

The effect of regular physical exercise on the thyroid function of treated hypothyroid patients: An interventional study at a tertiary care center in Bastar region of India

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ABSTRACT

Background: Thyroid hormone is a key substance in normal homeostasis, having variable influence on cell metabolism on different organs. Hypothyroidism is common, potentially serious, often clinically overlooked, readily diagnosed by laboratory testing, and eminently treatable. **Aim:** This study was conducted with the aim of finding the effect of regular physical exercise of medium-intensity on thyroid function in patients already undergoing treatment for hypothyroidism. **Materials and Methods:** A total of 20 ambulatory treated hypothyroid patients were included in the study. Serum samples were collected and evaluated for triiodothyronine (T3), thyroxine (T4), thyroid stimulating hormone (TSH) both before and after 3 months of daily 1 h physical exercise, from those patients doing exercise and from those who did not do any physical exercise. *T*-test was used to find a significant difference between the two groups. **Results:** Serum TSH was found to be significantly decreased in patients of regular exercise group postinterventionally ($P < 0.001$) when compared with nonexercise group ($P = 0.43$). Serum T3 and T4 were also found to be significantly raised in regular exercise group postinterventionally ($P = 0.007$ and $P < 0.001$ respectively) but not in nonexercise group ($P = 0.92$ and $P = 0.73$ respectively). On inter group comparison significant decrease in TSH was found in regular exercise group ($P = 0.002$) and significant increase was found in levels of T3 ($P = 0.002$) and T4 ($P = 0.001$) in regular exercise group. Mean weight was also found to be decreased in regular exercise group postinterventionally. **Conclusion:** Every hypothyroid patient should do regular physical exercise along with thyroxine replacement to improve thyroid function.

Key Words: Physical exercise, thyroid hormone levels, treated hypothyroidism

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Introduction

Thyroid diseases are arguably, among the commonest endocrine disorders worldwide. India too is no exception. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases.^[1] Thyroid hormones (THs) regulate the renal hemodynamics and basal metabolic

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rate of most cells. The thyroid gland synthesizes and releases triiodothyronine (T3) and thyroxine (T4), which represent the only iodine containing hormones in the vertebrates. T3 is the biologically active TH.^[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] TH synthesis and secretion are regulated by a negative feedback system that involves the hypothalamus, pituitary, and the thyroid gland.^[4] Exercise can also improve thyroid function. It can be difficult to find the energy to exercise when feeling fatigued but exercise is particularly important in the treatment of hypothyroidism. Exercise may be one of the most powerful natural therapies to alleviate depression, one common symptom of hypothyroidism.^[5] However, clinical studies on hypothyroid subjects are very few, and not much data are available on how physical exercise influences thyroid function in human beings. Hence, we conducted this observational study to see the relation of the physical exercise with thyroid function.

Materials and Methods

The study was conducted in Department of Biochemistry in a tertiary care centre in Bastar area (tribal area) of Chhattisgarh. 20 ambulatory otherwise healthy treated hypothyroidism male patients with comparable level of hypothyroidism were included in study, out of which 10 patients complied to do regular physical exercise for 1 h daily, and rest were not willing to do physical exercise. Serum T3, T4 and thyroid stimulating hormone (TSH) levels were analyzed preinterventionally to avoid any biases in the distribution of subjects into both groups. The regular exercise session in the form of sports or jogging continued for 3 months. All the patients were between age 30 and 40 years. All the subjects were stable on their respective thyroxine replacement doses (eltroxine) since last 6 months. Mean thyroxine dose was 97 µg/day in the exercise group and 100 µg/day in nonexercise group. Brief clinical history and examination along with some epidemiological data were taken. After a written and informed consent samples were collected and processed. Ethical clearance was taken for the study.

Collection and preparation of sample

We collected 5 mL of venous blood with full aseptic precautions without anticoagulant and allowed it to clot. Clotted blood was centrifuged, and clear serum was collected. Fresh serum samples were taken. Serum was checked for hemolysis, and if hemolyzed then that serum was discarded. Serum was analyzed for T3, T4 and TSH for Thyroid profile. This process was repeated again after 3 months of the start of the study to look for changes in thyroid profile if any happened in both the groups.

Analytical methods

Fifty microliter of serum was taken to analyze T3, 25 µl for T4 and 100 µl for TSH hormone level by ELISA method (Omega diagnostics) at 450 nm filter using Microplate Reader model 680 (Biorad). Normal range for T3 was 0.5-1.9 ng/mL, for T4 was 4.8-11.6 pg/dL (females) and 4.4-10.8 pg/dL (males) and for TSH it was 0.5-6.3 µIU/mL. *T*-test was used to find a significant difference between the two groups.

Results

Totally 20 male treated hypothyroid patients of middle age group ranging 30-40 years were evaluated for thyroid function, out of which 10 patients belonged to regular physical exercise group and 10 nonexercise group. Mean age for all 20 patients was 34.1 + 2.69. Serum TSH, T3 and T4 were analyzed at the end of 3 months in both exercise group and nonexercise group. Serum TSH was found to be significantly decreased in patients of regular exercise group postinterventionally ($P < 0.001$), but no such significant difference was seen with nonexercise group ($P = 0.43$). Serum T3 and T4 were also found to be significantly raised in regular exercise group postinterventionally ($P = 0.007$ and $P < 0.001$ respectively) but no such significant difference in T3 and T4 was found in nonexercise group ($P = 0.92$ and $P = 0.73$ respectively). On inter group comparison significant decrease in TSH was found in regular exercise group ($P = 0.002$) and significant increase was found in levels of T3 ($P = 0.002$) and T4 ($P = 0.001$) in regular exercise group. Mean weight was found to be decreased in regular exercise group postinterventionally [Tables 1-4].

Discussion

The present study is the first description of the effect of regular physical exercise on thyroid disorder status in and around this region. Thyroid disorder level is high among native tribal of

Table 1: Thyroid profile in exercising and nonexercising group preinterventionally

Serial number	Mean ± SD		Test of significance
	Exercise group	Nonexercise group	
T3	1.30±0.28	1.10±0.25	$t=1.5, P=0.12, df=18$
T4	8.09±0.45	8.64±0.97	$t=1.5, P=0.14, df=18$
TSH	2.51±0.24	1.92±0.85	$t=2.00, P=0.06, df=18$

SD = Standard deviation, TSH = Thyroid stimulating hormone

Tables 2: Thyroid profile in exercise group pre and postintervention

Serial number	Preintervention	Postintervention	Test of significance
T3	1.30±0.28	2.33±1.03	$t=3.03, P=0.007, df=18$
T4	8.09±0.45	11.34±1.98	$t=5.05, P=0.00, df=18$
TSH	2.51±0.24	0.61±0.42	$t=12.11, P=0.000, df=18$

TSH = Thyroid stimulating hormone

Table 3: Thyroid profile in nonexercise group pre and postintervention

Serial number	Preintervention	Postintervention	Test of significance
T3	1.10±0.25	1.11±0.23	$t=0.10, P=0.92, df=18$
T4	8.64±0.97	8.77±0.82	$t=0.34, P=0.73, df=18$
TSH	1.92±0.85	2.34±1.42	$t=0.80, P=0.43, df=18$

TSH = Thyroid stimulating hormone

Table 4: Thyroid profile comparison in exercise versus nonexercise group postintervention

Serial number	Exercise group	Nonexercise group	Test of significance
T3	2.33±1.03	1.11±0.23	$t=3.60, P=0.002, df=18$
T4	11.34±1.98	8.77±0.82	$t=3.77, P=0.001, df=18$
TSH	0.61±0.42	2.34±1.42	$t=3.66, P=0.002, df=18$

TSH = Thyroid stimulating hormone

Bastar region involving more commonly female population. The reason for this is not well known. This may be because Bastar region receives heavy rainfall and it is situated well above plains, so iodine of superficial layer gets washed away with water and here consumption of seafood which is rich in iodine is also less as this area is far from sea. Ground water of some regions in Bastar is rich in fluorine to the level that it may cause fluorosis too. According to present study thyroid functions improve in hypothyroid patients doing regular physical exercise, as TSH levels decreased, and T3 and T4 increased in regular exercise group. Exercising increases metabolic activity, which helps burn more calories and helps keep weight down. Research at the University of Gaziantep in Turkey set out to study the effects of exercise on levels of TSH, to see if it would help those with lower TSH levels. The 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.^[5] Hence some improvement in thyroid function can be attributed to decreasing in weight in regular exercise group. Exercise can by itself also improve thyroid function may be through better perfusion of gland. However this needs to be investigated further. Even gentle exercise such as walking, swimming, or yoga stimulates thyroid gland secretion and increases tissue sensitivity to THs. Peripheral metabolism of THs can be changed significantly by a number of physiological and pathological conditions, which can alter the deiodination pathway and lead to a change in the circulating level of THs. The biological effects of short-term changes in the TH levels are not currently completely understood but are potentially important in the body's adjustment to stressful or catabolic states.^[6] A connection is established between increasing training to 80 km/week and elevated hormone levels.^[7,8] Examined the TH levels of professional cyclists during a 3 weeks stage competition, they concluded that serum T4, FT4 and FT3 levels showed a significant increase by the last week of competition while concentrations of TSH and T3 remained unchanged.^[9]

Findings of the present study were different from previous studies done on hypothyroid patients as because most studies were on patients doing acute and stressful exercise Fortunato *et al.*, Hackney *et al.*^[10,11]

Conclusion

Hypothyroidism reduces exercise capacity but after hormone replacement with thyroxine exercise capacity can be attained back. After being euthyroid on hormone replacement regular physical exercise can improve thyroid function and thus improve mental and physical status of hypothyroid patient and concomitantly decrease dose of thyroxine replacement therapy. So every young to middle aged hypothyroid patient should do regular physical exercise to improve his/her thyroid status.

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