

REVIEW ARTICLE

Hypothyroidism: Management Based On Ayurvedic and Modern Therapeutic Perspective

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Date Received: 30th May 2016; Date accepted: 18th
June 2016; Date Published: 20th June 2016

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Abstract

Hypothyroidism is the pathological condition in which the level of thyroid hormones declines to the deficiency state. This communication address the therapies employed for the management of hypothyroidism as per the Ayurvedic and modern therapeutic perspectives on the basis scientific papers collected from accepted scientific basis like Google, Google Scholar, PubMed, Science Direct, using various keywords. The Ayurveda describe hypothyroidism as the state of imbalance of Tridoshas and suggest the treatment via use of herbal plant extracts, life style modifications like practicing yoga and various dietary supplements. The modern medicine practice define hypothyroidism as the disease state originated due to formation of antibodies against thyroid gland and hormonal imbalance and incorporate the use of hormone replacement i.e. Levothyroxine, antioxidants. Various plants like *Crataeva nurvula* and dietary supplements like Capsaicin, Forskolin, Echinacea, Ginseng and Bladderwrack can serve as a potential area of research as thyrotropic agents.

Keywords: Hypothyroidism, Herbal plants, Tridosha, Levothyroxine, Ayurveda.

INTRODUCTION

Hypothyroidism is the major endocrine disorder seen in general population. It is characterized by the deficiency of thyroid hormones to abnormal levels. This condition leads to the reduction in basal metabolic rate, affect physical and mental growth during infancy or childhood. It is prevalent among every one from ten adults in india, nearly 10.95 % in major cities of with significantly females number outweighing the male i.e. (15.86% female and 5.02% males)¹. This prevalence is 4.6 % in the developed world². Main causes are Hashimoto's thyroiditis (autoimmune thyroiditis), deficiency of iodine, surgical removal of thyroid gland i.e. thyroidectomy, radioactive treatment etc³. Hypothyroidism is associated with various pathological states that render person dependent on hormone replacement therapy lifelong⁴. Hence, it calls for the understanding of ayurvedic concept of this disease and establishing the management of hypothyroidism through Ayurvedic principles .

The Ayurveda, considers the balanced state of *agni* (enzymatic activity), *tridoshas*(bodily humours), *dhatu* (metal) & *mala* (impurity) as the foundation for the orderly functioning and *samavastha* (homeostasis)of human body. If any of the element gets disturbed, it give rise to disease state. All these elements, also controls the working of thyroid gland, which is located in the neck region (Kantha) also, is the place (sthana) for *Kaphadosha* (mucous), *Prana* (breath) and *Udana Vayu* (vital air), *Mamsa* (flesh) and *Medadhatu* (fatty tissue)^{5,6}.

This review aims to discuss both Ayurvedic and modern medicine concept of hypothyroidism pathophysiology, line of treatment and future areas of research based on use of herbal plants or dietary supplements. The idea is studied from information obtained from accepted scientific basis like Google, Google Scholar, PubMed, Science Direct, using various keywords

1. TYPES:

According to modern medicine concept, based upon the etiology of disease, severity of disease and the time of occurrence of hypothyroidism⁷, it may be classified as:

On the basis of etiology:

1. Primary hypothyroidism (thyroid gland defects)
2. Secondary hypothyroidism (pituitary gland defects) and
3. Tertiary hypothyroidism (hypothalamic defects).

On the basis of time of occurrence:

1. Adult onset hypothyroidism
2. Congenital hypothyroidism

On the basis of severity:

1. Subclinical hypothyroidism
2. Overt hypothyroidism

The prevalence of primary hypothyroidism is high accounting for over 95% of the total hypothyroidism^{8,9,10}. Central hypothyroidism of pituitary origin, occurrence rate is even lower i.e. 1 from 1000 cases due to pituitary adenoma¹¹. Hypothalamic defects associated central hypothyroidism has an estimated incidence of 1:65 000¹².

In Ayurveda, thyroid disorders are discussed under the term "Galaganda" (enlarged thyroid gland). This term is cited indirectly as "Galgand and Gandmala" in text, like *Charaka*¹³, *Sushruta*⁶ and *Ashtanghrudaya*¹⁴ describing the manifestation in and around the neck, which can be correlated with goiter and thyroidism.

ETIOLOGY (NIDANA)

Primary (thyroid gland) hypothyroidism:

Autoimmune (Hashimoto thyroiditis or postpartum thyroiditis), Iatrogenic (Thyroidectomy, thyroid surgery, radioactive iodine therapy and antithyroid medications), miscellaneous (Iodine deficiency and excess, other medication induced, exposure to radiations, moderate or severe systemic illness, thyroid agenesis, defective thyroid synthesis, resistance to thyroid hormone)

Secondary (Pituitary) hypothyroidism:

It may occur due to pituitary tumors, infarcts or trauma, surgery, infiltrative disorders (eg sarcoidosis, histiocytosis, lymphoma, hemochromatosis), lymphocytic hypophysitis, infection and medications

Tertiary (hypothalamus) hypothyroidism;

Infiltrative disorders (eg . Sarcoidosis, histiocytosis, lymphoma, hemochromatosis), and medication induced.

Medication induced hypothyroidism, is a great matter of concern these days. These medications could be part of therapy for other ailments but may directly or indirectly affect the thyroid function. Glucocorticoids, Bromocriptine, Octreotide, Opiates, phentolamine, growth hormone etc., they contribute to hypothyroidism via decreasing Thyroid stimulation hormone (TSH) secretion. Some drugs could adversely affect the thyroid hormone synthesis and their secretion (Iodine, Amiodarone, thionamides, thiocyanates, aminoglutethimide, perchlorate ions, lithium and certain cytokines), some act via altering thyroid hormones metabolism (rifampicin, phenytoin, carbamazepine, barbiturates, tyrosine kinase inhibitors, β -blockers, iodinated contrast media etc.) and some via increasing thyroxine binding globulin (Mitotane, estrogens, 5-fluorouracil etc.), last but not the least affect the exogenous absorption of thyroid hormones (calcium compounds, sucralfate, ferrous compounds, colessevelam, antacids, coffee etc.)¹⁵.

PATHOPHYSIOLOGY (SAMPRAPTI):

In Ayurveda, it is considered as state of "Pitta kshya (decrease of pitta), Kapha vridhi (increase of kapha or mucous) and medodusthti (impairment of fat) thereby affecting the Srotas (channels) of body"⁵. Ayurveda also considers it, as a state of disbalance between mind, body and soul due to grief, fear, anger, sorrow, excessive sleep and excessive vigil despite adequate food intake¹⁶.

Modern therapeutics take into consideration the derangements in gonadal hormones, leptin, and other feeding- and sleep-related hormones that disturbs hypothalamic-pituitary (HPT) feedback system thereby, disturbing thyroid hormone levels¹⁷. Hashimoto thyroiditis, is the result of cell and antibody-mediated destruction of thyroid tissue i.e. antibodies to thyroperoxidase, thyroglobulin, Thyroid Stimulating Hormone (TSH) and its receptors¹¹.

SIGNS & SYMPTOMS:

Clinical signs may include goiter (Galaganda), nonpitting edema, brittle nails, macroglossia,

slowed relaxation phase of reflexes, psychosis, bruising/bleeding, pericardial or Pleural effusion, ascites, hypothermia, hypotension, hypoglycaemia, altered mental status/coma¹⁸.

Ayurveda, describes the symptoms of hypothyroidism in terms of tridoshas i.e. gastro intestinal symptoms i.e. weight gain (Kapha dosha), constipation, anaemia (Pitta dosha); Cardiorespiratory symptoms i.e. Bradycardia, hypertension (Vata dosha), neuromuscular symptoms i.e. muscle/joint pain, memory impairment, depression, weakness in extremities, difficulty with concentration, myalgias and arthralgias, paresthesias (Vata dosha); dermatological symptoms i.e. dry skin and hair, reduction in scalp, pubic and axillary hairs (Vata-Kapha dosha); reproductive symptoms i.e. irregular menses and/or menorrhagia, sexual dysfunction, impaired fertility (Vata – pitta dosha); Ocular symptoms i.e. blurred vision (pitta dosha); Ear-nose-throat (ENT) symptoms i.e. hearing problems (vata dosha), feeling of fullness in throat (kapha dosha), hoarseness of voice (Vata dosha); other general symptoms like fatigue, cold intolerance, sleepiness (Kapha dosha)⁵.

DISEASE MANAGEMENT:

Concept for the pathogenesis of disease are different in Ayurveda and modern therapeutic system. Accordingly the way of treatment also change, but ultimate goal is to overcome to diseased condition

Modern therapeutic prospective:

The treatment as per the modern medicine practice include use of Levothyroxine sodium as a part of hormone replacement therapy (available as Synthroid, Eltroxin), thyroid extract preparation, and antioxidants such as selenium.

Levothyroxine Therapy:

Levothyroxine (T₄) is the standard replacement therapy in primary or central hypothyroidism¹⁹. Many physiological and pathological conditions can impair levothyroxine absorption such as patients factors (compliance), certain foods (e.g. grapes, coffee, etc.), drugs (e.g. antiacids, sucralfate etc.) gastrointestinal diseases (e.g. *H. pylori* infection). Certain new formulations are introduced for patient with impaired absorption of Levothyroxine i.e. Liquid formulation (patented by Institute Biochimique SA (IBSA), Lugano, Switzerland) and

soft gel formulation with improved bioavailability over traditional tablets²⁰. Pharmacodynamic equivalence of T₄ and L-triiodothyronine (T₃) combination is believed to be approximately 1:3²¹. Hypothyroidism, in an adult can be treated by administering sustained-release formulation of T₃ (0.005-0.03 µg/kg body weight/hour/day) in 5-25 µg dose at daily basis, without the need of administering the therapeutic dose of T₄²².

Selenium:

Administration of 200µg/day of selenium as selenomethionine) is effective in reducing the occurrence of Hashimoto thyroiditis, thyroiditis after delivery, and clinical hypothyroidism¹⁹.

Ayurvedic principles of treatment:

In ayurveda, thyroid gland is defined as a lymphatic Channel (rasabaha srotas)²³. The treatment follows holistic approach towards mind, behaviour, body and overall environment. Its main aim is to clear the blocked channels in body before initiating any oral therapy so as to balance tridoshas and then switch to rasayana (rejuvenative) therapy. According to one of the basic principle i.e. "Saamanya Vishesh Siddhanta", similar conditions, aggravate the disease condition, whereas, dissimilar things alleviate, this treatment methodology facilitate the decrease in kapha by the use of kapha inhibiting drugs, increase dhatugata (tissue level) i.e. pitta by the use of pitta enhancing drugs and lowers the meda (fat) by the use of meda neutralizing drugs. All these methods help, restores the homeostasis and metabolic activity in body which was altered by the blockage of channels by kapha²⁴.

Dietary supplements:

There are various dietary supplements available that may mimic the thyroid function but are of unproven clinical benefit, it includes Asian ginseng, bladderwrack, capsaicin, echinacea, and forskolin¹⁹. Other formulations used as thyroid supplements include Thyro-L#455 (*Laminaria sarassum*), B 37 K Para-Thy-Mix (Natural iodine from dulse with raw glandular extract), Suddha guggulu (*Commiphora mukul*), Kanchnar guggulu (*Bauhinia variegata*, *C. mukul*) and Gayatrin (*B. variegata*, *C. mukul*)²⁵.

Yoga:

Yoga is believed to be useful art to rejuvenate your body and soul. The asana, useful in managing hypothyroidism are Sarvangasana (standing erect on shoulders), Hlasana (plough posture), Matsyasana (fish like posture), Naukasana (boat like posture), Surya-namskar (salutation to sun), and some other useful pranayams include Suryabhedana (breathing from single nostril), Anulom- bilom (breathing from alternate nostril) and Ujjayi (means victorious form of breathing)²⁶.

Herbal plant used traditionally in management of

hypothyroidism:

Since 1990's, the soaring interest in traditional system of medicines have been witnessed globally. As the current estimates suggests the people in large numbers prefer phytomedicines (herbal medicines), alternative or complementary therapies over modern medicines and methods of treatment to ensure health care²⁷. Plants already reported with thyroid stimulant activity is summarized in **Table 1:**

Table 1: Herbal Plants with thyrotropic activities^{28,29,30,31}

Sr. No.	Botanical Name/Family	Common names	Part used	Actions
1.	<i>Bacopa monnieri</i> Scrophulariaceae	Brahmi	Whole plant	It raised both T3 & T4 , reduce oxidative stress, improves memory, concentration
2.	<i>Withania somnifera</i> Solanaceae	Ashwagandha	Root	It lowered cortisol, raise thyroid hormones levels, loweeds oxidative stress.
3.	<i>Commiphora mukul</i> Burseraceae	Guggulu	Oleo-resin, gum	It improved thyroid histology, raised T3, T4 ratio.
4.	<i>Moringa oleifera</i> Moringaceae	Shigru	Root, seeds, leaf	It raised thyroid hormone levels.
5.	<i>Achyranthes aspera</i> Amaranthaceae	Apamarga	Whole plant	It raised thyroid hormones, glucose, reduced oxidative stress.
6.	<i>Bauhinia variegata</i> Fabaceae	Kanchanara	Bark	It reduced swelling of neck, increased serum thyroid hormone concentrations, decreased Cholestrol and improved thyroid histology.
7.	<i>Eichhornia crassipes</i> Pontederiaceae	Water hyacinth	Whole plant	It stimulated thyroid function.
8.	<i>Bauhinia purpurea</i> Fabaceae	Khairwal	Bark	It raised thyroid hormone levels and decreased lipid levels
9.	<i>Saussurea lappa</i> Compositae	Kuth	Root	It improved thyroid histology.
10.	<i>Magnifera indica</i> Anacardiaceae	Mango	Fruit Peel	It raised thyroid hormone levels and reduced oxidative stress.
11.	<i>Citrullus vulgaris</i> Cucurbitaceae	Water melon	Fruit Peel	It raised thyroid hormone levels and reduced oxidative stress.
12.	<i>Cucumis melo</i> Cucurbitaceae	Musk melon	Fruit Peel	It raised thyroid hormone levels.
13.	<i>Inula racemosa</i> compositae	Pushkarmool	Root	It stimulated thyroid histology
14.	<i>Crataeva nurvula</i> Capparidaceae	Varuna	Bark, root	It possessed antitumour activity for extragrowths of thyroid
15.	<i>Pistia startiotes</i> Araceae	Jalakumbhi	Whole plant	It reduced swelling of thyroid.
16.	<i>Cassia fistula</i> Caesalpinaceae	Aaragvadha	Root, leaves, flower, fruit pulp	It raised thyroid hormone levels, decreased cholestrol levels.
17.	<i>Vitex nigundo</i> Verbenaceae	Nirgundi	Root, leaves, seeds	It reduce swelling of thyroids.
18.	<i>Linum usitatissimum</i> Linaceae	Alsi/Bijari	seeds	It maintained thyroid health, boost production of thyroid hormones.
19.	<i>Morus alba</i> Moraceae	Shahtoot	Leaf	It cured goitre.
20.	<i>Zingiber officinale</i> Zingiberaceae	Adrak	rhizome	It restored thyroid health in hypothyroidism

Table 2: Prospectives of Treatment

Sr.No.	Ayurvedic prospective:	Modern therapeutic prospective:
1	Use of herbal plant extracts or formulations to balance tridoshas or bodily humours with anti-kapha, anti-meda and pitta enhancing properties	Use of hormonal replacement therapy i.e. Levothyroxine sodium
2	Rejuvenation therapy or Rasayana therapy	Use of Antioxidants such as Selenium
3	Promotes Lifestyle modification, adoption of Yoga	Symptomatic management of associated ailments

The treatment for hypothyroidism, as per the Ayurvedic and modern medicine foundation can be summarized as **Table 2:**

FUTURE AREAS OF RESEARCH

Crataeva nurvula:

Crataeva nurvula commonly termed as Varuna is a valuable medicinal plants, belonging to the family, Capparidaceae, is reported to have analgesic, neuroprotective antiarthritic, anticancer, antidiabetic, cardioprotective, anti-inflammatory, antioxidant, hepatoprotective, nephroprotective activities³².

Ayurveda supports the use of leaves, stem bark and root bark of *Crataeva nurvula* to regulate equilibrium among three doshas (bodily humours) Vata (air), Pitta (earth) and Kapha (mucous or water)³³. Various acute or subacute studies over Varuna extracts and herbal formulations establish its wide safety profile upto 5000 mg/Kg in rodents³⁴ as per OECD guidelines

Forskolin:

Forskolin, is active constituent of *Coleus forskohlii*, extracted from its root part³⁵. As per our knowledge, negligible work has been done on crude *Coleus forskohlii* in relation to hypothyroidism using in vivo models. However, the effect of Forskolin (an active constituent of *Coleus Forskohlii*) is demonstrated in increasing thyroid hormone production on isolated thyroid gland³⁶ and in stimulating adenylate cyclase (cAMP) activity in mouse anterior pituitary tumour cells, an enzyme responsible for physiological functions of hormones³⁷.

Echinacea purpurea:

Echinacea purpurea with Laminaria in combination is patented in 2014 to be used as biologically active food additive to treat and normalize thyroid func-

tion³⁸.

Capsaicin:

Capsaicin is the principle pungent constituent of red pepper³⁹, which increases the levels of Uncoupling proteins 1 (UCPs 1) in Brown Adipose Tissue (BAT) and UCP2 in white adipose tissue thus suppressing accumulation of fat in body and adaptive thermogenesis⁴⁰. The levels of UCPs are regulated by thyroid hormones⁴¹. But, no study revealing the direct effect of capasaicin on thyroid hormones is done.

Asian ginseng:

Asian ginseng, botanically known as *Panax ginseng*⁴², effectively raised the levels of thyroid hormone T3 and T4 thus, showing positive regulatory action⁴³ but adequate studies on it to prove its effectiveness in hypothyroidism is not reported.

Bladderwrack (Kelp)

Bladderwrack (*Fucus vesiculosus*) is a seaweed, which serve as a source of Iodine and have shown its efficacy in maintaining hormonal status⁴⁴ but efficacy in raising thyroid hormones is not proven. These supplements are readily available for use in community, however are not regulated by Food and Drug Administration. Also, some of the cases of administration of kelp, reported the occurrence of thyrotoxicosis, secondary to weight lowering herbal supplements⁴⁵.

CONCLUSION

There are difference in the basis of understanding hypothyroidism in Ayurveda and modern therapeutics but the ultimate goal is achieve the effective management of disease but herbal method gains the edge over allopathic ones in terms of reduce side effects, holistic treatment and shorter duration which is lifetime administration in terms

of modern methods. To our best knowledge, no scientific data regarding the thyrotropic activity of various plants like *Crataeva nurvula* and dietary supplements like Capsaicin, Forskolin, Echinacea, Ginseng and Bladderwrack available except in the treatise of Ayurvedic medicine. Reported pharmacological activities and studies conducted on these plants and dietary supplement showed their role in management of hypothyroidism but has not yet proven clinically beneficial. This make them, suitable candidate to be studied extensively in context with hypothyroidism, and other associated disorders in preclinical studies using relevant animal models.

References:

1. Unnikrishnan A, Bantwal G, John M, et. al. Prevalence of hypothyroidism in adults: an epidemiological study in eight cities of India. Indian J. Endocrinol. Metab. 2013; 17: 647-652.
2. Hollowell JG, Staehling NW, Flanders WD, et al. Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). J Clin Endocrinol Metab. 2002; 87:489-499.
3. Radetti G, Clinical aspects of Hashimoto's thyroiditis. Endocrine Development, 2014; 26: 158-170.
4. Kadlaskar BB, Lakshmi R, Hypothyroidism in Ayurveda - A conceptual study. Ayushdhara, An International Journal of Research in AYUSH and Allied systems, 2015; 2(4): 246-250.
5. Hubale KS, Patil VS, Location and applied physiology of the thyroid Gland- An Ayurvedic Perspective. International Ayurvedic Medical Journal, 2015; 3(12): 2368-2374.
6. MaharshiSushruta. SushrutaSamhita, Sutrasthana, Edited by Anantram Sharma, Edition 2010, Vol 15/47, Chaukhamba Surbharati Prakashan, Varanasi:130, 2010.
7. Roberts CGP, Ladenson Paul W. *Hypothyroidism*. The Lancet. 2004; 363: 793-803.
8. BasVN, Cangul H, Agladioglu SY, et al. Mild and severe congenital primary hypothyroidism in two patients by thyrotropin receptor (TSHR) gene mutation. J Pediatr Endocrinol Metab. 2012; 25: 1153-1156.
9. Carvalho A, Hermanns P, Rodrigues AL, et al. A new PAX8 mutation causing congenital hypothyroidism in three generations of family is associated with abnormalities in the urogenital tract. Thyroid, 2013; 23: 1074-1078.
10. Nakamura K, Sekijima Y, Nagamatsu K, et al. A novel non-sense mutation in the TITF-1 gene in a Japanese family with benign hereditary chorea. J Neurol Sci. 2012; 313: 189-192.
11. Persani L. Central hypothyroidism: pathogenic, diagnostic and therapeutic challenges. J Clin Endocrinol Metab 2012; 97(9):3068-78.
12. Joustra SD, van Trotsenburg AS, Sun Y, et al. The IGSF1 deficiency syndrome: a newly uncovered endocrinopathy. Orphanet Journal of Rare Diseases, 2013; 1: e24883.
13. Charaka Samhita of Agnivesha elaborated by Charaka and Drudhabala with the Ayurveda Dipika commentary by Chakrapani dutta, Sutrasthana, Edited by: Vaidya Jadavji Trikamji Chapter- 28, Verse No-9-22:179.
14. Vagbhata,Ashtanghrudayam,Sutrasthana,Doshabhedhiya Adhyaya, Edited by Kaviraj Atridev Gupta, Vaidya Yadunandan Upadhyaya, Chaukhamba Prakashan, 12/5, Edition 2011: 120.
15. Almandoz JP, Gharib H, Hypothyroidism: Etiology, diagnosis, and management. Med Clin N Am, 2012; 96: 203-221.
16. Sharma RK, Dash B. Charaka Samhita. Chaukhambha Sanskrit Series, Varanasi, India, Vimansthana, verses: 8-9.
17. Devdhar M, Ousman Y, Burman K. Hypothyroidism. Endocrinol Metab Clin North Am 2007;36:595-615.
18. Dubbs SB, Spangler R. *Hypothyroidism: Causes, killers, and life-saving treatment*. Emerg Med Clin N Am. 2014; 32: 303-317.
19. Garber JR, Cobin RH, Gharib H, et al. Clinical Practice guidelinesfor hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and The American Thyroid Association. Endocrine Practice, 2012; 18 (6): 988-1028.
20. Ianiro G, Mangiola F, Di Rienzo TA, Bibbo S, et al. *Levothyroxine absorption in health and disease, and new therapeutic prospective*. European re-

- view for Medical and Pharmacological Sciences, 2014;18:451-456.
21. Celi FS, Zemsanova M, Linderman JD, et al. The pharmacodynamic equivalence of levothyroxine and liothyronine: a randomized, double blind, cross-over study in thyroidectomized patients. *Clinical Endocrinology*, 2010; 72: 709-715.
 22. Klein I, Ojamaa K, Danzi S. Methods for treating hypothyroidism. US 20050176829 A1: 2005.
 23. Panthi S, Gao T. Diagnosis and management of primary hypothyroidism in Traditional Chinese medicine (TCM) and Traditional Indian Medicine (Ayurveda). *International Journal of Clinical Endocrinology and Metabolism*, 2015; 1(1):009-012.
 24. Kunte AM, Shastri KR. Vagbhata Ashtanga Hridayam with Sarvanga sundara and Ayurveda Rasayana Commentary. Chaukhambha Orientalia, Varanasi, India, 2005;956:10.
 25. Mishra LC. Scientific Basis for Ayurvedic Therapies (Ed). CRC Press, New York, USA, 2004:34.
 26. Swami R. Yoga, Its Philosophy and Practice. Divya Prakashan Hardwar India, 2007.
 27. World Health Organization, Geneva. WHO monographs on selected medicinal plants. 1999;1:7. Retrieved from website <http://apps.who.int/medicinedocs/en/d/Js2200e/2.html>
 28. Sharma T, Gupta M, Nathani S. Review of Ayurvedic drugs acting on hypothyroidism. *International Ayurvedic Medical journal*, 2015; 3 (8): 2572-2579.
 29. Verma P, Jameel K. Studies on traditional treatment of thyroid by the tribals of chitrakoot district, Uttar Pradesh. *International Journal of Science and Research*, 2014; 3 (10): 1370-1373.
 30. Sinha MP, Tabassum W, Kullu AR. Effect of leaf extract of Moringa Oleifera on regulation of hypothyroidism and lipid profile. *The Bioscan, An International Quarterly Journal of Lifesciences*. 2013; 8(2): 665-669.
 31. Parmar HS, Kar A. Protective role of Mangifera indica, Cucumis melo, Citrullus vulgaris peel extracts in chemically induced hypothyroidism. *Chemico-Biological Interactions*, 2009; 177: 254-258.
 32. Khattar V, Wal A. Utilities of Crataeva nurvala. *International Journal of Pharmacy and Pharmaceutical Sciences*, 2012; 4 (4): 21-26.
 33. Udaysing HP, Gaikwad DK. Medicinal profile of a sacred Drug in Ayurveda : Crataeva religiosa A review. *Journal of Pharmaceutical Sciences and Research*, 2011; 3 (1): 923-929.
 34. Sikarwar MS, Patil MB. Antihyperlipidemic activity of Crataeva nurvala Stem bark Extracts, *Indian Journal of Pharmaceutical Education and Research*, 2012; 46(4): 378-382.
 35. Coleus forskohlii monograph, *Alternative medicine review*, 2006; 11(1): 47-51.
 36. Bove M, et al. Thyroid disorder: Hypothyroidism & Hyperthyroidism. *Endocrine Disorders and Adrenal support* 2010; 186-197.
 37. Heisler S, Reisine T. Forskolol stimulates adenylate cyclase activity, cyclic AMP accumulation, adrenocorticotropin secretion from mouse anterior pituitary tumor cells. *Journal of Neurochemistry*, 1984; 42 (6): 1659-1666.
 38. Vyacheslav NT, Yulia AE, Konstantin GE, Natalia VK. Biologically active food additive for normalizing the function of the thyroid gland, US patent vide US20140220071 A1, assigned to JSC Patent Attorney, 2011.
 39. Nelson EK, Dawson LE. The constitution of capsaicin, the pungent principle of capsicum. *J Am Chem Soc*, 1923; 45: 2179-2181.
 40. Masuda Y, Haramizu S, Oki K, et al. Upregulation of uncoupling proteins by oral administration of capsiate, a nonpungent capsaicin analog. *J Appl Physiol*. 2003;95:2408-2415.
 41. Bianco AC, Sheng X, Silva JE, Triiodo thyronine Amplifies Norepinephrine Stimulation of Uncoupling Protein Gene Transcription by a Mechanism Not Requiring Protein Synthesis. *The Journal of Biological Chemistry*, 1988; 263 (34): 18168-18175.
 42. Khare CP. *Indian Medicinal Plants*. Springer - Verlag Berlin/Heidelberg, 2007;177.
 43. Xiaohua D, Yixuan Z, Xingqun YU, Mingxiang H. Effect of ginseng injection on Congestive heart failure and thyroid hormones. *CJIM*, 2000; 6(1): 29-31.
 44. Skibola CF. The effect of Fucus vesiculosus, an edible brown seaweed, upon menstrual cycle length and hormonal status in three pre-

menopausal women: a case report. BMC Complement Altern Med. 2004;4:10.

45. Poon WT, Ng SW, Lai CK, Chan YW, Mak WL. Factitious thyrotoxicosis and herbal dietary supplement for weight reduction. Clin Toxicol. 2008; 46(4):290-292.

