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Original Research Article

Effect of Ocimum Sanctum on Serum Concentration of Thyroid Hormones and Atherogenic Profile in Rabbits

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ABSTRACT

Ocimum sanctum (OS) is used for its varied medicinal properties. The present study was undertaken to evaluate the effect of OS on serum concentration of thyroid hormones and atherogenic profile in rabbits. Rabbits were divided into 2 groups of 10 each. Group I (Control): Standard chow diet. Group II (Test): maintained on same diet which control group rabbits received along with supplementation of 2 gm fresh leaves of Ocimum sanctum orally/day for 30 days. After 30 days in the rabbits receiving Ocimum sanctum, marked increase in the levels of T_3 and T_4 was observed where as TSH levels were significantly reduced as compared to control group. There was an improvement in the atherogenic profile in the test group. Ocimum sanctum can be used as adjunctive therapy for the regulation of thyroid functions and with hypolipidemic drugs.

Keywords: Ocimum Sanctum, TSH, T3, T4, atherogenic profile.

INTRODUCTION

Plants have been used worldwide across various cultures as a safe natural source of medicines for treating various ailments. The WHO has estimated that 80% of the population of developing countries is dependent on plant based traditional medicine. Traditional medicine has the advantage of being easily accessible, affordable and also overcomes the major problems associated with synthetic drugs like high treatment costs, side effects and resistance. Ocimum sanctum (OS) known as Tulsi in hindi and Holy basil in English is a popular herb in Indian subcontinent. It is a sacred herb for Hindus and finds its use deeply rooted in traditional medicine. [1] Although whole plant including roots, stem, flowers, seeds has medicinal properties but leaves are most commonly used. [2] Leaves of OS are fragrant, aromatic and possess antifertility & abortifacient, antispermatogenic, hypoglycemic, hypolipidemic, adaptogenic, anticancer, radioprotective, analgesic & antiniflammatory properties. [3-10] Pharmaceutical industry is now focusing on ingredients which can be obtained from plant sources.

The hormones secreted by thyroid (T3, triiodothyronine & T4, thyroxine) are critical for the development of brain and has broad effects on metabolism and cardiovascular function in adults. [11] Thyroid function is regulated by hypothalamic-pituitary axis. Thyroid stimulating hormone (TSH) is a glycoprotein hormone released by pituitary and is under negative feedback control by circulating thyroid hormones. Thyroid

function can be evaluated by measuring the levels of TSH, T3 & T4. Thyroid hormones have been found to have marked effect on the metabolism of lipids and hence lipid profile.

MATERIALS AND METHODS

Male albino rabbits weighing 1.5-2.5 kg were procured from the disease free animal house of the CCS Haryana Agriculture University Hisar (Haryana, India). The rabbits were housed under controlled conditions of light (12 –h light-dark cycle) and temperature [(23 ± 2) °C] with free access to respective diets and water *ad libitum* for a period of 30 days. Institutional Animal Ethical Committee (I.A.E.C.) approval (IAEC/PATHO/08/2352-58 dated 18.09.08) was obtained before the experiment and care of animal was taken as per guidelines of CPCSEA, Department of Animal Welfare, Govt. of India.

Experimental Design

Rabbits were divided into 2 groups of ten each.

Group I (Control): Standard chow diet

Group II (Test): Maintained on same diet which the control group rabbits received along with supplementation of 2 g fresh leaves of Ocimum sanctum orally/day for 30 days.

Fresh tulsi leaves were collected, cleaned and weighed and used for the study and fed to the rabbits under the supervision of trained staff of animal house to ensure complete consumption. After 30 days the animals were kept fasting overnight and their blood samples were taken from the marginal vein of pinna. The thyroid hormones FT_3, FT_4 and TSH were assayed by principle of chemiluminesence. The plasma was separated and estimation of lipid profile and thyroid hormones was done. Estimation of total Cholesterol (TC), trigycerides (TG) and high density lipoprotein cholesterol (HDL-C) was done by autoanalyser (Konelab 30i, Trivitron) by enzymatic methods using kits by Randox. [12] Concentrations of low density lipoprotein cholestrerol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) were calculated by Friedewald's formula. [13] The atherogenic index was calculated by using the following formulae-

- Total Cholesterol / HDL-Cholesterol.
- Triglycerides / HDL-Cholesterol.
- LDL-Cholesterol / HDL-Cholesterol.

Data obtained was analyzed statistically by applying student 't' test using SPSS version 14.0.

RESULTS

Table 1. Serum Concentration of FT_3, FT_4 and TSH in rabbits of control and test group (Mean ± Standard deviation)

Groups	FT_3 (pg/mL)	FT_4 (ng/dL)	TSH (µIU/mL)
Control	2.50 ± .50	.59 ± .12	13.34 ± 3.5
Test	4.44 ± .73	1.57 ± .18	0.22 ± .09
p value	<0.001	<0.001	<0.001

n= 10 in each group

The test group showed highly significant increase in the levels of T_3 and T_4 whereas TSH levels correlated well inversely with T_3 and T_4 levels.

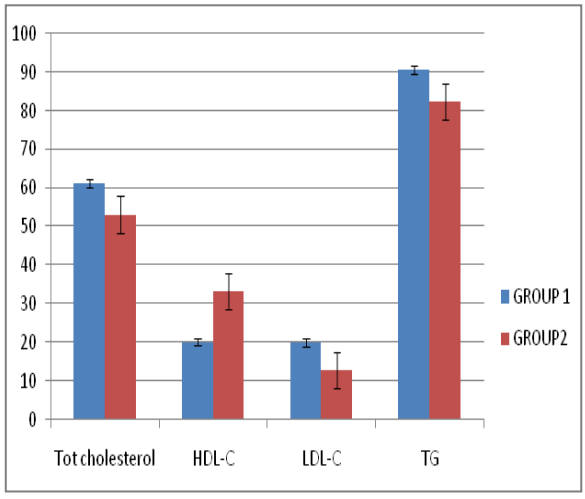

Fig. 1

Table 2. Atherogenic profile in rabbits of control and test group. (Mean ± standard deviation)

Groups	TG/HDL-C	LDL/HDL-C	TC/HDL-C
Control	4.47	0.98	3.02
Test	2.48	0.38	1.06
Protection* (%)	44.5	61.2	64.9

n= 10 in each group

$$\text{Protection} * (\%) = \frac{\text{Atherogenic index of control group} - \text{atherogenic index of treated group} \times 100}{\text{Atherogenic index of control group}}$$

DISCUSSION

Thyroid hormones are important for the growth and development of the body and regulation of metabolism. [14] Increase in the production of thyroid hormones reflects increase in the activity of thyroid gland. Various factors both pathological and physiological have been known to affect the concentration of these hormones & derange the metabolic activities. The morphological structure and functions of thyroid hormones can be influenced by thiocyanate from tobacco, smoke, perchlorate and iodine containing drugs. [15] Similar effect has been documented by the use of medicinal plants and their extracts in the experimental models. In Iranian traditional medicine caraway is used for weight loss & its overdose leads to symptoms of hypothyroidism. Dehghani et al, observed that on administration of caraway extract serum T3 and T4 levels were increased and TSH levels decreased significantly. [16] Similar results on thyroid hormones were observed in experimental studies by administrating extracts of leaves of moringa oleifera, everyouth and dreamshape. [17,18] These studies are in accordance with the results of our study in which the test group showed that consumption of ocimum sanctum leaves led to significant increase in the levels of T3 and T4 hormones and corresponding significant decrease in TSH levels. However, Panda et al have reported that OS leaf extract (0.5 g/ kg body weight) led to significant decrease in serum T3 and T4 levels which are in contrast to our study. [19] Since not much literature is available regarding the effects of OS on thyroid hormones, the present study was undertaken to analyze the effect of OS on thyroid profile and atherogenic indices.

Increase in the levels of T3 and T4 in our study may be due to increase in the activity of thyroid gland by some compound in ocimum sanctum which affects the physiology and function of follicular cells. [16] Ocimum sanctum may also cause enhancement of the transport of sodium-iodide transport and increased absorption of iodide resulting in increased production of T3 and T4 and effect on iodotyrosine deiodinases. [20]

The studies on relationship between serum thyroid & serum lipid parameters found that an inverse relationship exists between thyroxine levels and cholesterol. [21,22] In clinical hypothyroidism also, the presence of hypercholesterolemia is well established. [23] Results of our study also reveal that supplementation of OS leaves significantly (p) decrease the TC, TG & LDL-C levels while it increases the levels of HDL-C. Decrease in total cholesterol may be due to decreased absorption of dietary cholesterol from the intestinal lumen by plant sterols. [24] Eugenol found in ocimum sanctum inhibits peroxidation of lipids and causes hypocholestrolemia due to significant antioxidant action. [25] Nutritional antioxidants increase HDL-C by activating sulfhydryl (SH) group of lecithin cholesterol acyl transferase (LCAT) enzyme. [26] LCAT incorporates free cholesterol from LDL into HDL and esterifies it. [27] The normal physiological action of thyroid hormone stimulates the synthesis of cholesterol but more so its oxidation and biliary secretion. The net effect is a decrease in the body pool and plasma levels of total & LDL-C along with synthesis of bile acids. [11] Hepatic uptake of cholesterol is increased by increase expression of LDL receptors in liver. Therefore the net effect is a significant decrease in plasma cholesterol & total lipids. OS improves the lipid profile through its antioxidant as well as thyroid stimulant effect.

Increased TG and TC and decrease HDL-C levels represent a displayed lipid profile known as atherogenic profile which leads to development of Coronary heart disease. Atherogenic indices are powerful indicators of risk of heart disease; the higher the value, higher is the risk of development of coronary vessel disease. Lowering of these indices lipids through diet/ therapy is associated with lowering the risk of CAD. From the above discussion and table (Table

2) it is evident that OS also improves the atherogenic profile and may provide protection against heart disease.

CONCLUSION

It can be concluded that OS has significant thyrotropic, antioxidant and hypolipidemic effects and thus can be used as an adjuvant therapy for regulation of thyroid functions and along with hypolipidemic drugs. However, further studies are required to isolate active principle and elucidate its exact mechanism of action on thyroid hormones.

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