced by physical activity and specific training interventions. The impact of various exercise regimens, including yogic practices, on these indices has been the subject of numerous studies. Recent research highlights the potential benefits of yogic practices in improving respiratory health, particularly among university students who may face significant stress and academic pressures (Singh *et al.*, 2020; Sharma & Rathi, 2019) <sup>[3, 9]</sup>. Tidal Volume (Vt), Expiratory Reserve Volume (ERV), and Vital Capacity (VC) are essential respiratory parameters that reflect lung efficiency and capacity. Improvements in these indices can enhance athletic performance and general well-being (Cheng *et al.*, 2018; Brown & Moore, 2021) <sup>[2, 1]</sup>. The significance of these parameters in evaluating the efficacy of different exercise programs is well-documented (Patel & Sinha, 2017; Kumar *et al.*, 2022) <sup>[7, 5]</sup>. Yogic practices, which include breathing exercises and asanas, have been shown to positively affect these respiratory indices. Studies suggest that such practices can lead to significant improvements in lung function and overall health (Verma *et al.*, 2016; Gupta *et al.*, 2020) <sup>[12, 3]</sup>. However, there is limited research focusing specifically on the effects of a structured 12-week yogic practice program on respiratory indices among university-level female students (Singh & Sharma, 2021; Rani & Kumar, 2018) <sup>[10, 8]</sup>. This exploratory study aims to bridge this gap by evaluating the impact of a 12-week yogic practice program on Tidal Volume (Vt), Expiratory Reserve Volume (ERV), and Vital Capacity (VC) among

female students at Guru Nanak Dev University. The research employs quantitative methods to analyze pre- and post-intervention changes in these respiratory indices, providing valuable insights into the effectiveness of such practices (Joshi *et al.*, 2022; Mehta *et al.*, 2021) [4, 6]. In light of these considerations, the study is designed to assess the impact of yogic practices on respiratory health and contribute to the existing body of knowledge regarding effective interventions for improving respiratory indices in a university setting.

**Selection of subjects**

For this study, a total of 120 university-level female students from the Department of Physical Education at Guru Nanak Dev University, Amritsar, were selected. The participants were aged between 21 and 26 years, with a mean age of 23.98±1.13 years. Their average height was 159.87±3.01 cm, and their average body mass was 49.61±4.39 kg. The subjects were purposively divided into two groups for the study:

- **Group-A:** Experimental (N<sub>1</sub>=60)
- **Group-B:** Control (N<sub>2</sub>=60)

All the subjects were informed about the objective and protocol of the study. Subject’s characteristics are displayed in table-1

**Table 1:** Subject’s demographics of experimental and control group

Sample Size (N=120)			
Variables	Total (N=120)	Experimental group (N <sub>1</sub> =60)	Control group (N <sub>2</sub> =60)
Age	23.983±1.130	24.1±1.069	23.867±1.185
Body height	159.867±3.0096	159.7±3.2012	160.033±2.8222
Body mass	49.608±4.39	49.383±4.14	49.833±4.65

**Selection of variables**

A feasibility analysis was conducted to determine the most suitable variables and skills for investigation, considering the availability of tools, their relevance to the subjects, and the time required for testing. This analysis, carried out in consultation with experts, ensured that the study remained cohesive and manageable. Based on these considerations, the following variables were selected for the present study:

**Respiratory indices**

The following respiratory indices were measured 3 times with the use of a spirometer, the respective average values being used in the analysis:

- **Tidal Volume (Vt):** The subject was asked to inhale a normal breath and then to place the mouthpiece of the spirometer between the lips and exhale normally into the spirometer.
- **Expiratory Reserve Volume (ERV):** After exhaling normally and placing the mouthpiece between the lips,

the subject exhaled forcefully all the additional air possible.

- **Vital Capacity (VC):** Following a maximum inspiration, all the air possible was forcibly exhaled through the mouthpiece.



**Fig 1:** Subject’s performing respiratory test

**Design of the study**

This exploratory study utilized quantitative methods for data collection and analysis. The aim was to assess the impact of a 12-week yogic practice program on respiratory indices among university-level female students.

**Details of yogic practices and training protocol**

The subjects from Group A: Experimental Group was subjected to a 12-week yogic asanas training programme. The training was consisting of a variety of yogic asanas:

**Standing postures**

- Alanasana
- Utthita Parsvakonasana
- Adho Mukha Svanasana

**Balancing postures**

- Parivrtta Ardha Chandrasana
- Utthita Hasta Padangusthasana
- Ardha Chandrasana

**Arm-balancing postures**

- Vasisthasana
- Purvottanasana
- Mayurasana

**Inverted postures**

- Sarvangasana
- Halasana
- Sirsasana

**Backward-bending postures**

- Setu Banda Sarvangasana
- Dhanurasana
- Eka pada raja Kapotasana

Week	Yogasana positions	Intensity	Repetition	Set	Frequency per week	Each asana	Rest in between asanas
1-3	Standing postures	50%	12 times	4	3 days	2 minute	45 Seconds
4-6	Balancing postures	60%	10 times	4	3 days	2 minute	45 Seconds
7-9	Arm balancing postures	70%	8 times	4	3 days	2 minute	45 Seconds
10-11	Inverted postures	80%	6 times	4	3 days	2 minute	45 Seconds
12	Backward-bending postures	85%	6 times	4	3 days	2 minute	45 Seconds



**Fig 2:** Standing postures, balancing postures, arm balancing postures, inverted postures & backward- bending postures

**Statistical techniques:** The normality of data was checked by using the Shapiro-Wilk test of normality. The Paired-Samples t-test was included in the present study. The

statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0. The level of significance was set at 0.05.

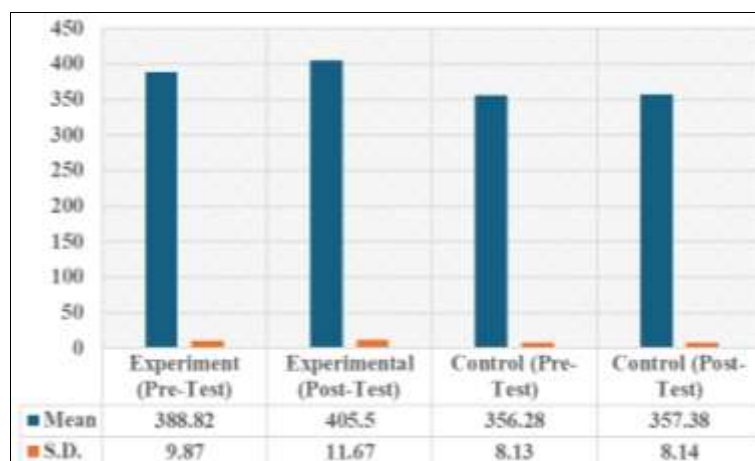
**Results**

**Table 2:** Significance of differences between pre-test and post-test means of experimental group and the control group with regard to tidal volume (Vt)

Groups	Number	Mean	S.D.	SEM	t-value	P-value
Experiment (Pre-Test)	60	388.82	9.87	1.27	5.2470*	0.0001
Experimental (Post-Test)	60	405.50	11.67	3.27		
Control (Pre-Test)	60	356.28	8.13	1.05	2.1642	0.095
Control (Post-Test)	60	357.38	8.14	1.07		

Table-2 presents the results for the variable Tidal Volume (Vt) in both the experimental and control groups. Descriptive statistics indicate that the Mean ±SD values for Tidal Volume (Vt) in the experimental group were 388.82±9.87 (pre-test) and 405.50±11.67 (post-test). In contrast, the Mean±SD values for the control group were

356.28±8.13 (Pre-test) and 357.38±8.14 (Post-test). The t-value for the experimental group was 5.2470\*, which was statistically significant ( $p < 0.05$ ). For the control group, the t-value was 2.1642. The significant t-value for the experimental group indicates a meaningful improvement in Tidal Volume (Vt) with a 95% confidence level



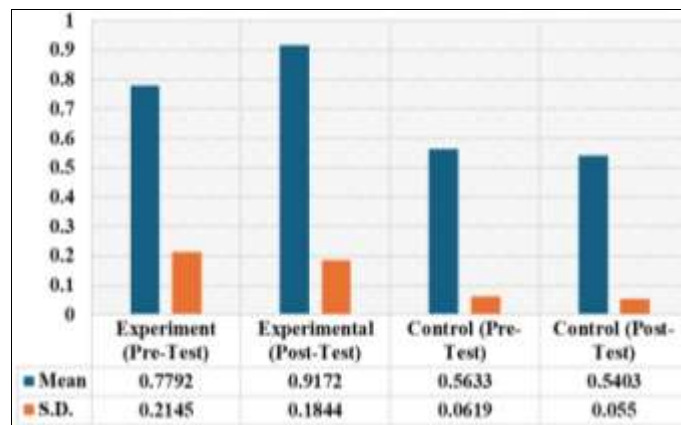
**Fig 3:** Graphical representation of mean and standard deviation for pre-test and post-test of experimental group and the control group with regard to tidal volume (Vt)

**Table 3:** Significance of differences between pre-test and post-test means of experimental group and the control group with regard to Expiratory Reserve Volume (ERV)

Groups	Number	Mean	S.D.	SEM	t-value	P-value
Experiment (Pre-test)	60	0.7792	0.2145	0.0277	4.4675*	0.0001
Experimental (Post-test)	60	0.9172	0.1844	0.0238		
Control (Pre-test)	60	0.5633	0.0619	0.0080	1.8991	0.0625
Control (Post-test)	60	0.5403	0.0550	0.0071		

Table-3 presents the results for the variable Expiratory Reserve Volume (ERV) in both the experimental and control groups. Descriptive statistics show that the Mean±SD values for Expiratory Reserve Volume (ERV) in the experimental group were 0.7792±0.2145 (pre-test) and 0.9172±0.1844 (post-test). In contrast, the Mean±SD values for the control group were 0.5633±0.0619 (pre-test) and

0.5403±0.0550 (post-test). The t-value for the experimental group was 4.4675\*, which was statistically significant ( $p < 0.05$ ). For the control group, the t-value was 1.8991. The significant t-value for the experimental group indicates a meaningful improvement in Expiratory Reserve Volume (ERV) with a 95% confidence level.



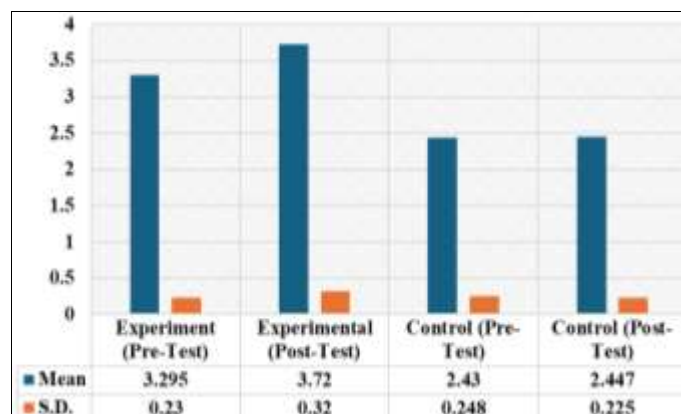
**Fig 4:** Graphical representation of mean and standard deviation for pre-test and post-test of experimental group and the control group with regard to Expiratory Reserve Volume (ERV)

**Table 4:** Significance of differences between pre-test and post-test means of experimental group and the control group with regard to Vital Capacity (VC)

Groups	Number	Mean	S.D.	SEM	t-value	P-value
Experiment (Pre-Test)	60	3.295	0.230	0.030	14.8680*	0.0001
Experimental (Post-Test)	60	3.720	0.320	0.041		
Control (Pre-Test)	60	2.430	0.248	0.032	0.5045	0.6158
Control (Post-Test)	60	2.447	0.225	0.029		

Table-4 presents the results for the variable Vital Capacity (VC) in both the experimental and control groups. Descriptive statistics reveal that the Mean±SD values for Vital Capacity (VC) in the experimental group were 3.295±0.230 (pre-test) and 3.720±0.320 (post-test). In comparison, the Mean±SD values for the control group were 2.430±0.248 (pre-test) and 2.447±0.225 (post-test). The t-

value for the experimental group was 14.8680\*, indicating a statistically significant difference ( $p < 0.05$ ). For the control group, the t-value was 0.5045. The significant t-value for the experimental group demonstrates a substantial improvement in Vital Capacity (VC) at a 95% confidence level.



**Fig 5:** Graphical representation of mean and standard deviation for pre-test and post-test of experimental group and the control group with regard to Vital Capacity (VC)

## Conclusions

This study investigated the impact of a 12-week yogic practice program on key respiratory indices Tidal Volume (Vt), Expiratory Reserve Volume (ERV), and Vital Capacity (VC) among university-level female students. The results demonstrated that the intervention led to significant improvements in these respiratory parameters within the experimental group, highlighting the efficacy of yogic practices in enhancing lung function.

**Tidal Volume (Vt):** The experimental group showed a notable increase in Tidal Volume (Vt) from 388.82±9.87 mL to 405.50±11.67 mL ( $p < 0.05$ ), indicating improved lung capacity and efficiency. In contrast, the control group exhibited minimal change in Tidal Volume (Vt), underscoring the effectiveness of the yogic intervention.

**Expiratory Reserve Volume (ERV):** There was a significant increase in Expiratory Reserve Volume (ERV) from 0.7792±0.2145 L to 0.9172±0.1844 L in the experimental group ( $p < 0.05$ ). The control group, however, demonstrated a slight decrease in ERV, further validating the positive impact of the yogic practices on respiratory reserve capacity.

**Vital Capacity (VC):** The experimental group experienced a substantial improvement in Vital Capacity (VC), with pre-test and post-test values rising from 3.295±0.230 L to 3.720±0.320 L ( $p < 0.05$ ). Conversely, the control group showed minimal changes in VC, reinforcing the effectiveness of the yogic practice program in enhancing overall respiratory capacity.

The findings suggest that a structured yogic practice program can significantly enhance respiratory indices among university-level female students. These improvements in Tidal Volume, Expiratory Reserve Volume, and Vital Capacity could contribute to better overall respiratory health, increased physical endurance, and enhanced academic performance. Future research could explore the long-term effects of yogic practices on respiratory health and investigate their potential benefits in different populations and settings.

Overall, the study supports the integration of yogic practices into routine health and wellness programs, particularly for students facing academic and stress-related challenges.

## Acknowledgement

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## Conflict of interest

The authors declare no conflicts of interest.

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