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The effect of eight weeks yoga program on the thyroid function in middle-aged women

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Abstract

Introduction: Yoga may have a role in revitalizing thyroid function there are few studies on the effects of yoga on thyroid function. The aim of present study was to investigate the effect of eight weeks yoga program on triiodothyronine (T_3), thyroxine (T_4) and thyroid stimulating hormone (TSH) in young sedentary women.

Material & Methods: Twenty sedentary women aged between 20 to 40 years old participated in this study as the subject. The subjects were divided into yoga group (n=10) or control group (n=10) randomly. The subjects in the yoga group underwent 90 min hatha yoga practices daily, 3 times a week for 8 weeks, whereas control group continued their usual routine activities. Basal level of serum T_3, T_4 and TSH were measured before commencement and after 8 weeks of yogic training.

Results: The results indicated that T_3 decreases significantly in the control group ($t = -2.02$, $P = 0.05$); however, there was no significant change in T_4 ($t = -0.3$, $P = 0.7$) or TSH

(t = 0.15, P = 0.8) in any of the two groups over the 8 weeks period.

Conclusions: In summary, the results suggest yoga training utilized in this study had not significant effect on thyroid function in sedentary women.

Keywords: Yoga training, Thyroid function, Triiodothyronine, Thyroxine, Thyroid stimulating hormone

1. Introduction

The thyroid gland is one of the largest endocrine glands in the body, is, that the normal weight adults is 15 to 20 grams, and placed immediately below the larynx, and the sides and front of the trachea (1). Thyroid hormones regulate the renal hemodynamics and basal metabolic rate of most cells. The thyroid gland synthesizes and releases triiodothyronine (T_3) and thyroxine (T_4), which represent the only iodine containing hormones in the vertebrates. T_3 is the biologically active thyroid hormones (2). These hormones are required for the normal growth, development and function of nearly all tissues, with major effects on oxygen consumption and metabolic rate (3). Thyroid hormones synthesis and secretion are regulated by a negative feedback system that involves the hypothalamus, pituitary, and the thyroid gland (4). Thyrotropin–releasing hormone (TRH) secreted from hypothalamus stimulates anterior pituitary to release thyrotropin (TSH, thyroid stimulating hormone) (5). Physical activity has been reported to affect endocrine function (6). Any mode of exercise or physical activity corresponds to a physical stress on the endocrine system that challenges homeostasis (7,8). The influence of exercise on thyroid function is controversial and seems to depend on the intensity and the duration of the training protocol (9). Yoga is an ancient Indian mind-body technique intended to stabilize and reconditioning the psycho-physiological make-up which influence the natural endocrinal homeostasis within the body. Yoga offers a unique combination of mild to moderate physical exercise (suryanamaskar and asana), cleansing process (kriya), breathing control (pranayama) and meditation (dhyana) (10). In recent times there is a shift in paradigm and Complementary and Alternative Medical (CAM)

therapies such as yoga are being increasingly used as adjuncts to modern medicine. It has been suggested that yoga may have a role in revitalizing thyroid function as well as improving psycho–neuro–endocrine function on the whole (11,12). Werner et al. (1986) investigated the effect of long term practice of transcendental meditation and transcendental meditation–sidhi program on some endocrine variables. TSH, T_3, T_4, prolactin, growth hormone and cortisol in serum were taken on five consecutive days (initial and after 5, 49, 115 and 167 weeks). All samples were drawn one hour following 30 - 60 min of practice of meditation. A progressive decrease in serum TSH, GH and prolactin levels occurred over the three years while no consistent change in cortisol, T_3 and T_4 levels were observed (13). Maclean et al. (1997) studied the effect of transcendental meditation program in hormonal levels. The subjects were assigned randomly to participate in 4 months either the transcendental meditation program or a stress education control program. Blood samples were collected before and after transcendental meditation. Cortisol and TSH were decreased, whereas growth hormone increased after 4 months of transcendental meditation (14). In a prospective randomized control trial Gordon et al. (2008) evaluated the effects of yoga and traditional physical training exercise regimens on fasting blood glucose, serum insulin, TSH, T_3 and T_4 at baseline, after three months and six months in individuals with type 2 diabetic mellitus. They reported that there is no significant change in TSH, T_3 and T_4 level after the practice of yoga or traditional physical exercise and control groups during three different (at 0, 3 and 6 months) periods (15). Recently, Chatterjee and Mondal (2017) were studied the effect of combine graded yoga program on the basal level of thyroid hormones in healthy middle-aged adults. They reported that twelve weeks of yogic training produces a significant increase in serum TSH level for male and decrease in T_3 and T_4 for both male and female groups as compared to their baseline data, whereas no such changes were observed in the control group during these 12 weeks (9).

The hypothalamus–pituitary–thyroid axis plays an important role in metabolism of almost all body tissues, energy homeostasis, growth and tissue differentiation as well as gene expression and thermoregulation in the body throughout the life (3,16). Moreover growing bodies of animal

and human studies indicate thyroid hormones also play a role in cardiovascular, nervous, immune and reproductive system development and function (17). Adequate thyroid function is essential for normal development and retention of cognitive function throughout life (18).

Yoga may affect thyroid hormones and thereby body metabolism, while the effects of yoga on the thyroid function is not clear. Thus the present study was done to examine the effect of eight weeks yoga program on T_3, T_4 and TSH in sedentary women.

2. Material & Methods

Subjects

Twenty healthy and sedentary women participated in this study. Their ages were between 20 to 40 (30.4 $\pm$ 5.1) years. All subjects were informed about the purpose and procedures of the study. All subjects were volunteers and selected randomly. They had a medical examination and completed a health status questionnaire.

Study design

The study was a quasi-experimental, pre-test and post-test comparison group designed. Twenty healthy and sedentary women were randomly assigned to a control group (n=10) or yoga group (n=10). The study was approved by the Ethics Committee of the Islamic Azad University, Marvdasht branch, Iran. The subjects were familiarized with the aims and objectives of the study as well as laboratory environment and their written consent obtained. They were normally healthy. Subjects were free from any metabolic ailments and were not on any medication prior to the study. Both groups were assessed two times each, under similar conditions. Baseline assessments were made prior to beginning of the yoga training (pre-test). After this the experimental group received training in yoga, while the control group carried on with their routine activities. Subsequent assessments for both the groups were done after 8 weeks (post-test).

Measurements

In this study, chronological age, standing height, body weight, body mass index (BMI), waist circumference, maximum hip circumference, waist to hip ratio (WHR) and level of serum TSH, T_3 and T_4 were measured by electrochemiluminesence method. Personal characteristics of the subjects are presented in the Table 1.

Table 1. General variables of yoga and control group (Mean ± SD)

Variables	Yoga group	Control group
Age (y)	31.1 ± 6.1	29.8 ± 4.3
Height (cm)	161.0 ± 7.1	163.1 ± 4.6
Body weight (Kg)	60.9 ± 9.1	70.5 ± 13.3
BMI ($Kg.m^{-}$)	23.9 ± 3.06	28.1 ± 7.6
WHR	0.84 ± 0.07	0.85 ± 0.07

► *Yoga training protocol*

The combination of yoga practices are adopted for this study. Yoga training protocol of this study was derived from the protocol of Chatterjee and Mondal (2014) (19). The yoga group (experimental) pursued training in *suryanamaskar* (dynamic physical posture), *asanas* (static physical postures), *kriyas* (cleansing practices), *pranayamas* (breathing control) and *dhyana* (meditation) for a period of 8 weeks. Progressive training load were applied in terms of time, degree of difficulty and repetitions from the first week to 8 weeks of the training period. In the initial stage of training, first one week, duration of practice was 45 min. Practiced time was increased gradually and reached 90 min at the beginning of 4 week, mid stage of training and the practice time was fixed in the 4 week and continued to 8^{th} week. In the initial stage of training very simple techniques were introduced whereas, advance techniques were given after 4^{th} week. The subjects were practiced yoga session in the morning for 3 days in a week for 8 weeks with an individual attendance of 83 – 87 %. Waitlist control group was given no specific intervention and continued with their routine activities. They attend "health and positive mental attitude awareness" class in a day per week. A general record book was also maintained to note their daily activity level and lifestyle.

Statistical analysis

Results were expressed as the mean ± SD and Shapiro-Wilk Test was applied to evaluate the normal distribution of variables. Paired sample t-test and independent sample t-test were used to assess the inter-group and between group changes. The significant level of this study was set at $P<0.05$ and the data were analyzed using SPSS software for windows (version 22, SPSS, Inc., Chicago, IL).

3. Results

Changes of TSH in the yoga group and control group are presented in the Figure 1. The results indicated that TSH decreased in the control group (12%; t = 2.06 and P = 0.06) and it decreased in the yoga group (11.7%; t = 1.3 and P = 0.1) after the intervention. No Significant differences were observed between two groups (t = 0.15, P = 0.8).

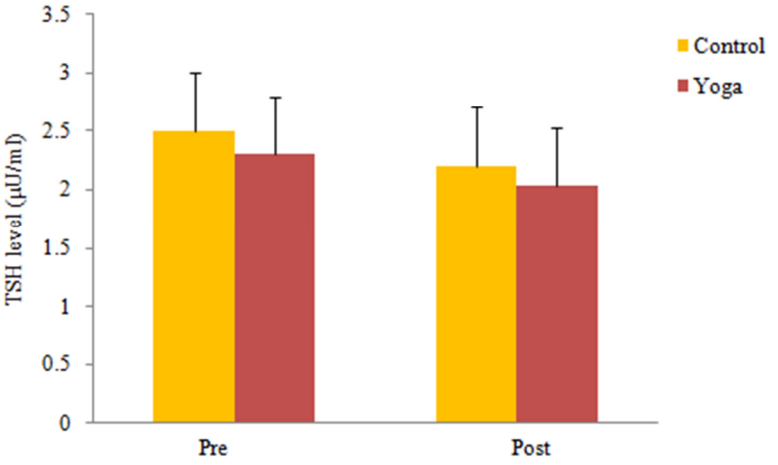

Figure 1. Changes of TSH in the yoga group and control group

Changes of T_3 in the yoga group and control group are presented in the Figure 2. The results indicated that T_3 decreased significantly in the control group (14.2%; t = 3.7 and P = 0.005) but it had tendency to decrease in the yoga group (1.4%; t = 0.2 and P = 0.8) after the intervention; although it was not significant statistically. No Significant differences were observed between two groups after the intervention (t = – 2.02, P = 0.05).

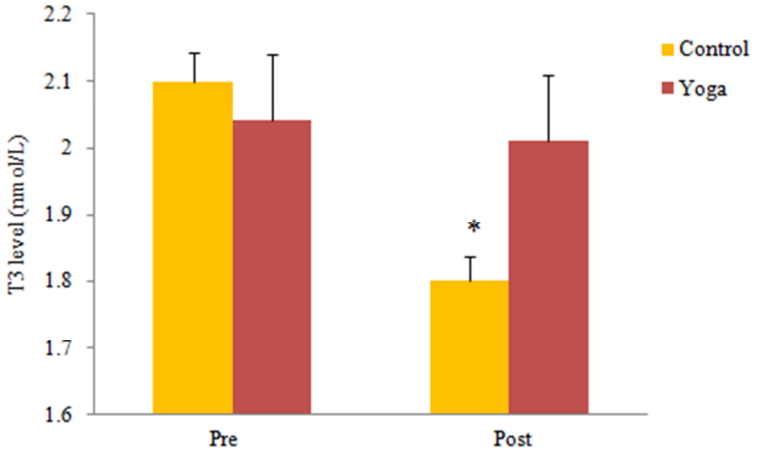

Figure 2. Changes of T3 in the yoga group and control group

* Significant differences between pre vs. post-training

Changes of T_4 in the yoga group and control group are presented in the Figure 3. The results indicated that T_4 increased in the control group (1.4%; t = – 0.4 and P = 0.6) and it increased in the yoga group (3.7%; t = – 0.7 and P = 0.4) after the intervention. No Significant differences were observed between two groups (t = – 0.3, P = 0.7).

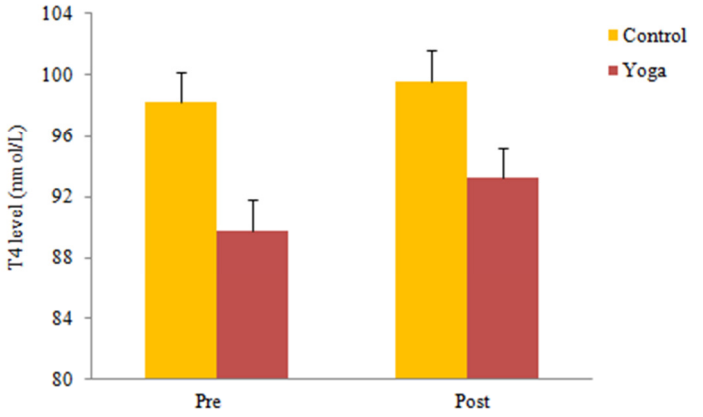

Figure 3. Changes of T4 in the yoga group and control group

4. Discussion

Yoga is an alternative system of healing, its power being widely harnessed to prevent and treat thyroid gland dysfunction. Yoga is

undoubtedly a reliable avenue for holistic health. Yoga not only serve as a helpful therapy in relieving existing symptoms, but also act in the management of hypothyroidism and prevention of further damage to thyroid gland. Many of the thyroid disorders occur due to excessive stress. Yoga can help alleviate stress and anxiety to a great extent. This practice is also useful in maintaining the right balance between the mind and the body (20). The aim of the present study was to examine the effects of 8 weeks yoga training on the thyroid function in sedentary women. The results indicated that T_3 decreases significantly in the control group; however, there was no significant change in T_4 or TSH in any of the two groups over the 8 weeks period.

TSH secreted by the pituitary gland regulates the synthesis and the secretion of T_3 and T_4. Thyroid hormones are important regulators of energy metabolism and may influence energy processes during physical exercise (21). The function of T_3 and T_4 includes increasing the rate of the metabolism of carbohydrates and fats, as well as the synthesis and degradation of proteins inside the cell.

Yoga is a profound ancient technique that reduced resting heart rate, respiratory rate, metabolic activity and energy expenditure (22) as observed during the practice of *dhyana* (meditation) and few meditative and relaxation types of *asana* (postures). On the other way, *pranayamas* (specific breathing control practices) like *Ujjayi*, *Surya Anulome Vilome* and cultural *asanas* increased oxygen consumption, metabolic rate and energy expenditure (23,24), thus produce a vitalizing effect in the mind-body system.

The results of present study in line with the results recorded by Werner et al. (1986) and Maclean et al. (1997) who reported that transcendental meditation had no significant effected on T_3 and T_4 level (13,14). In another study Gorden et al. (2008) also, reported that there is no significant change in TSH, T_3 and T_4 level after the practice of yoga (15). Gorden et al. (2008) did not give any clear explanation about the details of yoga regimen. The results are contradictory to results recorded by Chatterjee and Mondal (2017) who reported that twelve weeks of yogic training produces a significant increase in serum TSH level for male and decrease in T_3 and T_4 for both male and female groups as

compared to their baseline data, whereas no such changes were observed in the control group during these 12 weeks (9). These discrepant results may be attributed to differences in subject populations and yoga training duration.

Chatterjee and Mondal (2017) noted that transcendental meditation gives rise to a unique state of deep rest by marked reductions in resting heart rate, respiratory rate, oxygen consumption, metabolic activity, increased cerebral blood flow may responsible for the decrease of serum TSH in the human body (9). In the graded yogic training schedule there were *suryanamaskara* (dynamic physical posture), *shitilikarana* (loosening) practices and *asanas* (physical postures) which were reported as moderate aerobic type of exercises may positively increased the basal level of TSH and decreased T_3 and T_4 levels in the plasma blood (24,25). Moreover specific yogic poses (*Sarvagasana, Halasana, Usthrasan, Matyasana, Bhujangasan*) can stimulate the throat area by squeezing and stretching or massaging the thyroid gland placed in the neck region (9). Regular practice of p*ranayama* (*surya vedhana, ujjai, bhastrika, bhramari, sitali, sitkari*) and meditation may send a positive feedback to the hypothalamus and pituitary (9). On the other hand, exercising increases metabolic activity, this helps burn more calories and helps keep weight down. Research results showed that medium-intensity aerobic exercise, which the study classified as 70% of a person's maximum heart rate, produced the best results for improving TSH. Exercise can by itself improve thyroid function may be through better perfusion of gland (26). However this needs to be investigated further.

5. Conclusion

The results indicated that utilized in this study had not significant effect on thyroid function in sedentary women.

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