



ISSN: 2456-0057

IJPNPE 2024; 9(2): 24-26

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Received: 18-05-2024

Accepted: 25-06-2024

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## Impact of a 12-week pranayama intervention on bone integrity among female participants

**Dr. Baljinder Singh Bal and Dr. Parmjit Kaur**

### Abstract

**Background and Study Aim:** The current research endeavors to explore the ramifications of a 12-week pranayama intervention on the bone integrity of university-level female participants.

**Material and Methods:** In this study, we employed a quasi-experimental design involving sixty healthy volunteer female participants with the following demographics (Mean  $\pm$  SD): age 24.00 $\pm$ 1.79 years, body height 159.12 $\pm$ 5.43 cm, and body weight 52.97 $\pm$ 7.62 kg. The participants were enrolled from Guru Nanak Dev University, Amritsar, Punjab, India. They were divided into two groups: Group-A (n<sub>1</sub>=30) received the Pranayama Intervention (PI), while Group-B (n<sub>2</sub>=30) served as the control. The sample size (N=60) was determined using G\*Power 3.1.9.7 software, with a power of 0.80 (1- $\beta$  err prob) and a significance level ( $\alpha$ ) of 0.05. Baseline and post-12-week assessments were conducted for both groups, with Group-A receiving the pranayama intervention and Group-B serving as the untreated control group.

**Results:** When comparing the Pranayama Intervention (PI) group with the control group, the 12-week Pranayama intervention program did not yield a significant impact on bone integrity within the PI group.

**Conclusion:** In conclusion, our study demonstrates that a 12-week Pranayama training regimen did not result in significant improvements in bone health measures, including bone mineral density (BMD) and bone turnover markers. This outcome challenges existing assumptions and underscores the necessity for additional research to thoroughly assess the effectiveness of Pranayama and other interventions that may be included in enhancing bone health.

**Keywords:** Bone mineral density, pranayama, Anulom Vilom pranayama, Bhastrika pranayama, Kapalbhathi pranayama, Bhramari Pranayama, Sheetkari pranayama, Sheetali pranayama, DEXA

### Introduction

Yoga is an ancient discipline designed to bring balance and health to the physical, mental, emotional, and spiritual dimensions of the individual. It is long popular practice in India that has become increasingly more common in Western society. "Yoga" means union of our individual consciousness with the Universal Divine Consciousness in a super-conscious state known as Samadhi [1]. Yoga is recognized as a most beneficial complementary and alternative therapy. Yoga is being explored currently in the western countries due to its increased reputation among the broader population. Yoga incorporates the body and mind for positive health benefits; it comprises of Asanas (Yogic exercise) Pranayama (yogic breathing exercises) and Dhyana (Meditation) [2]. Research studies have reported that the practice of yoga (pranayama and asana) improves symptoms of atrial fibrillation, anxiety, depression, and quality of life [3]. Pranayama enhances cardiorespiratory system, pulmonary functions blood pressure, heart rate, lipid profile, left ventricular ejection fraction (LVEF), and psychological states [4, 5]. Yoga appears to be beneficial in improving biological modifiable risk factors for cardiovascular diseases. Yoga can play an essential role in the prevention of cardiovascular diseases [6]. These kind adverse effects of mental stress can be tackled with yoga techniques such as pranayama (breathing exercise) which improves vagal tone that is essential to maintain the calm mind [7]. One such breathing exercise is Bhramari Pranayama (Humming bee breathing of low-pitch character) which has shown to reduce stress by controlling the cardiovascular reactivity in healthy volunteers [8, 9]. Modern science has just started to confirm and analyze this fact in more detail. Yogic breathing exercises are known as Pranayama and are considered a form of meditation in itself, as well as a preparation for deep meditation [10].

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**Materials and Methods**

**Participants**

We employed a quasi-experimental design involving sixty healthy volunteer female participants with the following demographics (Mean ± SD): age 24.00±1.79 years, body height 159.12±5.43 cm, and body weight 52.97±7.62 kg. The participants were enrolled from Guru Nanak Dev University, Amritsar, Punjab, India. The subjects were divided into two groups: Group-A: Pranayama Intervention; (n<sub>1</sub>=30), and Group-B: Control; (n<sub>2</sub>=30). The sample size (N=60) was calculated using the G\*Power 3.1.9.7 software. A power of 0.80 (1-β err prob) and significance level (α) of 0.05. Subjects from both groups (pranayama and control) were assessed at baseline and right after 12-weeks. Group-A: (n<sub>1</sub>=30) subjected

to Pranayama Intervention and Group-B: (n<sub>2</sub>=30) with no training.

**Procedure**

The DEXA test was used to measure bone mineral density, and the T-Score of DEXA was calculated. Subjects from both groups (pranayama intervention and control) were assessed at baseline and immediately after 12 weeks.

**Pranayama Intervention**

The training (pranayama intervention) group practiced Anulom-Vilom, Bhastrika, Kapalbhathi, Bharamari, Sheetkari and Sheetal Pranayama for 12-weeks.

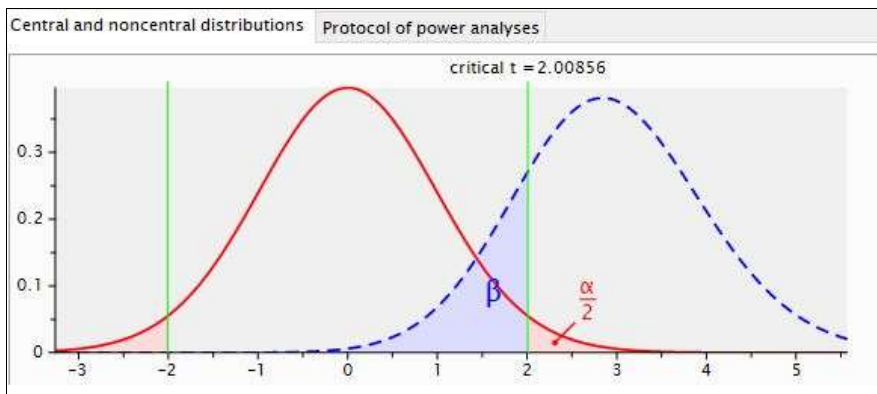
**Table 1:** 12-week Pranayama Training for subjects

12-Week Pranayama Training			
Week	Schedule	Execution Time	Volume
1-4 Week	Preliminary Yogic Exercises 5-minute 20 minute	5 minutes	35 minutes
	Practice of Anulom Vilom Pranayama Bhastrika Pranayama Kapal Bhati Pranayama Bhramari Pranayama Sheetkari Pranayama Sheetali Pranayama (9X1 Set)	25 minutes	
	Om chanting & breathing for relaxation	5 minutes	
5-8 Week	Preliminary Yogic Exercises 5-minute 20 minute	5 minutes	45 minutes
	Practice of Anulom Vilom Pranayama Bhastrika Pranayama Kapal Bhati Pranayama Bhramari Pranayama Sheetkari Pranayama Sheetali Pranayama (12X1 Set)	35 minutes	
	Om chanting & breathing for relaxation	5 minutes	
9-12 Week	Preliminary Yogic Exercises 5-minute 20 minute	5 minutes	55 minutes
	Practice of Anulom Vilom Pranayama Bhastrika Pranayama Kapal Bhati Pranayama Bhramari Pranayama Sheetkari Pranayama Sheetali Pranayama (15X1 Set)	45 minutes	
	Om chanting & breathing for relaxation	5 minutes	

**Statistical Analysis**

This study’s data analysis procedure was divided into three sections: - The G\*Power 3.1.9.7 software was used in the first section. The normality of data was checked by using the Shapiro-Wilk test of normality in the second section. The

hypothesis testing with analysis of paired sample t-test was included in the third section. The level of significance was set at 0.05. The statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0.



**Fig 1:** Protocol of power analysis was done to get the required minimum number of sample (n=52) for the experimental study with large effect size (0.80), as to obtain the strong impact on power (1-β err prob=0.80) of the study at α err prob=0.05

**Table 2:** Normal distribution of data by utilizing Shapiro-Wilk Test of Normality of Pranayama Intervention (PI).and control one of Bone Integrity (BI) of university-level female participants

Shapiro-Wilk Test of Normality				
Bone Integrity (BI)				
Sig.	Pranayama Intervention (PI) Group Pre-Test	Pranayama Intervention (PI) Group Post-Test	Control Group Pre-Test	Control Group Post-Test
	0.190	0.192	0.078	0.084

## Results

**Table 3:** Calculated statistical values of Paired sample t-test of Pranayama Intervention and Control one of Bone Integrity (BI) of university-level female participants

Group	N	Mean	Standard Deviation	Standard Error of the Mean	t-value	p-value
Pranayama Intervention(Before)	30	1.02	0.01	0.00	1.00	0.32
Pranayama Intervention (After)	30	1.02	0.01	0.00		
Control One (Before)	30	1.04	0.00	0.00	1.00	0.32
Control One (After)	30	1.04	0.00	0.00		

The mean and standard deviation values of Bone Integrity (BI) of Pranayama Intervention stood at  $1.02 \pm 0.01$  and  $1.02 \pm 0.01$  congruently. The mean and standard deviation of Bone Integrity (BI) of Control one was  $1.04 \pm 0.00$  and  $1.04 \pm 0.00$  congruently. The variance of Post Bone Integrity (BI) of Pranayama Intervention is insignificant while, the variance of Control one came out as insignificant as well.

## Conclusion

Our study demonstrates that a 12-week Pranayama training regimen did not result in significant improvements in bone health measures, including bone mineral density (BMD) and bone turnover markers. This outcome challenges existing assumptions and underscores the necessity for additional research to thoroughly assess the effectiveness of Pranayama and other interventions that may be included in enhancing bone health.

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