

## A STUDY ON EFFECT OF YOGA ON OSTEOPOROSIS IN POSTMENOPAUSAL WOMEN

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Received : 20/09/2023  
Received in revised form : 23/10/2023  
Accepted : 01/11/2023

**Keywords:**

Yoga, Osteoporosis, Menopause, DEXA Scan, BMD.

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DOI: 10.47009/jamp.2023.5.6.17

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2023; 5 (6); 77-81



### Abstract

**Background:** Osteoporosis is a skeletal disorder characterized by compromised bone strength and a consequent increased risk of fragility fractures. Chronic disabling pain, fear, anxiety and depression are common co-morbidities of osteoporosis. Yoga is an increasingly popular activity among older adults and studies have suggested that yoga can improve back pain, posture, body composition and health-related quality of life in healthy adult populations. **Materials and Methods:** The present study included 50 women of postmenopausal age between 45-60 and DEXA score of  $\leq -2.5$ . The subject were given 1 hour yoga asanas 4 days per week for 24 weeks. Demographic details were recorded. Pre and post-test DEXA scores of were recorded. After completion of 6 months of yoga practice according to study design, T-score of DEXA scan at the lumbar spine was calculated. **Result:** The present study was conducted to find pre and post effect of yogasanas on osteoporosis in postmenopausal women. The results shown the increase in T-score of DEXA scan at lumbar spine which indicates improvement in BMD. The pre T – score was  $-2.75 + 0.56$  and post T-score was  $-2.52 + 0.62$ , P-value  $<0.05$ , which indicates high significance. **Conclusion:** The present study concludes that integrated yoga is a safe mode of physical activity which includes weight bearing as well as not weight bearing asanas, Pranayama, and suryanamaskar, all of which helps to induce improvement in BMD in postmenopausal osteoporotic females.

## INTRODUCTION

The prevalence of age-related bone health disorders such as osteoporosis or osteopenia are growing as the proportion of older adults increases. These disorders are characterised by a deterioration of bone health indicators, such as bone mineral density (BMD) and bone mineral content (BMC), which in turn increase the risk of osteoporosis-related fractures. Moreover, these fractures are associated with higher mortality and morbidity in both men and women, although women may be at increased risk, specially postmenopausal women, who are particularly exposed to an accelerated BMD loss as a consequence of reduced estrogen production.

Concerning possible approaches to strengthen bone tissue, a pharmacological approach may improve bone mass, but it presents with side effects, such as deleterious effects on bone quality and architecture resulting in further fragility. In this context, non-pharmacological approaches, such as physical activity or exercise, have been proposed as both preventive and therapeutic strategies. Increasing physical activity levels has been related with the

preservation of BMD and physical function, and consequently with a reduction in the risk of fracture. Likewise, exercise interventions should specifically address bone remodelling, considering different patterns of mechanic stress.<sup>[1-6]</sup>

World Health Organization defines natural menopause as at least 12 consecutive months of amenorrhea not due to physiologic and pathologic causes. Statistics show that the mean age of natural menopause is 51 years in industrialized nations, compared to 48 years in poor and non-industrialized nations. With the average life span extended to 70 years, most women will spend more than one third of their life time beyond the menopausal transition. Besides, the proportion of menopausal women is rising since the aging population is expanding rapidly. Thus, the health: of menopausal women becomes a prime concern worldwide. Menopause is a natural physiological phenomenon resulting from primary ovarian failure secondary to apoptosis or programmed cell death. Ovarian function declines with age. The onset of menopause features includes, decreasing production of estradiol, as well as increasing levels of follicle-stimulating hormone

(FSH). During the menopausal transition period, women will experience a number of bothersome symptoms, such as hot flushes, night sweats, vaginal atrophy and dryness, dyspareunia, sleep disturbance, and mood swings.

Osteoporosis, a multifactorial systemic skeletal disease, is characterized by low bone mineral density (BMD) and micro-architectural deterioration of bone tissue resulting in bone fragility. BMD measured by dual X-ray absorptiometry is the gold standard to diagnose osteoporosis. According to WHO criteria, osteoporosis is defined as the T-score of less or equal to  $-2.5$  and osteopenia as the T-score between  $-1.0$  and  $-2.5$ . The femoral neck and lumbar spine are recommended as the anatomic region of interest. At menopause the normal bone turnover cycle is impaired by estrogen deficiency. This may be due to the presence of estrogen receptors in osteoclast progenitor cells and multi-nucleated osteoclasts. The osteoclastic resorption activity increases while the osteoblastic activity decreases. As a result, the amount of bone resorbed exceeds the amount deposited, which leads to a net loss of bone. The increase of overall bone resorption is due to a weakened inhibition effect due to the reduction of available estrogen on both osteoclastogenesis and osteoclast activity. The stimulatory effect of estrogen on bone formation is less-well-understood, but may be mediated by estrogen-receptor-responsive elements on promoters for genes involved in bone matrix biosynthesis, including type I collagen, or cytokines believed to be important for coupling of bone resorption and bone formation.<sup>[7-9]</sup>

There are two phases of bone loss in women: The first occurs predominantly in trabecular bone and starting at menopause. It results from estrogen deficiency, and leads to a disproportionate increase in bone resorption as compared with formation. This phase could be defined as menopause related bone loss. After 4–8 years, the second phase exhibits a persistent, slower loss of both trabecular and cortical bone, and is mainly attributed to reduced bone formation. This is age related bone loss, which is the only phase that also happens in men. During the menopausal transition period, the average reduction in BMD is about 10%. Approximately half of women are losing bone even more rapidly, perhaps as much as 10%–20% in those 5–6 years around menopause. About 25% of postmenopausal women can be classified as fast bone losers, and they could be discovered by the measurement of bone loss and bone resorption markers.<sup>[7,10,11]</sup>

Yoga can stimulate the bones to retain calcium, provided the body gets enough calcium in the first place. It does this through weight bearing poses of yogasanas that affect the spine, arms, shoulders, elbows, legs while encouraging a full range of motion. Weight bearing yoga training has shown a positive effect on the bone by reducing the bone resorption and hence preventing the risk of osteoporosis in postmenopausal women. Study proves that yoga enhances muscular strength and

body flexibility. It is one of the few exercise systems in which weight is borne through the arms and upper body, causing bones to become thicker and stronger. Recent research has proved that yoga can alleviate some of the height loss associated with osteoporosis. Yoga can be used as alternative therapy to exercises.<sup>[1,12-14]</sup> The present study conducted to analyze the effects of integrated yoga on osteoporosis in postmenopausal women aged between 45-60 years.

## MATERIALS AND METHODS

The study was an experimental pre-post study. A total of 50 actively doing routine works the age group between 45–60 years and who are suffering with postmenopausal osteoporosis, with a dual-energy X-ray absorptiometry (DEXA) score of  $\leq -2.5$  were included for study. The exclusion criteria that we followed, the women who had fractures associated with osteoporosis and any major associated illness of cardiovascular, neurological, or respiratory system and who are unable to perform yogasanas [Table 1]. Demographic details and family history of osteoporosis and their routine activity recorded. This work was done in different medical institutions in Karnataka.<sup>[1]</sup>

Women who were included in the study were done 1 hour Yoga at least 4 days per week for 24 weeks. The one-hour yoga included with warm-ups, suryanamaskar, and asanas in positions of standing, sitting, supine, and prone. Each position included three different asanas one of which was meant for relaxation to the subjects, also to let them get ready for the next position without any stress. These were followed by Pranayama and Omkar. Each asana was repeated 5 times with holds of 15–30 s. After completion of 6 months of yoga practice according to study design, T-score of DEXA scan at the lumbar spine was calculated. Patients were asked to about their experience about their general health, mental health and any discomfort they observed during the yoga practice for 6 months on completion of the study. This was not recorded.<sup>[1]</sup>

## RESULTS

The present study conducted to find pre and post effect of yogasanas on osteoporosis in postmenopausal women. The results shown the increase in T-score of DEXA scan at lumbar spine which indicates improvement in bone mineral density BMD. The pre T – score was  $-2.75 + 0.56$  and post T-score was  $-2.52 + 0.62$ , P-value  $< 0.05$ , which indicates high significance [Table 2]. This indicates that yogasanas in regular practice shows good improvement in osteoporosis of post menopause women and it also indicates good improvement in general health. The study also showed that intervention at any age can reverse and improve BMD losses imposed by menopause or ageing.

**Table 1: The Yoga asanas which were given during study periods to subjects for 1 hour , minimum 4 days per week.**

Warm up :10 min	Circle the waist, circle knees and ankles, side lift 10 min, stretching, forward bend, side lunge, arm swing, twist upper back, waist twist, opening the chest, back and to the center
Suryanamaskar : 5 min	Suryanamaskar including Yogasanas and Pranayama. Every stage of Suryanamaskar is accompanied by breath regulation.
Standing Asanas	Prarthanasana: 2 min Tadasana: 30 s to 1 min Trikonasana (extended triangle pose): 30 s to 1 min
Sitting Asanas	Ardh-Matsyendrasana: 3 min Paschimottasana: 3 min
Asanas in supine	Padmasana: 3 min Setu Bandha Sarvangasana (bridge pose): 30 s – 1 min Supta Vajrasana: 30 s to 1 min Shava-asana (the corpse posture): 3-5 min or longer
Asanas in prone	Marjariasana (cat pose): 2 min Naukasana: 3 min Makrasana: 3-5 min or longer
Pranayama and types	Sheetali Pranayama Sadant Pranayama Bhastrika Type I Type II Ujjayi Pranayama
Omkar	AUM is the root of all the mantras. AUM is composed of 3 elements, "a", "u" and "m." The fusion of these 3 elements is AUM or OM. The alphabets are pronounced in series.

**Table 2: Mean + SD of pre & para post Training Scores**

T Scores of DEXA Scan	Mean +SD	
Pre-Training Score	-2.75 + 0.56	P < 0.05.
Post Training Score	-2.52 + 0.62	
Difference Between Pre and Post Training Score	-0.23+0.04	

## DISCUSSION

Osteoporosis and osteopenia affect up to 200 000 000 people worldwide today, with numbers likely to grow with our aging population. Many people are without access to medications or professional help after the fractures that are more likely without them. A low-cost, low-risk alternative is desirable. Annual spinal fractures in the United States exceed 700 000, with more than 300 000 hip fractures. After hip fracture, 25% of Americans will succumb, and another 25% will never leave the nursing institution to which they are admitted following hospitalization. The United States currently spends an estimated \$19 billion on the more than 2 million annual fragility fractures and the 500 000 hospitalizations this entail. Yoga is low-cost and best alternative to medications and the elaborate health care their absence is alleged to engender. The “side effects” of yoga include better posture, improved balance, enhanced coordination, greater range of motion, higher strength, reduced levels of anxiety, and better gait. Improved posture directly addresses spinal fractures, while all of these documented benefits of yoga reduce the risk of falling, which is the main cause of all other osteoporotic fractures. Improvement in BMD could be attributed to the effects of mechano transduction which plays an important role in pathologic fracture healing, physical adaptations, and most importantly the therapeutic adaptations to osteogenesis. In order to meet the functional demands in the mechanical environment, physical remodelling of the bone takes place. There is a dynamic balance maintained

between the process osteogenesis and bone resorption by the virtue of mechanical loading which activates the mechano transducers to do so.<sup>[1,15]</sup>

In present study T Scores of DEXA Scan, Pre Training Score was -2.75 + 0.56 Post Training Score was -2.52 + 0.62 and difference between Pre and Post Training Score was -0.23+0.04 and statistically significance difference is P < 0.05. In study of Ruben Fernandez-Rodriguez et al,<sup>[1]</sup> also show similar results and study design. A pilot study done by Fishman given significant improvement in the T-score at spine and hip over a period of 2 years. In study of different yogasanas such as trikonasana, bhujanganasa, setu bandhasana, and paschimotasana were included, in present study also we have included similar yoga asanas, in same observed greater increase in BMD at the hip as compared to the spine.<sup>[16]</sup> In study of Angin and Erden observed the improvement in the T-score, however there was no significant difference between the mean improvements obtained after the exercise program for the postmenopausal osteoporotic and osteopenic groups, but 43.8% of osteoporotic women had a T-score showing osteopenia, and 23.5% of osteopenic women had a T-score falling within normal range.<sup>[17]</sup> In study of Yi-Hsueh Lu et al,<sup>[15]</sup> Bone mineral density improved in spine, hips, and femur of the 227 moderately and fully compliant patients. Monthly gain in BMD was significant in spine (0.0029 g/cm<sup>2</sup>, P = .005) and femur (0.00022 g/cm<sup>2</sup>, P = .053), but in 1 cohort, although mean gain in hip BMD was 50%, large individual differences raised the confidence interval and the gain was not significant

for total hip (0.000357 g/cm<sup>2</sup>). No yoga-related serious injuries were imaged or reported. Bone quality appeared qualitatively improved in yoga practitioners, and same study concluded that Yoga appears to raise BMD in the spine and the femur safely.<sup>[15]</sup>

Studies of yoga in people at risk of fracture are limited and 2 RCTs were available to provide very low certainty evidence that the effect of yoga on physical functioning is uncertain. A systematic review by Sivaramakrishnan et al.<sup>[18]</sup> included 5 RCTs (n = 377) that investigated the effect of yoga on physical functioning and health related outcomes in older adults, including balance and walking speed. Compared with inactive controls, yoga significantly improved balance (Hedges' g = 0.7; 95% CI: 0.19, 1.22) but not walking speed (Hedges' g = 0.38; 95% CI: -0.02, 0.78) among older adults. It is possible that the presence of pain, gait impairments or hyperkyphosis may affect the generalizability of the findings in older adults to those with osteoporosis. However, guideline developers can still draw indirect evidence from older adult populations to inform guidelines for adults with low bone mass with thoughtful considerations of the population's unique characteristics.<sup>[18]</sup>

A study by Soomro et al., done on comparing the effects of osteoporosis prevention exercise protocol versus walking for preventing osteoporosis in younger females, in this study it was observed that there was no difference in the T-score of both groups after 3 months of intervention, which implicated further studies to be done for longer duration to evaluate the efficacy of the exercise protocol.<sup>[19]</sup> In a systemic review of Kawon V. Kim et al,<sup>[20]</sup> revealed knowledge gaps related to the effect of yoga on health-related outcomes determined as important by patients and health care professionals. There is very low certainty evidence yoga does not improve measures of HRQoL among older adults with low bone mass compared with education or active control, and the effect of yoga on physical functioning and pain was uncertain based on the studies included in their review. No information was available to establish yoga's effect on fracture-related mortality, hip fractures, fragility fractures, fall-related injuries, mortality, and falls in older adults with low bone mass. Individuals at risk of fracture who wish to practice yoga should seek advice from or attend a yoga class taught by a qualified instructor with knowledge of how to adapt postures for older adults with low bone mass.<sup>[20]</sup> The present study concludes that it various yoga asanas along with Pranayama and suryanamaskar are effective in improving BMD and integrated yoga exercises should be an important component of any osteoporosis treatment exercise regime.

## CONCLUSION

The present study concludes that integrated yoga is a safe mode of physical activity which includes weight bearing as well as not weight bearing asanas, Pranayama, and suryanamaskar, all of which helps to induce improvement in BMD in postmenopausal osteoporotic females.

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