

Correlation Between Age and Lung Function Among Postmenopausal Women: Observational Study

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Abstract— Background Menopause is a natural physiological transition associated with a decline in ovarian hormones, particularly estrogen and progesterone. Along with the normal effects of ageing, these hormonal changes may influence respiratory function. Ageing may lead to reduced lung elasticity, chest-wall compliance and respiratory muscle performance, which can contribute to a decline in respiratory function. Therefore, assessment of respiratory function among postmenopausal women may be clinically relevant.

Objectives - To assess the age of postmenopausal women included in the study. To assess respiratory function using the Single Breath Count test. To determine the correlation between age and the recorded Single Breath Count among postmenopausal women.

Methodology -An observational study was conducted among 51 postmenopausal women. Participants were selected using convenience sampling according to the specified inclusion and exclusion criteria. Respiratory function was assessed using the Single Breath Count test, in which the participant took a deep breath and counted aloud continuously in a single breath. The recorded SBC value was used for analysis. Descriptive statistics were expressed as mean $\pm$ standard deviation. Pearson's correlation was used to determine the linear relationship between age and SBC, while Spearman's correlation was used as a non-parametric analysis. Statistical significance was set at $p < 0.05$.

Result- A total of 51 postmenopausal women was included in the study. Pearson's correlation demonstrated a statistically significant negative correlation between age and SBC ($r = -0.341$, $p = 0.014$). The coefficient of determination was $R^2 = 0.116$, indicating that approximately 11.6% of the linear variation in SBC was associated with age in this sample. Spearman's rank correlation also demonstrated a statistically significant negative association ($p = -0.406$, $p = 0.003$). These findings indicate that higher age was

associated with lower SBC values among the postmenopausal women studied.

Conclusion -The study concluded that there was a statistically significant negative correlation between age and the recorded Single Breath Count among postmenopausal women. As age increased, SBC values tended to decrease.

Index Terms—Age, Postmenopausal women, Lung function, Single Breath Count, Respiratory function, Menopause

I. INTRODUCTION

Menopause is an important physiological transition in a woman's life and represents the permanent cessation of menstruation and reproductive function. It is accompanied by substantial hormonal, metabolic, cardiovascular, musculoskeletal, and respiratory changes. The menopausal transition occurs as ovarian function progressively declines, resulting in a reduction in circulating ovarian hormones, particularly estrogen and progesterone. These hormonal changes occur together with the natural process of ageing and may influence several body systems, including the respiratory system. ¹ Menopause and reproductive ageing may influence respiratory function, and evidence suggests that the menopausal transition can be associated with changes in lung function. Menopause has been reported to be associated with an accelerated decline in pulmonary function, indicating that respiratory ageing in women may be influenced by menopausal status in addition to chronological ageing. ² the menopausal transition has also been associated with changes in lung function and respiratory symptoms. These findings suggest that the period surrounding menopause may represent an

important stage for the development of respiratory changes in women.³ Inflammatory mechanisms may also contribute to changes in respiratory function among postmenopausal women. An association between C-reactive protein and pulmonary function has been reported, suggesting that systemic inflammatory status may have a relationship with respiratory function following menopause.⁴

The American Thoracic Society and European Respiratory Society have established technical standards for interpreting routine lung function tests. These standards emphasize appropriate performance and interpretation of pulmonary function measurements.⁴⁸ Age, sex, and other demographic characteristics are important when interpreting spirometric measurements. Global Lung Function Initiative reference equations demonstrate the importance of these variables when evaluating lung function.⁴⁹ Interpretation of pulmonary function tests requires consideration of appropriate reference values and patterns of ventilatory impairment. Standardized interpretative strategies are therefore important when assessing respiratory function.⁵⁰ General considerations for lung function testing include appropriate test performance, measurement procedures, and participant factors. Standardization is essential for obtaining reliable pulmonary function measurements.⁵¹ Measurement of lung volumes is also subject to standardized procedures. Accurate assessment of lung volumes and respiratory function requires appropriate testing techniques and standardized methodology.⁵²

Although several studies have investigated menopause, reproductive lifespan, age at menopause, hormonal status, and pulmonary function, comparatively limited research has specifically examined the relationship between chronological age and a simple bedside measure of lung function such as Single Breath Count among postmenopausal women. The use of a simple respiratory assessment may be particularly relevant in community and low-resource settings where conventional spirometry may not always be readily available.

II. METHODOLOGY

1. Source of data: Dr. Vedprakash Patil Ayurved College and Reserch Center.
2. Study design - Observational study

3. Sampling method - convenience sampling
4. Sampling Type – 45 – 55 years postmenopausal women
5. Sample size – 51
Sample size for quantitative data
 $N = 4pq / E^2$
 $= 4 \times 15 \times 85 / E^2$
 $= 4 \times 15 \times 85 / 100$
 $N = 51$
6. Study of duration - 6 month
7. Study population – Menopausal women

Selection Criteria

Inclusion criteria:

1. Postmenopausal women who have experienced natural menopause (defined as the absence of menstruation for at least 12 consecutive months).
2. Age group between 40 to 50 years to include a broad range of postmenopausal stages.

Exclusion criteria:

1. Women who have undergone surgical menopause, such as hysterectomy or bilateral oophorectomy.
2. Women with cardiopulmonary condition
3. Women with hormone replacement therapy

Study Duration:

The study was conducted from 2024 – 2026

III. DATA ANALYSIS

The supplied dataset consisted of 51 post-menopausal women. The available variables for the requested analysis were age and a variable recorded in the source sheet as “SBC”. Descriptive statistics were expressed as mean $\pm$ standard deviation (SD). Pearson’s product-moment correlation was used to assess the linear relationship between age and SBC. Spearman’s rank correlation was also calculated as a non-parametric sensitivity analysis. Statistical significance was set at $\alpha = 0.05$.

The mean age was 50.78 ± 3.44 years (range 45–55 years). The mean SBC was 43.37 ± 9.02 (range 25–59).

Pearson’s correlation demonstrated a negative association between age and SBC ($r = -0.341$), which was statistically significant ($p = 0.014$). The coefficient of determination was $R^2 = 0.116$, indicating that approximately 11.6% of the variation in SBC was

linearly associated with age in this sample. Spearman's analysis produced a similar negative association ($p = -0.406$, $p = 0.003$). Thus, the null hypothesis of no correlation was rejected at the 5% significance level.

IV. RESULTS

Graphs And Tables

Table 9.1 Descriptive statistics of age and SBC

Variable	N	Mean	SD	Range
Age (years)	51	50.78	3.44	45–55
SBC	51	43.37	9.02	25–59

The mean age of 50.78 years indicates that the study population consisted predominantly of women in the early post-menopausal age range. The mean SBC value was 43.37, with a standard deviation of 9.02, demonstrating variability in the recorded SBC measurement between participants.

Table 1.2 Pearson correlation between age and SBC

Analysis	Coefficient	p-value	Significance	Direction
Pearson correlation	$r = -0.341$	0.014	Significant ($p < 0.05$)	Negative

The magnitude of Pearson's correlation coefficient ($r = -0.341$) indicates a weak-to-moderate negative linear relationship between age and SBC. The negative direction indicates that an increase in age was associated with a decrease in SBC. The relationship was not strong, suggesting that age was only one of several factors associated with variation in SBC values among the participants. The statistically significant p-value indicates that the observed association was unlikely to have occurred solely due to random variation within this sample under the tested null hypothesis.

Table 1.3 Age-wise distribution of SBC

Age group	N	Mean SBC	SD
45–48	16	46.62	10.35
49–52	14	44.50	9.11
53–56	21	40.14	6.98

The table demonstrates a progressive decrease in the mean SBC value across the three age groups.

The youngest age group, 45–48 years, had the highest mean SBC value of 46.62 ± 10.35 . The middle age

group, 49–52 years, had a mean SBC value of 44.50 ± 9.11 . The oldest age group, 53–56 years, had the lowest mean SBC value of 40.14 ± 6.98 . Thus, the descriptive data demonstrate that the mean SBC decreased as the age group increased.

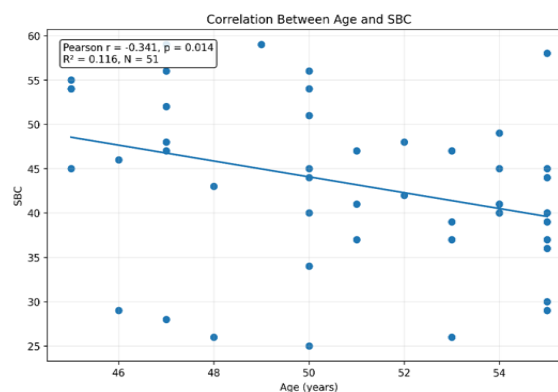
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Scatter Graph

Graph 1 displays individual observations for age and SBC together with the fitted linear trend line. The downward trend is consistent with the negative Pearson correlation.



Graph 1.1 Scatter plot showing the relationship between age and SBC.

The scatter plot demonstrates an overall downward pattern. Pearson's r was -0.341 and the association was statistically significant ($p = 0.014$). The R^2 value of 0.116 indicates that age explained approximately 11.6% of the linear variability in SBC.

The scatter plot was used to visually demonstrate the relationship between age and SBC among the 51 post-menopausal women.

Graph 1.1 Scatter plot showing the relationship between age and SBC

The scatter plot demonstrates an overall downward trend between age and SBC. The fitted regression line slopes downward from left to right, which is consistent with the negative Pearson correlation coefficient.

The correlation coefficient was $r = -0.341$, indicating a weak-to-moderate negative linear association.

The statistical test showed that the relationship was significant:

$p = 0.014$

Therefore, the downward trend observed in the scatter plot is supported by the statistical analysis.

The scatter of individual observations around the fitted line also demonstrates that the relationship was not perfect. Participants with similar ages could have different SBC values, indicating individual variability.

The scatter plot therefore provides a visual representation of the statistical finding that increasing age was associated with decreasing SBC values.

The R^2 value of 0.116 further indicates that age explained approximately 11.6% of the linear variability in SBC.

It is important to note that the scatter plot should be generated using the actual individual age and SBC values of all 51 participants. The fitted regression line should be based on those original observations.

V. DISCUSSION

The present study was conducted to determine the correlation between age and lung function among postmenopausal women. A total of 51 postmenopausal women were included in the study. The mean age of the participants was 50.78 ± 3.44 years, with an age range of 45–55 years. The mean Single Breath Count (SBC) score was 43.37 ± 9.02 , with a range of 25–59. Pearson's correlation analysis demonstrated a statistically significant negative correlation between age and SBC ($r = -0.341$, $p = 0.014$). This finding indicates that as age increased, the recorded SBC value tended to decrease. The magnitude of the correlation suggests a weak-to-moderate negative relationship between age and the recorded respiratory measure. The coefficient of determination ($R^2 = 0.116$) indicated that approximately 11.6% of the variation in SBC was linearly associated with age in the present sample.

The findings of the present study are consistent with previous literature suggesting that lung function may decline with increasing age and during the postmenopausal period. Normal ageing is associated with physiological changes in the respiratory system, including reduced lung elasticity, decreased chest-wall compliance, reduction in respiratory muscle strength, and changes in expiratory volumes. In postmenopausal women, these age-related changes may occur together with hormonal changes associated with menopause. Therefore, the observed reduction in SBC with increasing age may reflect the combined influence of ageing and postmenopausal physiological changes. The introduction of the present study also recognizes that menopause and ageing occur simultaneously, making it difficult to completely separate the effect of chronological ageing from hormonal changes.

The present findings are also supported by studies included in the literature review. Triebner K et al. 2017 reported that lung function declined more rapidly among transitional and postmenopausal women, particularly for FVC, beyond the expected age-related change. This suggests that reproductive ageing may contribute to deterioration in respiratory function³. Similarly, Real et al. 2008 reported an association between the menopausal transition and changes in respiratory health and lung function. These findings provide supportive evidence that respiratory function may change during the menopausal transition and later postmenopausal period³.

Campbell et al. 2020 also reported that an earlier age at natural menopause was associated with lower post-bronchodilator lung function, with findings suggestive of a restrictive pattern rather than obstruction⁷. Their study provides important background for understanding the possible relationship between reproductive ageing and later respiratory health. Lim et al. 2020 similarly reported that shorter reproductive lifespan among postmenopausal women was associated with decreased lung function, particularly a restrictive ventilatory disorder. These studies support the concept that the duration and timing of exposure to female reproductive hormones may have an influence on respiratory function¹.

The Spearman rank correlation analysis produced a similar negative and statistically significant association ($\rho = -0.406$, $p = 0.003$). The similarity between Pearson and Spearman results strengthens the observation that increasing age was associated with

lower SBC values in this sample. Therefore, the null hypothesis stating that there is no correlation between age and lung function among postmenopausal women was rejected at the 5% level of significance. However, the association should not be interpreted as proof that age alone causes a reduction in lung function. The remaining variation may be related to other factors such as physical activity, body composition, lifestyle, respiratory history, hormonal factors, and other individual characteristics that were not included in the correlation analysis¹.

The use of Single Breath Count as the respiratory assessment method is relevant from a physiotherapy perspective. SBCT is a simple, rapid and low-cost bedside method requiring minimal equipment. It may be useful in community-based and low-resource settings where formal pulmonary function testing is not readily available. Previous literature included in the study also suggests that SBCT can provide useful information about respiratory performance and has potential applications in clinical practice. However, SBCT does not directly provide quantitative measurements such as FVC, FEV₁ or FEV₁/FVC and therefore should be considered a screening or bedside assessment rather than a replacement for spirometry. Overall, the findings of the present study indicate that increasing age was associated with decreasing SBC values among postmenopausal women. The results are in agreement with the general evidence that respiratory function can decline with advancing age and may also be influenced by reproductive ageing and hormonal changes. The statistically significant negative correlation observed in this study highlights the importance of respiratory assessment in postmenopausal women. Further research using larger samples, standardized pulmonary function testing and assessment of additional factors is required to better understand the relationship between ageing, menopause and lung function

VI. CONCLUSION

The present observational study concluded that there was a statistically significant negative correlation between age and the recorded Single Breath Count (SBC) measure among postmenopausal women. Pearson's correlation showed $r = -0.341$ with $p = 0.014$, indicating that increasing age was associated with lower SBC values in the study population. The

Spearman correlation also demonstrated a significant negative association ($\rho = -0.406$, $p = 0.003$), supporting the findings of the Pearson analysis. Therefore, the null hypothesis was rejected. The findings suggest that respiratory performance as assessed by SBC may decrease with increasing age among postmenopausal women; however, the association does not establish that age alone causes the reduction in respiratory function.

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