ORIGINAL ARTICLE

Serum mineral status and climacteric symptoms in perimenopausal women before and after Yoga therapy, an ongoing study

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ABSTRACT

Background: Many women report an increased level of anxiety, irritability and mood swings during their perimenopausal state. Studies show that physically active people can reduce their anxiety and depression by practicing yoga. Serum minerals such as calcium, copper and magnesium and the ferro-oxidase, ceruloplasmin play an important role in the body during the perimenopausal period.
Objective: The objective of this study is to assess the serum mineral status, anthropometric parameters and climacteric symptoms in perimenopausal women before and after yoga intervention.
Subjects and Methods: A total of 30 subjects with perimenopausal symptoms, aged between 40 and 60 years (49.43 ± 6.15) were included in the study. Yoga intervention was given on a daily basis (45 min duration) for 12 weeks. The climacteric symptoms were assessed by Greene's climacteric scale and biochemical parameters were analyzed spectrophotometrically.
Results: A significant decrease in the waist hip ratio ($P < 0.036$) and body mass index ($P < 0.036$) was observed after yoga intervention. Systolic ($P < 0.064$) and diastolic ($P < 0.082$) blood pressure (BP) showed marginal decrease after yoga therapy. Climacteric symptoms improved significantly ($P < 0.001$) after yoga intervention. A significant increase ($P < 0.001$) in serum calcium and copper and a marked decrease in serum magnesium ($P < 0.05$) and ceruloplasmin ($P < 0.028$) levels was observed, post yoga therapy. Serum magnesium negatively correlated ($r = -0.467$, $P < 0.035$) with systolic BP after yoga intervention.
Conclusion: The overall changes observed in the mineral status and climacteric symptoms suggest that yoga therapy protocol can be effectively used to improve the quality of life in perimenopausal women.

Key Words: Blood pressure, body mass index, Greene's climacteric scale, perimenopause, serum minerals, yoga therapy

INTRODUCTION

The perimenopausal period in women is characterized by various somatic, vasomotor, sexual and psychological symptoms like increased level of anxiety, irritability and mood swings thus, affecting their quality of life with average duration of 4 years.[1] Mood disorders because of perimenopause and menopause cause significant distress to women. In United States, one half of the perimenopausal women report that they are irritated or depressed.[2] Menopause is associated with weight gain but most of the studies do not reveal increases in body mass index (BMI) independent of normal aging.[3,4] It is also associated with the increase in blood pressure (BP)[1,5] and alteration of calcium metabolism.[6] Information on effects of normal aging on serum calcium levels is scanty and contradictory.[7-10] Calcium deficiency in the body causes restlessness and awakefulness observed in perimenopausal women. The level of serum calcium appears to be associated with BP and could also be a metabolic risk factor for cardiovascular disease. Therefore, estimation of

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Access this article online

Quick Response Code:

Website: www.jmidlifehealth.org

DOI: 10.4103/0976-7800.122251

serum calcium may be important. Copper is required in the cross linking of collagen and elastin. Copper deficiency causes inhibition of bone growth and osteoporosis as observed in Menkes' disease.[11] Many of the studies have also shown that increase in magnesium intake relieves the mood disorders in menopausal women. Magnesium plays an important role in preventing osteoporosis in the postmenopausal period, bone mineral density loss[12] and in body temperature regulation.[13] Heart palpitation associated with hot flashes during perimenopausal period can also be improved by increasing intake of magnesium.[14] Ceruloplasmin, a copper containing protein is known to act as a free radical scavenger besides its role as a late response acute phase reactant.[15]

Yoga, a form of physical activity consisting of various postures (asanas), breathing and meditation techniques (pranayama)[16] has been shown to be very effective in managing hypertension[17] and diabetes.[18] Yoga is also effective in reducing stress[19] and body weight.[20] Greene's climacteric scale (GCS) measures menopausal symptoms and consists of 21 items listed under three main independent domains, psychological, somatic and vasomotor, fourth being sexual dysfunction. GCS has been used to assess the changes in different symptoms in perimenopausal women before and after yoga intervention.[21]

Hence, the present study was undertaken to examine the effect of yoga on the serum minerals (such as calcium, magnesium and copper), ceruloplasmin, anthropometric parameters and climacteric symptoms in perimenopausal women.

SUBJECTS AND METHODS

It is a single group, pre/post study. The protocol and informed consent document was submitted to the Institutional Review Board and the Ethical Committee and approval was obtained for this study.

A total of 30 female subjects belonging to the coastal belt of Udupi District, Karnataka with perimenopausal symptoms and ability to perform yoga, aged between 40 and 60 years (49.43 ± 6.15) were included in this study. Women on hormone replacement therapy or any other alternative therapies were excluded from the study. Subjects were selected from women self-help groups residing in this region. Awareness sessions on menopause were conducted for these groups. The basis of the study was clearly explained to them. Socio-economically, all the women belonged to the middle income group. Among the 30 subjects, 80% were vegetarian. The daily yoga therapy schedule was of 45 min duration, extending for 12 weeks. For the first 2 weeks, yoga practice was taught under the direct supervision of a yoga therapist. For the remaining weeks, a home program was set up and handouts with clear instructions were given to all the participants. Follow-up was conducted once in a week. None of the subjects dropped out during the program. Fasting blood samples were collected in plain vacutainers, 1 day before starting and the next day of the last yoga intervention from all the participants. BP was measured prior to the blood sample collection on the same day. Body weight, waist circumference (WC) and hip circumference were also measured before and after yoga intervention in fasting condition. Each symptom of GCS questionnaire was rated by the subjects according to its severity scale from 0 to 3 (0 = none, 1 = mild, 2 = moderate, 3 = severe) before and after yoga intervention. The score was calculated using factor analysis for Indian women.[22] Serum copper,[23] calcium[24] and ceruloplasmin[25] were analyzed spectrophotometrically. Magnesium was assayed by kit method (DiaSys, Diagnostic System GmbH, Germany).

Statistical analysis was performed with SPSS version 14 (SPSS, Chicago, IL, USA). All values were reported as mean ± SD. Pearson's correlation coefficient was used to analyze linear correlation between variables. All the tests carried out were 2-tailed and $P < 0.05$ was considered statistically significant. Non-parametric test was used to analyze the climacteric symptoms.

RESULTS

A significant decrease in the waist and hip circumference ($P < 0.001$), waist hip ratio (WHR) ($P < 0.036$) and BMI ($P < 0.036$) was observed after 3 months of yoga intervention. Systolic ($P < 0.064$) and diastolic ($P < 0.082$) BP showed marginal decrease after yoga therapy [Table 1]. There was a highly significant decrease in vasomotor ($P < 0.003$), psychological ($P < 0.001$) and somatic ($P < 0.001$) symptoms after yoga intervention. Sexual symptoms also improved significantly ($P < 0.033$) after yoga exercises, in the GCS scale [Table 2].

Table 1: Anthropometric measurements before and after yoga intervention in perimenopausal women (*n*=30, Mean±SD)

Anthropometric measurements	Before yoga	After yoga
Waist circumference (inches)	35.233±4.314	32.630±4.191**
Hip circumference (inches)	36.466±2.976	34.743±3.762**
WHR	0.965±0.074	0.938±0.05*
BMI (kg/m^2)	23.92±5.883	23.707±5.845*
Systolic blood pressure (mmHg)	136.6±11.851	127.2±11.716
Diastolic blood pressure (mmHg)	84.33±8.976	81.9±5.979

*P<0.036; **P<0.001, paired sample t test, WHR: Waist hip ratio, BMI: Body mass index, SD: Standard deviation

Serum calcium and copper levels were increased significantly ($P < 0.001$) and serum magnesium and ceruloplasmin levels were decreased significantly ($P < 0.05$, $P < 0.028$, respectively) after 3 months of yoga intervention [Table 3]. Further, before administering the yoga protocol, there was no correlation between minerals and BP, BMI and WHR, but after intervention magnesium levels showed a significant negative correlation ($r = -0.467$, $P < 0.035$) with systolic BP.

DISCUSSION

Rasheed *et al*.[26] reported a decrease in serum calcium level during perimenopause. Martin *et al*.[27] have reported that both younger and older age group (>55 years) women had higher mean serum calcium concentration as compared with the women between 45 and 50 years. This suggests that age has an independent influence on calcium concentration. Moreover, advance in age leads to decreased level of estrogen in women thus, reducing calcification process.[1] A longitudinal study[28] has shown that calcium absorption decreases during perimenopause. The increase in serum calcium after yoga intervention in the present study may probably be due to increase in calcium absorption after yoga. Several studies[18,29] have clearly shown the therapeutic effects of yoga therapy in managing various chronic health disorders affecting almost all the major systems including cardiovascular, respiratory, neuroendocrine, gastrointestinal and musculoskeletal systems. Serum copper status also improved after yoga intervention. The abundance of copper may prove to be atherogenic[30,31] but as a constituent of the antioxidant enzyme, superoxide dismutase it might be beneficial also.

Table 2: Climacteric symptoms in perimenopausal women (*n*=30) before and after yoga intervention, median (inter-quartile range)

Greene climacteric scale	Before yoga	After yoga
Anxiety	3 (2-5)	1 (0-2.25)*
Depression	3 (1-5)	1 (0-3)*
Somatic	4.5 (1.75-7)	2 (0-3)*
Vasomotor	0 (0-2.25)	0 (0-0.25)**
Sexual	0 (0-1)	0 (0-0.25)***

Nonparametric two sample *t* test, *P<0.001, **P<0.003, ***P<0.033

Table 3: Serum mineral levels in perimenopausal women before and after yoga intervention (mean±SD)

Biochemical parameters	Subjects (*n*=30)	
	Before yoga	After yoga
Calcium (mg/dl)	8.348±0.916	9.370±0.943*
Copper (μg/dl)	99.972±24.245	126.559±29.823*
Magnesium (mg/dl)	2.071±0.363	1.871±0.434**
Ceruloplasmin (mg/dl)	38.151±12.777	31.923±10.029***

Paired sample *t* test, *P<0.001, **P<0.052, ***P<0.028, SD: Standard deviation

The significant decrease in serum magnesium concentration after yoga intervention in perimenopausal women may be due to its utilization for improvement of vasomotor symptoms and making them more comfortable with less mood disturbances since magnesium plays an important role in regulation of body temperature.[6,32] The decrease in serum ceruloplasmin after yoga intervention can be explained on the basis of its antioxidant function.[33] Women during perimenopause are under stress, anxiety and depression. This leads to generation of more free radicals. Regular practice of yoga tends to increase the body's ability in consuming antioxidants.[34] Ceruloplasmin might have been utilized as an antioxidant to improve the quality-of-life of perimenopausal women by reducing stress, anxiety and depression as is evident by the GCS scores, post yoga.

According to a retrospective observational study[20] regular yoga practice reduces the body weight. Several intervention studies elsewhere[17,19,35-38] have reported that yoga practice was very effective in reducing body weight. The results of the present study also revealed that yoga practice reduces BMI and WHR. It improves BP among people with hypertension,[37-48] cardiovascular diseases[19,36,48] or diabetes.[42-46] Many studies also found that yoga practice reduces BP in healthy people regardless of the type of yoga.[48,49] Intra-abdominal fat adds to the WC[49] which is one of the risk factors for hypertension. We found a highly significant decrease in WC and also a significant reduction in hip circumference, which might be one of the reasons for decrease in BP along with decreased magnesium levels after yoga intervention.

Thus, the overall changes in the mineral status and climacteric symptoms suggest that the yoga therapy protocol can be effectively used to improve the quality-of-life in perimenopausal women. However, this fact needs further study involving a larger sample size.

ACKNOWLEDGMENT

We are thankful to Dr. Asha Kamath, Department of Community Medicine, Kasturba Medical College and Hospital, Manipal - 576 104, Karnataka, India for her assistance in statistical analysis.

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How to cite this article: Kumar A, Archana E, Pai A, Nayak G, Shenoy RP, Rao A. Serum mineral status and climacteric symptoms in perimenopausal women before and after Yoga therapy, an ongoing study. J Mid-life Health 2013;4:225-9.

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