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Original Article

Alternative Medicine Section

Comparative Assessment of the Effects of Hatha Yoga and Physical Exercise on Biochemical Functions in Perimenopausal Women

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Introduction: Menopause is a transitional phase in which some women experience discomfort, while others may exhibit variety of symptoms. The power of yoga therapy in relieving stress, enhancing health, improving fitness and managing symptoms of a variety of disorders is remarkable.

Aim: The current study was designed to study the effect of Hatha yoga therapy and regular physical exercise on the Fasting Blood Sugar (FBS), Glycated Haemoglobin (GHB), Thyroid Stimulating Hormone (TSH), serum cortisol and total plasma thiol levels in perimenopausal women.

Materials and Methods: The study included 216 women with perimenopausal symptoms, 111 in test group (Hatha yoga) and 105 in control group (physical exercise). The duration of intervention was 45 minutes every day for 12 weeks. Blood samples were collected in the pre and post intervention period. Statistical significance was defined as $p<0.05$.

Results: FBS and GHB ($p\leq0.05$) showed a significant decrease after yoga therapy. Cortisol levels significantly ($p\leq0.05$) increased in the post intervention period in the control group. However, it is maintained in the test group between the two time periods. The total plasma thiols level showed a rise in the post intervention period, significant rise ($p\leq0.001$) in control group but not significant in the test group. The TSH levels were not altered in any group.

Conclusion: It is concluded that exercise helps in maintaining the sugar levels but calming effects of yoga practice is important in relieving stress and enhancing health in perimenopausal women.

Keywords: Calming effect, Lifestyle, Relaxation, Stress, Women's health

INTRODUCTION

Menopause is the natural cessation of menstruation that occurs in women between 45 and 55 years of age. During this phase, some women experience discomfort, while others may exhibit variety of symptoms which can vary from physical disturbance to psychological complaints and thus may impair the overall quality of life [1]. The transition phase is not sudden; rather, it occurs over several years (5-8 years) and is also called as perimenopausal period [2].

Perimenopause or menopausal transition is a phase of intermittent amenorrhea and irregular menstruation which a middle-aged women experience preceding the menopause. This is also called as 'climacteric' and symptoms are referred as climacteric symptoms [3]. During perimenopausal period, a number of signs and symptoms may occur due to alteration in the hormonal profile. These symptoms include irritability, insomnia, night sweats, hot flashes, headache, involuntary urination, decreased libido and vaginal dryness [4-7]. Previous studies have shown that hypoestrinism is responsible for abnormal atherogenic lipid profile observed in perimenopausal period [8,9]. Sone et al., has reported dysglycaemia and increased risk of diabetes in menopausal women [10]. Therefore, the decrease in estrogen and high glucose levels increases the oxidative stress in the body, thus causes the depletion of the plasma and enzymatic antioxidants [11]. High blood glucose and insulin resistance also aggravates the risk of metabolic syndrome, which is very common during menopausal transition.

To improve the immediate symptoms of menopause due to altered hormonal profile and to manage long term consequences, Hormone Therapies (HT) have been extensively used. Some studies have reported that HT can be useful in some co-morbid conditions such as type II diabetes, osteoporosis, certain cardiovascular pathologies and colon cancer [12,13]. Previous study by Women's Health Initiative (WHI) and Million Women Study (MWS) indicate that HT increases the risk of strokes, deep vein thrombosis, pulmonary embolism, uterine and breast cancer [14].

Concerns about the safety of estrogen-based hormone replacement therapy after publication of WHI and MWS have led women turning to alternative therapies. Hath yoga is one among the many alternative therapies and it is the best non- pharmacological approach for life style disorders. Especially pranayama (controlled breathing), asana (posture) and dhyana (meditation) help to improve the strength, wellbeing and overall quality of life [15-17].

On the other hand, physical exercise tones the muscles, strengthens the heart, lungs and bones. It helps in relieving depression and improves vitality [18]. Previous studies have reported the beneficial effect of brief high intensity exercise on blood glucose levels [19,20], blood pressure, [21,22] body weight [23] and stress levels [24,25] on different population. The effect of exercise on the menopausal symptoms was also attempted in the previous studies [26]. By keeping the above observations in mind, the present study was undertaken to assess the effects of planned yoga therapy and regular physical exercise on the FBS levels, GHB, serum TSH, serum cortisol and total plasma thiols levels in perimenopausal women.

MATERIALS AND METHODS

This was a non-randomized controlled study approved by the institutional ethical committee. Informed consent was obtained from the volunteer participating in the study. It was carried out

in 216 women aged 40 to 60 years, belonging to various self-help groups, women organizations and yoga therapy clinics in and around the district. The participants were divided into two groups; of which first group who underwent yoga therapy were included as the test group (n=111) and those with regular physical exercise formed the control group (n=105). The details of yoga and exercise are given in [Table/Fig-1,2] respectively.

Asanas (body postures) Approximate time
Swastikasana (auspicious pose) 2 min
Vajrasana (thunderbolt pose) 2 min
Suptavajrasana (reclined Thunderbolt Pose) 2 min
Tadasana (Mountain pose) 2 min
Trikonasana (Triangle pose) 2 min
Parsvakonasana (extended side angle pose) 2 min
Paschimottasana (seated forward bend) 2 min
Purvatanasana (seated back arch) 2 min
Janushirshana (head to the knee pose) 2 min
Pavanamuktaasana (wind relieving pose) 2 min
Bhujangasana (cobra pose) 2 min
Shalabhasana (locust pose) 2 min
Dhanurasana (bow pose) 2 min
Vakrasana (twisted pose) 2 min
Padottanasana (wide-legged forward bend) 2 min
Shavasana (corpse pose) 5 min
Pranayama(breathing exercises)
Anuloma-viloma (alternative nostril) 5 min
Suryabhedana (right nostril) 5 min
Sheetali (through tongue) 2 min
Bhramari (honey bee sound during exhalation) 2 min

[Table/Fig-1]: The details of asanas and the approximate time during the intervention in the test group (yoga therapy).

Loosening E xercises:
Sitting: Passive rotation of toes, Toe bending, Ankle bending, Ankle rotation, Knee bending, Knee rotation, Knee cap tightening, Half butterfly, Full butterfly, Neck bending, Neck rotation. Standing: Waist rotation, Wrist rotation, Shoulder rotation. Each one repeated for 10 rounds or 10 rotations.
Strengthening Exercises (While standing): Wrist — Stretching arms straight in front, make the tight fist, palm facing down, move the fist up and down vigorously from the wrist-10 times.
Palms — Holding near the chest bending at the elbow, spread the fingers, and move palms up and down vigorously from the wrist.
Fingers — Throwing out the arms in front, give the fingers of both the arms the shape of the hood of cobra, stiffen the entire length of the arms from the shoulder joints to the finger tips till they start trembling-5 times.
Elbows — Stretch the arms straight down beside the body, make the tight fist of the palms, and raise the fists forward up to the level of the shoulder with a jerk-10 times.
Arms — Make the fists of hands with thumb tucked in, bend the elbow and raise the forearms till they parallel to the ground, push both the arms forward forcefully and vigorously to the level of the shoulder-10 times.
Back — Spreading the legs apart as far as possible, place the hands on the hips bend backward from the waist as far as possible and then forward without bending the knees till head reaches the ground-5 times.
Thighs — Stretch out the arms facing down straight in front at the shoulder heights, inhaling bend the knees till thighs come parallel to the ground, and then come up exhaling-5 times.
Calves — Stretch out the arms facing down straight in front at the shoulder heights, inhaling squat and go down as far as possible-5 times. Supine rest 5 to 10 minutes.

[Table/Fig-2]: The details of exercise used during the intervention in the control group (exercise).

Inclusion criteria: (a) 40 to 60 years of age; (b) be willing and be able to practice yoga; (c) have at least some of these perimenopausal symptoms such as irregular periods, hot flashes or flushes, lower sexual drive, vaginal dryness, involuntary urination, insomnia, night sweats, feeling tired or worn out.

Exclusion criteria: (a) women who were already practicing yoga for a month or more; (b) women with surgical menopause and receiving any kind of hormone therapy; (c) women who had any active psychological disorders or any other medical disorders.

Before the initiation of intervention, venous blood – 5ml was drawn from the patients in fasting condition for the following investigations: FBS, GHB, TSH, cortisol and total thiols levels.

FBS was estimated using Glucose Oxidase Peroxidase (GOD POD) method (enzymatic method) in a Roche/Hitachi clinical chemistry analyser.

GHB was measured by the turbidimetric inhibition immunoassay using commercial kits supplied by Tina-quant [27].

TSH [28] and cortisol [29] were measured by chemiluminescent immunoassay using commercial kits supplied by COBAS in an Elesys immunoassay analyser.

Total plasma thiols were measured by colorimetric method using 5.5.-dithio-bis (2-nitrobenzoicacid) (DTNB). In this method, 5-5 dithiobis-2-nitrobenzoic acid reacts with total sulfhydryl groups to form a chromogen whose extinction is measured at 420 nm (Ellman, 1959) [30].

After the baseline measurement, the intervention program was initiated. The intervention was practice of yoga or exercise for 45 minutes per day for 12 weeks. Final assessment for these parameters was conducted at the end of the intervention.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for Social Sciences, version 15.0 (SPSS Inc. South Asia, Bangalore) for a level of statistical significance of 5%. Two-way repeated measures of ANOVA were used to compare the results within the group and between the groups. The p-values less than 0.05 were accepted as significant differences between pre and post-intervention data.

RESULTS

The average age (in years) of women in yoga group was 48.34±4.63 and in control group was 48.30±5.11. [Table/Fig-3] shows the baseline data of prevalence of perimenopausal symptoms in the study participants. [Table/Fig-4] shows that yoga therapy intervention resulted in significant ($p \leq 0.05$) decrease in FBS and GHB. The significant decrease ($p \leq 0.05$) in GHb was also observed in control (exercise) group. [Table/Fig-5] indicates that TSH levels did not exhibit any significant change in the two time periods. Cortisol was significantly increased ($p \leq 0.05$) in the control group but maintained in test group. There was an increase in total plasma thiols in both the groups. This increase was observed within as well as between the groups. The increase in total plasma thiols in control group was statistically significant ($p \leq 0.001$) but the increase in the test group was statistically not significant.

DISCUSSION

In the present study we estimated the levels of TSH, cortisol and thiols in the perimenopausal women. This is the only study where the effect of yoga and exercise on these parameter was studied in perimenopausal women. The results of this study indicated that the longer duration of yoga can be beneficial in maintaining the levels of thyroid hormone and stress level in the body. The stress levels can be maintained by modulating the levels of cortisol and thiols in the body. This study was undertaken to find out the effect of two different exercises {physical exercise and mind-body exercise (yoga therapy)} on the blood sugar, TSH, stress hormone (cortisol) and antioxidant levels (total plasma thiols) in perimenopausal women. Previous studies in diabetic patients and in perimenopausal women have indicated that yoga alone or with other therapies can reduce the levels of FBS and GHB [31-35]. Mondal et al., have documented similar results in elderly women [36]. The decreases in FBS and GHB in control group reflect that even exercise helps in maintaing the glycaemic control of the body. Our study is similar to reports in a previous study by Zoic et al., who explained that aerobic exercise helps in decreasing the GHB levels in post-menopausal women which decreases the risk of micro- and macro vascular complications associated with high blood glucose [37]. Therefore, practice of either of the above

Domain	Sl.No	Symptoms	n= 216	Percentage
Vaso-motor	1.	Hot flashes or flushes	79	36.6
	2.	Night sweats	61	28.2
	3.	Sweating	103	47.7
Psycho-social	4.	Being dissatisfied with personal life	64	29.6
	5.	Feeling anxious or nervous	85	39.4
	6.	Experiencing poor memory	163	75.5
	7.	Accomplishing less than I used to	112	51.9
	8.	Feeling depressed down or blue	83	38.4
	9.	Being impatient with other people	68	31.5
	10.	Feeling wanting to be alone	70	32.4
Physical	11.	Flatulence (wind) or gas pain	120	55.6
	12.	Aching in muscle and joints	128	59.3
	13.	Feeling tired or worn out	151	69.9
	14.	Difficulty sleeping	102	47.2
	15.	Aches in back of neck or head	119	55.1
	16.	Decrease in physical strength	144	66.7
	17.	Decrease in stamina	142	65.7
	18.	Feeling of lack of energy	112	51.9
	19.	Drying skin	75	34.7
	20.	Weight gain	94	43.5
	21.	Increased facial hair	25	11.6
	22.	Changes in skin texture or tone	48	22.2
	23.	Feeling bloated	91	42.1
	24.	Low aback ache	117	54.2
	25.	Frequent urination	66	30.6
	26.	Involuntary urination	91	42.1
Sexual	27.	Changes in sexual desire	64	29.6
	28.	Vaginal dryness	55	25.5
	29.	Avoiding intimacy	62	28.7

[Table/Fig-3]: Prevalence of perimenopausal symptoms in four domains at the baseline.

Test	Results	Yoga (n = 111)	Control (n = 105)	p-value
FBS (mg/dl)	Pre Post p-value Effective size	110.26±31.95 106.59±26.88 0.05* 3.68	111.26±29.46 114.57±57.02 0.56 † - 3.31	0.31‡
GHB (%)	Pre Post p-value Effective size	6.34±0.84 6.22±0.83 0.03* 0.12	6.44±0.86 6.26±0.80 0.003* 0.16	0.50 ‡

[Table/Fig-4]: The pre and post mean values of FBS and GHB in both yoga and control groups. (Mean ± SD)
*significant increase within the group; † no significant change within the group;
‡no significant difference between the groups

Test	Results	Yoga (n = 111)	Control (n = 105)	p-value
TSH (UIU/ml)	Pre Post p value Effective size	4.04±0.45 4.21±6.87 0.81 † - 0.17	4.11±9.28 3.55±5.91 0.14 † 0.57	0.73 ‡
Cortisol (µg/dl)	Pre Post p value Effective size	14.16±5.62 14.46±5.73 0.57 † - 0.30	12.86±5.36 13.93±5.31 0.04* - 1.07	0.17 ‡
Total plasma thiols (µM/L)	Pre Post p value Effective size	308.82±62.97 313.93±64.00 0.56 † - 5.11	267.06±98.17 314.10±62.94 0.001* - 47.05	0.001**

[Table/Fig-5]: The pre and post mean values of TSH, cortisol and total plasma thiols in both yoga and control groups. (Mean±SD).
*significant increase within the group; † no significant change within the group;
**significant difference between the groups, ‡no significant difference between the groups

two modalities helps in controlling the blood glucose levels in perimenopausal women.

Further in our study we observed a slight decrease in TSH levels post physical exercise but the decrease was not statistically significant. Previous studies did mention about the decrease in TSH post aerobic and resistant exercise [38] and increase after the endurance training [39]. But we did not observe any significant change in the TSH levels post physical exercise which is similar to two previous studies [40,41]. The differences in the TSH level might be due to different exercise/training protocol, study population and the duration of the intervention. In the yoga group we did not find any significant change after the intervention. Study by Bhavanani et al., has indicated that one year of yoga therapy has resulted in decrease of TSH levels [42]. But we did not find any changes in the TSH levels probably due to limited duration of intervention (12 weeks). Continued practice of yoga for one year might result in a similar trend. Thus, yoga might prove to be more beneficial than physical exercise.

Perimenopause is said to be a stressful physiological state in women [43,44]. Moreover, to improve the quality of life of such women they are advised to introduce certain changes in their lifestyle e.g. diet, exercise, yoga etc. But it is well documented that exercise leads to increased oxidative stress and release of free radicals [45,46] as well as an increase in the levels of the stress hormone, cortisol [47]. In the present study, it has been observed that there is a significant increase in the plasma cortisol level post exercise but it is maintained in the post yoga group (within the group comparison). This effect is probably because of the relaxing/calming nature of yoga practices as well as its ability to create an alteration in the sympatho – parasympathetic axis [48,49]. Further, since exercise leads to oxidative stress, there is a marked increase in the levels of the antioxidant, total plasma protein thiols post exercise to quench the free radicals produced therein [46,50]. probably leading to its increased turnover, as noted in this study. But in the post yoga group no such preventive action of the antioxidant was seen to be necessitated (within the group comparison). Hence, the thiol levels do not exhibit any significant change in this group. The above discussion indicates that yoga prove to be as beneficial or better than exercise at improving the biochemical parameters including FBS, GHB, TSH, cortisol and plasma protein thiols in perimenopausal women.

LIMITATION

Randomization of the participant was the main limitation of the study. As this study is totally based on volunteer participation of the study participants, it was difficult to randomly assign them into yoga and control group. Most of the participants requested to be included only in yoga group. This makes this study a non-randomized controlled study. The estimation of T_4 and T_3 along with TSH could have been done to get a better understanding of the role of yoga and exercise on thyroid hormone levels. Longer duration of yoga/exercise (at least for 6 months) could have given better results.

CONCLUSION

As observed in this study, with improvement in blood sugar and GHB levels, calming effects of yoga practice and a general feeling of wellness due to maintained antioxidant status after 12 weeks of yoga therapy, there will also be a significant positive change in their perception of the quality of life. Yoga increases flexibility, endurance, strength, relaxation and tranquility. Thus, it contributes to the improvement of overall quality of life. The biggest challenge in practicing yoga is the inability to do, or hold, an asana (yoga pose) and for exercise is the tiredness after the workout. This can be overcome by regular practice and gradual increase in the duration of holding a particular asana. Moreover, for the elderly women, yoga can be practiced safely, at a gradual pace without any injurious effect on the body when compared to physical exercise which is more vigorous and fast paced. Thus, it must be encouraged in the regular management, preventive and adjuvant therapy in perimenopausal women.

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