DOPPLER MONITORING OF THYROID BLOOD FLOW BEFORE AND AFTER YOGASANAS

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ABSTRACT

Background : Hypothyroidism is one of the commonest of all endocrine illnesses .Medical therapy in the form of oral thyroid tablets can cause harmful effects if the dosage is not carefully regulated and the patient also has to be on tablets lifelong. Yogasanas are considered to be the best remedy to activate the thyroid gland. The thyroid specific asanas are considered to increase the flow of fresh oxygenated blood to the thyroid, which in turn can activate the thyroid gland. The aim of our study is to find out the role of yogasanas in increasing the blood flow to the thyroid gland.

Materials and methods: We evaluated this by measuring the Peak Systolic Velocity and Resistive Index in the inferior thyroid artery using colour Doppler ultrasound in 40 female medical students (age 17-19 yrs) before and after 3months of yoga training.

Conclusion : Increased mean PSV (P value < 0.0001)and decreased RI showed that the yogasanas are effective in increasing the blood flow to the thyroid gland. Increase in flow may be due to the inverted postures attracting more blood towards the head and neck and also due to increased secretion of TSH from pituitary. Regular practice of yogasanas is suggested for hypothyroid patients to correct the hormonal imbalance as well as for normal individuals to maintain thyroxine level of blood.

INTRODUCTION

Yoga asana is that system of poses which helps the merging of the individual in god consciousness .It is the means to health. The yogic way of life is always in tune with nature, well harmonized, peaceful and productive of happiness. Yogasanas have been shown to reduce systolic and diastolic BP of hypertensive subjects, improves glycaemic control in diabetes mellitus and reduces the frequency of asthmatic attacks [19]. Everything said and done regarding yoga must be reasoned, scientific and supported by facts and figures. Yoga inducts an effective and vigorous blood circulation and completely eliminates all impurities from the system[17]. This makes the ductless glands function in a normal way and secrete their juices effectively and get them absorbed in the blood stream. When circulation fails to any part, functional defection occurs. This can be corrected by specific asanas which can direct the blood circulation to any gland or organ of the body without undue strain on the heart.

Hypothyroidism [14] is one of the most common of all endocrine illnesses and is caused by any structural or functional derangement that interferes with the production of adequate amounts of thyroid hormone. The manifestations include generalized apathy and mental sluggishness in the early stages of the disease. Mucopolysaccharide rich edema accumulates in skin, subcutaneous tissue and a number of visceral sites. They are listless, cold intolerant and often obese. For thyroid malfunction oral thyroid tablets are recommended. This therapy is however fraught with grave risks, because if the dosage is not carefully regulated ,the heart ,lungs or the nervous system are sure to be damaged and so has to be conducted under close medical supervision. Yogasanas are considered to activate the thyroid gland by increasing the blood flow. Blood circulation is affected immensely during yoga because of two process called extension and compression. These two dynamics are Said to work together to deliver fresh blood to every joint, muscle and organ within the body. The thyroid specific asanas increase the flow of fresh oxygenated blood to the thyroid. Increased oxygen and nutrient availability activate the thyroid gland to increase the synthesis of T3 and T4, thereby correcting hypothyroidism. The purpose of this study is to find out whether the thyroid specific yogasanas would help to increase the blood flow to the thyroid gland.

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MATERIALS AND METHODS

Forty female subjects in the age group between 17 -19 yrs were included in this study after obtaining their informed consent. The Institutional Ethics Committee approved the study protocol.

Yogasanas to improve the thyroid function were taught by a certified yoga teacher to the female medical subjects. The training was given for a period of 3 months and the parameters peak systolic velocity (PSV) and resistive index (RI) were recorded before and after yoga training.

Inclusion criteria:

1. Weight 47+/-8 kgs
2. Normal Lipid profile
3. Fresh yoga learners
4. Age matched, young subjects(PSV in thyroid arteries increases with age)3
5. Women (Due to the effect of estrogen in increasing the thyroid metabolism, PSV values was higher in women than in men. Mixed population would affect the result. Either men or women has to be taken)
6. Normal T3,T4 and TSH level(checked before the beginning of study)

Exclusion criteria:

1. Subjects who were regularly doing yoga
2. History of Hypertension
3. H/O Diabetes mellitus
4. H/O Hypo or Hyperthyroidism.(the subjects thyroid status was assessed before and after the study by checking serum T3,T4 &TSH levels)
5. H/O Dysfunctional uterine bleeding
6. Hip, neck and back disorders
7. Anaemia
8. On drug therapy

The yoga training session was conducted in the department of physiology in VMKV medical college, Salem between 4.30-5.30 pm everyday for 5 days in a week. No other physical exercise like swimming, walking, dancing etc was allowed during the period of training. The following thyroid specific asanas were taught in a well ventilated room with adequate light. The asanas[17]include

S.No	Name of the asana	Turns	Duration
1.	Halasana	10	2sec
2.	Paschimottanasana	10	2sec
3.	Sarvangasana	2	7-10 min
4.	Matsyasana	3	1 min
5.	Ardha sirasasana	2	5 min
6.	Ardhamatsyendrasana	3-6	3sec
7.	Paadahasthasana	3-6	3 sec
8.	Setubandhasana	3	2sec
9.	Trikonasana	3-6	2sec
10.	Padmasana	1	5min
11.	Shavasana	1	7 min
12.	Nadi shuddhi		10 min

Since only 6 out 0f 40 subjects were able to perform Shirasasana, for uniformity all were instructed to do Ardhasirsasana. Counter asanas were performed after each asana.eg. sarvangasana is followed by Matsyasana. Periods of rest from 10seconds to 1 minute depending on the body needs were given between 2 rounds of yogasanas.

The parameters checked are Peak Systolic Velocity[10] (PSV) and Resistive Index (RI) and the measurements were performed at the level of Inferior thyroid artery[6]using a 7.5 MHZ linear electronic transducer. Using colour Doppler the measurements were taken after 5 minutes rest in a horizontal position with a cushion under the shoulder and neck hyper extended. Inferior thyroid artery (ITA) was examined in the oblique transverse plane, close to the transition between the medium and inferior thyroid. All flow velocity wave forms were obtained after angle correction. The spectral wave form tracing is then analyzed for PSV (the Doppler wave form recorded at the point with the highest frequency shift) and RI. Multiple sampling was performed (at an interval of 5 minutes) to account for variations and the mean

value was expressed. The mean value found in the right and left lobes was used as a representative parameter. RI [3]was calculated using Pourcelot's formula (RI=PSV-EDV%PSV) to characterize the peripheral vascular resistance of the vessel studied.

Measurements were taken from the Inferior thyroid artery for the following reasons.

1. The values of PSV and RI in the superior thyroid artery was higher than in the inferior thyroid artery due to its high blood supply from the external carotid artery which is larger than the thyrocervical trunk from where the ITA arises.
2. The diameter of the ITA is larger when compared with the intraparenchymal arteries
3. Enables proper angle correction.

The parameters were taken at the beginning of the study and also after the study period of three months.

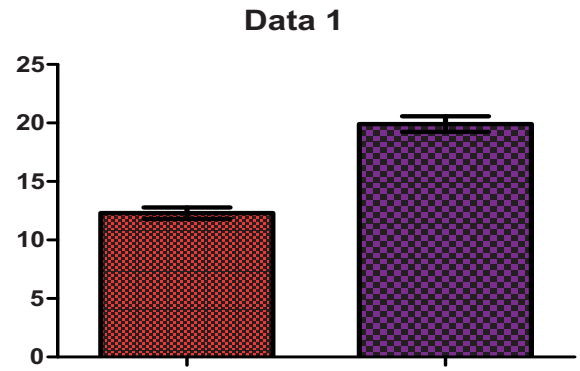
Table: Comparing PSV and RI before and after yoga training

	Peak Systolic velocity (PSV)cm/s		Resistive Index (RI)	
	Before yoga training	After yoga training	Before yoga training	After yoga training
Right	12.3 + /_0. 48	19.8 + /_0.66	0.68 + /_0.01	0.60 + /_0.02
Left	10.2 + /_1.1	15.1 + /_0.76	0.58 + /_0.02	0.49 + /_0.01

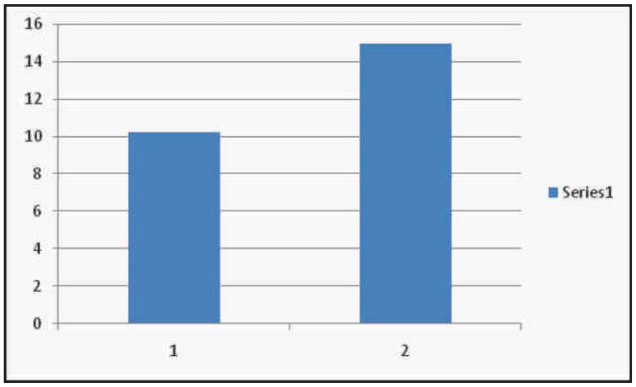
P value <0.0001

The results were analyzed in Microsoft office excel and Graphpad Prism, Peak systolic velocity (PSV) before and after yogasanas were compared and analyzed using Student unpaired T test. There was significant increase in PSV noted after yoga training from mean value of 12.3cm/sec to 19.3cm/sec and 10.2cm/sec to 15.1cm/sec in the right and left side respectively with the P value of less than 0.0001.

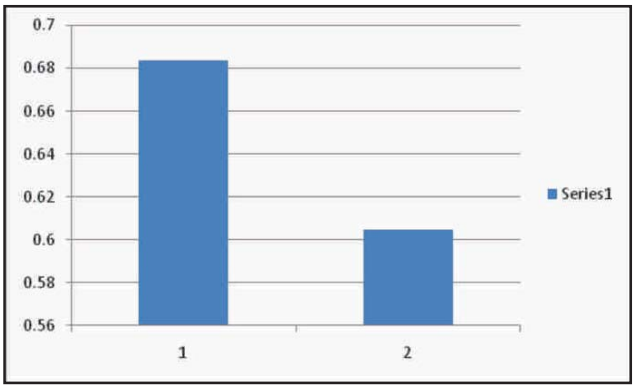
Resistive Index (RI) showed significant decrease after yogasana training 0.68 to 0.6 in right side and 0.58 to 0.49 in the left side. The analysis showed results were significant with the P value of less than 0.0001.



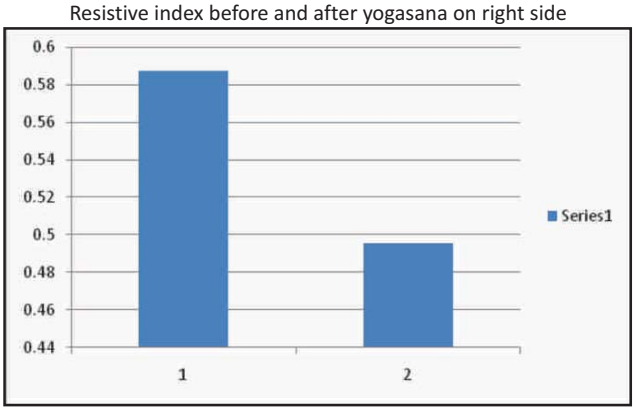
Peak systolic velocity right side before and after yogasana



PSV on left side before and after yogasanas



Resistive index before and after yogasana on right side



Resistive index before and after yogasana on left side

DISCUSSION

To maintain normal levels of metabolic activity in the body, precisely the right amount of thyroid hormone must be secreted at all times. Thyroxine has both general and specific effects on growth[14], especially in growing children. Increased thyroid hormone decreases the concentration of cholesterol, phospholipids and triglycerides in the plasma. Thyroxine 1. Decreases body weight 2.increases Heart rate, strength and cardiac output 3.increases gastrointestinal motility 3. Has an excitatory effect on the central nervous system 4.maintains muscle and bone strength 5.helps in normal sexual function 6.maintains temperature.

Hypothyroidism[7] is characterized by fatigue and extreme somnolence with sleeping up to 12-14 hours a day extreme mental sluggishness, slowed heart rate, decreased cardiac output, decreased blood volume, increased body weight, constipation, depressed growth of hair and scaliness of skin, development of frog like husky voice, development of an edematous appearance throughout the body and increased blood cholesterol(associated with atherosclerosis) resulting in Peripheral Vascular Disease, Deafness, Coronary artery disease and increased blood sugar leading to secondary Diabetes mellitus.

The treatment for hypothyroidism is aimed at correcting the blood thyroxine level by substituting thyroxine in the form of tablets. Drug treatment has to be followed lifelong in certain cases. Regular practice of asanas will help to reduce the drug dosage and can protect the individual from the side effect of the drugs.

Yoga induces an effective and vigorous blood circulation. The factors, skeletal muscle contraction and gravity (due to Inverted postures) improve the thyroid function by increasing the blood flow to the thyroid [8,9.]

The yogasanas which are known to specifically activate the thyroid gland are Vipareethakarani, Sarvangasana, ArdhaSirasasana, Halasana and Matsyasana. In Sarvangasana (shoulder stand), for example, the body is tipped up with the help of the elbow. The neck is lying close to the ground. The chin is pressed down and rests against the chest. In this inverted posture, the thyroid is below and the heart is above. Gravity acts and exerts its pull downwards. The object of exertion is to draw down extra blood supply the gland and tone up the nerves controlling this region.

Also Skeletal muscle contraction and the abdominal compression that occurs during the practice of asanas increases the venous return to the heart which in turn increases blood flow to the thyroid gland. Gravity[17] attracts good quantities of blood fresh from the heart rich in oxygen and nutrients to bathe the thyroid gland. The chin pressed against the chest compresses the thyroid gland and checks the direct and immediate flow of blood out of the gland but enables it to flood the glandular tissue, supplying them with the necessary materials for their internal secretion immediately after resuming normal posture. The nerves control the caliber of the arteries and see that they do not distend beyond their endurance. The viscera pressing against the diaphragm also helps to increase the venous return. In Setubandhaasana, when the chin is locked blood is forced out of the thyroid. When the pose is released, fresh oxygenated blood is able to flow back in and circulate around the thyroid. S.B.Rawal[13]and collegues observed an increase in thyroxine level after one month of practicing yoga in general (not specific thyroid asanas)

Thyroid gland is regulated by TRH and TSH from hypothalamus and anterior pituitary. In inverted postures like Sirasasana or Sarvangasana(shoulder stand)[18], not only thyroid gland, but all the glands in the body are activated. Because of increased blood flow to the pituitary there will be increased synthesis and release of 1.TSH which can stimulate the thyroid gland 2.ACTH which can stimulate the adrenal gland and FSH and LH which can stimulate ovary and testis. Increased blood flow to hypothalamus in brain in turn activates pituitary via Releasing hormones. This helps to correct any hormonal imbalance and maintain homeostasis.

The regular practice of postures like Setubandhasana (bridge pose) helps to activate the Fifth Chakra which controls the thyroid to work properly. Fifth chakra (Visuddha) in yoga means purity. The organs associated with the fifth chakra are thyroid, parathyroid, jaw, neck etc. yoga poses that activate this chakra are neck and shoulder stretches, bridge pose and plough pose.

Colour Doppler seems to be a promising technique to evaluate the thyroid blood flow at low cost, and is an easy,

non invasive and fast approach. Mean Reference values for Doppler ultrasound parameters of the thyroid in healthy iodine non-deficient population given by Macedo[11] et al for RI is 0.57.

Intrathyroidal blood flow can be quantitated by the measurement of peak systolic velocity. Velocity of blood flow is displacement of blood per unit time (cm/s). V=Q/A where Q is blood flow and A is cross section area of blood vessels. As long as diameter of a blood vessel does not change, changes in the blood flow in the vessel are directly related to changes in flow velocity. According to ohm's law[18], the blood flow is directly proportional to the pressure difference and inversely proportional to the resistance. The quantity of blood that passes a given point in the circulation in a given period of time is blood flow. Blood flow is an inverse function of resistance. According to HagenPoiseuille's law, resistance is inversely proportional to the fourth power of the radius.

In our study, increased blood flow to the thyroid is shown by increase in mean PSV (up to 6cm/s on right side and 5cm/s on left side) at the level of the inferior thyroid artery and a decrease in resistive index. Resistive index indicates the internal vascular resistance. Decrease in resistive index shows the decreased resistance to blood flow in the thyroid vessels.

The value of PSV at the level of the inferior thyroid artery is a best predictor of thyroid blood flow [1].Ueda M et al[15] showed an increase in PSV in early Grave's disease relapse after antithyroid drug withdrawal. According to Giuseeppe and Vitti P et al[6,16] in all patients with Grave's disease the peak systolic flow was always over 150cm/sec, while in other autoimmune thyroiditis the PSV was within the normal range and never exceeded 65cms/sec.

A diffusely increased thyroid blood flow is pathognomic of untreated Graves's disease. Even in patients with subclinical thyroid dysfunction in spite of normal serum T3 or T4, higher intrathyroidal mean PSV values are recorded. Thyroid vascularity and blood flow is not dependant on serum thyroid hormone[5] levels. Increased blood flow to the thyroid gland shows increased metabolism .Different procedures practiced in yoga have stimulatory or inhibitory effects on the BMR[4, 12]. Analysis of the study showed that an increase in blood flow (signified by an increase in PSV) to the thyroid gland can be due to the following reasons:

1. Inverted posture-tilting the person up bring the brain to occupy a level below the heart and gravity which was against previously is now in favour of brain.
2. Compression of neck muscle increases flow out of the gland and relaxation increase flow into the gland. According to an endorsement submitted at the International Ayurvedha Conference held in India in 2000,Dr.Thanikachalam[2] showed in asanas like Vipareethakarani and Halasana ,an acute dilatation of the internal jugular vein on both sides occur, with low Doppler flow velocity which return more than normal velocity of Doppler veins after cessation of posture. ie. Return to normal posture relieved the buckling pressure and the flow is twice the normal.

The increase in blood flow in turn increase the activity of thyroid by 1. Providing sufficient oxygen 2. Nutrients like glucose, iodine etc 3. More delivery of TSH from anterior pituitary stimulates all the steps in thyroid synthesis and release. TSH is also responsible for increased blood flow. Regular practice of thyroid specific asanas is better when compared to exercise as yogic physical culture gives the real strength, the strength of the vital organs.

CONCLUSION

The above study confirms the effect of thyroid specific asanas in improving the blood flow to the thyroid gland, thereby increasing the thyroid metabolism. Yogasanas help to maintain thyroid balance in normal individuals. Regular practice of yogasanas is recommended for growing children and hypothyroid patients especially. These asanas also dispenses the need for medical and surgical treatment. This will help to reduce the drug dosage and protect from harmful side effects.

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