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Botanical Solutions: Exploring Herbal Therapies for Thyroid Disorders

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ABSTRACT

Thyroid disorders, encompassing conditions such as hypothyroidism, hyperthyroidism, and thyroid nodules, pose significant challenges in healthcare due to their prevalence and diverse clinical manifestations. While conventional medical treatments play a crucial role, increasing attention has been directed towards herbal interventions as adjunctive or alternative therapies. This review systematically examines the efficacy and underlying mechanisms of various herbs commonly used in the management of thyroid disorders. Through comprehensive literature analysis, we highlight the pharmacological properties and clinical evidence supporting the use of herbs such as Bacopa monnieri, Withania somnifera, Commiphora mukul, and Guggul, among others, in thyroid dysfunction. We discuss their potential to modulate thyroid hormone levels, exert antioxidant and anti-inflammatory effects, and regulate immune responses. Furthermore, we explore the synergistic effects of herbal formulations and their potential interactions with conventional thyroid medications. Despite promising findings from preclinical and clinical studies, several challenges remain, including standardization of herbal preparations, elucidation of optimal dosages, and rigorous evaluation of long-term safety profiles. Moreover, the integration of herbal therapies into conventional healthcare practices necessitates collaboration between traditional healers, herbalists, and allopathic practitioners to ensure patient safety and optimize treatment outcomes. This review underscores the importance of further research to validate the efficacy, safety, and mechanisms of action of herbal interventions in thyroid disorders, thus facilitating informed clinical decision-making and enhancing therapeutic options for patients with thyroid dysfunction.

Keywords: *Thyroid disorders, herbal medicine, alternative therapy, hypothyroid, botanicals*

INTRODUCTION

Thyroid is an endocrine gland. It is located in the inferior, anterior neck and is responsible for the formation and secretion of thyroid hormones and iodine homeostasis within the human body. The thyroid gland consists of two lobes on either side of the ventral aspect of the trachea. (Endocrinology: An Integrated Approach, 2001). The thyroid produces approximately 90% inactive thyroid hormone, or thyroxine (T4), and 10% active thyroid hormone, or triiodothyronine (T3) (Yasoda A., 2018).

The thyroid is an important part of the human endocrine system, regulating oxygen use, basal metabolic rate, cellular metabolism, and growth and development. The thyroid gland secretes thyroxine (T4) and triiodothyronine (T3), which are needed for proper growth and development and are primarily responsible for determining the basal metabolic rate. Through the activation

of genes, thyroid hormones stimulate protein synthesis, promote nervous system maturation, and increase cell respiration rate in tissues, thus elevating the Basal Metabolic Rate (BMR). The variations in the levels of these hormones lead to disturbed BMR and present systemic signs and symptoms (Primal, P.K. et.al.)

THYROID DISORDERS

The major disorders of thyroid glands are over-secretion (hyperthyroidism) and under-secretion(hypothyroidism) of thyroid hormones. (Khan A et.al., 2002)

HYPOTHYROIDISM: Hypothyroidism results from low levels of thyroid hormone with varied etiology and manifestations. Untreated hypothyroidism increases morbidity and mortality. (Patil N et.al., 2023) The NHANESIII (National Health and Nutrition Examination Survey) study found the prevalence of overt hypothyroidism among adults in the United States (12 years of age and older) to be 0.3% and subclinical hypothyroidism 4.3%.

HYPERTHYROIDISM: Hyperthyroidism is a syndrome associated with excess thyroid hormone production. Hyperthyroidism can be overt or subclinical. Overt hyperthyroidism is defined as low or suppressed thyroid stimulating hormone (TSH) levels with elevated triiodothyronine (T3) levels and/or elevated thyroxine (T4) levels. Subclinical hyperthyroidism is low or suppressed TSH with normal T3 and T4 levels. (Mathew P et.al., 2023)

GOITRE AND IODINE DEFICIENCY: Goitre means enlargement of the thyroid gland. Severe iodine deficiency causes goitre and hypothyroidism (Eastman, J.C. et.al., 2018). Brain damage and irreversible mental retardation are the most important disorders induced by iodine deficiency: In 1990 it was estimated that among the 1572 million people in the world exposed to iodine deficiency (28.9 % of the then world population), 11.2 million were affected by overt cretinism, the most extreme form of mental retardation due to iodine deficiency and that another 43 million people were affected by some degree of intellectual impairment (WHO, UNICEF, and ICCIDD).

AUTOIMMUNE THYRODITIS: Hashimoto thyroiditis is an autoimmune disease that destroys thyroid cells by cell and antibody-mediated immune processes. It is the most common cause of hypothyroidism in developed countries. In contrast, worldwide, the most common cause of hypothyroidism is an inadequate dietary intake of iodine. Women are more often affected. The female-to-male ratio is at least 10:1. Conventional treatment is comprised of levothyroxine at the recommended dose of 1.6 to 1.8 mcg/kg/day.

Table 1. Prevalence of thyroid disorders in eight urban cities of India [Kalra S, et.al., 2013]

City	n	Hypothyroidism n (%)	Self-reported, hypothyroidism n (%)	Undetected hypothyroidism n (%)	Subclinical hypothyroidism n (%)	Hyperthyroidism n (%)	Subclinical hyperthyroidism n (%)	Anti-TPO positivity n (%)
Ahmedabad	377	40 (10.61)	31 (8.22)	9 (2.39)	27 (7.16)	3 (0.8)	2 (0.53)	50 (13.26)
Banglore	867	80 (9.23)	47 (5.42)	33 (3.81)	63 (7.27)	7 (0.81)	9 (1.04)	151 (17.42)
Chennai	430	42 (9.77)	33 (7.67)	9 (2.09)	23 (5.35)	2 (0.47)	7 (1.63)	111 (25.81)
Delhi	1,436	159 (11.07)	102 (7.10)	57 (3.97)	138 (9.61)	5 (0.35)	15 (1.04)	316 (22.01)
Goa	142	10 (7.04)	4 (2.82)	6 (4.23)	6 (4.23)	1 (0.7)	5 (3.52)	26 (18.31)
Hyderabad	383	34 (8.88)	15 (3.92)	19 (4.96)	28 (7.31)	2 (0.52)	5 (1.31)	91 (23.76)

Kolkata	466	101 (21.67)	84 (18.03)	17 (3.65)	55 (11.8)	5 (1.07)	2 (0.43)	106 (22.75)
Mumbai	1,259	121 (9.61)	85 (6.75)	36 (2.86)	90 (7.15)	11 (0.87)	23 (1.83)	320 (25.42)
Total	5360	587 (10.95)	401 (7.48)	186 (3.47)	430 (8.02)	36 (0.67)	68 (1.27)	1,171 (21.85)

Table.1 The figure shows the prevalence of thyroid disorder in eight urban cities. Highest prevalence of hypothyroidism was seen in Delhi and the lowest in Goa. Some Individuals reported themselves and some were undetected. In case of hyperthyroidism highest prevalence was found in Mumbai and the lowest in Goa.

ROLE OF HERBS IN THYROID

Medicinal plants have been identified and used throughout human history. Chemical compounds in plants mediate their effect on the human body. Herbal medicines produce fewer side effects. The herbs and spices used by humans to season food also yield useful medicinal compounds (Bharthi V et.al., 2017). In recent years there has been a tremendous range of interest in medicinal plants especially those used in Ayurveda, Siddha, Unani, Modern Arnchi, Homeopathy, and Naturopathy. Drugs obtained from plants are believed to be much safer and exhibit remarkable efficacy in the treatment of various ailments. The folk medicinal traditions play a reflecting and prominent role in human and environmental interaction (International Journal of Biosciences 2012).

MECHANISM OF ACTION

The conventional approach of treatment of hypothyroidism relies on the use of levothyroxine replacement therapy. The therapy is known to cause impairment in the neurocognitive functions that led to poor quality of life and life-long treatment causes poor patient compliance. Herbal approach and their bioactive constituents came up as suitable alternative for hypothyroidism. In this context, Costuspictus belonging to the family Costaceae, also termed as the insulin plant because of its utility for diabetes management has shown potential application for alleviating hypothyroidism. The concoction restores the normal thyroid levels and improved the thyroid profile (Ashwini, S. et.al., 2017).

For eg: - Seaweed have been amongst the top choices in the management of thyroid disorders due to their high iodine content. Fucus vesiculosus (or bladderwrack, brown seaweed) has shown thyroid stimulating property however, no safety, efficacy or clinical dosage evidences highlight its usage (Shilo, S. etl.al., 1986). Fucus versiculosus and sea kelp (Ascophyllum nodosum) are known to be best sources of natural iodine however, excess intake is associated with thyroid overactivity.

The combination of with ania (1.4g/kg body weight) along with Bauhinia purpurea (2.5mg/kg body weight) significantly improved the thyroid function and ameliorated diabetes induced hypothyroidism (Jatwa, R. et.al., 2009).

Triphladya guggulu that directly affects the thyroid gland without direct involvement of the pituitary-TSH axis. Guggul (Commiphora mukul) possesses thyroid stimulating properties and helps in alleviating LDL levels in hypothyroidism cases. Guggulu (200mg/ kg/day) treatment for thirty days stimulated the thyroid functions and exerted antiperoxidative and antioxidant effect by triggering the production of superoxide dismutase (SOD) and catalase (CAT) that helped to ameliorate hypothyroidism (Panda, S. et.al., 2005).

HERBS USE TO TREAT THYROID

1. Aegle marmelos L.Correa:- (fig.2)

Local Name- Bael, Family-Rutaceae, Part used- Leaves, Area- Southeast Asia, Grown throughout India. It is a nutritious and medicinal fruit plant, which is most suitable to grow in water-scarce areas of the country. Its fruit is rich in riboflavin, vitamin A, carbohydrate, etc. Various chemical constituents' viz., alkaloids, coumarins, and steroids have been isolated from different

parts of bael plants. Bael is known as the panacea of stomach ailments and marmelosin is probably the therapeutically bioactive compound of bael fruit (0.03-0.37%) which varies according to variety and locality (Dixit and Dutt, 1932).It is also used in the preparation of several Ayurvedic medicines since ancient times (Sharma et al., 2007).

2. Aloe barbadensis: - (fig.3)

Local Name- Aloe vera Family- Liliaceae Part used- Leaves Area- Rajasthan, Andhra Pradesh, Tamil Nadu, Maharashtra, Gujrat. It benefits obesity, cholesterol, and anti-diabetic activity (Nuria Chinchilla et.al., 2013). It is also known for its various medicinal properties like effects on skin exposure to UV and gamma radiations, anti-inflammatory action, maintaining immune health, moisturizing and anti-aging effects, etc. (Surjushe A et.al., 2008)

3. Avena sativa L.- (fig.4)

Local Name- Jai/ Javi Family-Poaceae Part used- young seeds Area-north and southeast Asia. Oats (*Avena sativa* L.) are rich in protein, fiber, calcium, vitamins (B, C, E, and K), amino acids, and antioxidants (beta-carotene, polyphenols, chlorophyll, and flavonoids). β-glucan and avenanthramides improve the immune system, eliminate harmful substances from the body, reduce blood cholesterol, and help with dietary weight loss by enhancing the lipid profile and breaking down fat in the body. β-glucan regulates insulin secretion, preventing diabetes. (Kim S et.al., 2021)

4. Bacopa monnieri L. Pennell. - (fig.5)

Local Name- Brahmi Family-Scrophulariaceae Part used- leaves Area-southern and eastern India, Australia, Eupore. Brahmi is rich in innumerable bioactive secondary metabolites, especially bacosides that can be employed to reduce many health issues. This plant is used as a neuro-tonic and treatment for mental health, depression, and cognitive performance. Brahmi is also known for its antioxidant, anti-inflammatory, and anti-hepatotoxic activities. (Sudheer, W.M. et.al., 2023)

5. Fucus vesiculosus: - (fig.6)

Local Name- Bladderwrack Family-Fucaceae Part used- whole plant Area-coastlines of Atlantic and Pacific Oceans. Seaweeds are known to be a good supply of key nutrients including carbohydrates, protein, minerals, polyunsaturated lipids, as well as several other health-promoting compounds capable of acting on a wide spectrum of disorders and/or diseases (Catarino D.M. et.al., 2018) such as anti-inflammatory effects, thyroid function, maintaining skin health, regulation of menstrual cycle patterns. (Skibola F.C. et.al., 2004)

6. Commiphora wightii: - (fig.7)

Local Name- Guggul, Guggal Family-Burseraceae Part used- resin flowing in the branches Area-India, Bangladesh, and Pakistan. The active compound found is Guggul is Guggulsterone which increases T3 synthesis by boosting T4 to T3 conversion (Gupta et al., 2016b). It has been used for the treatment of a variety of disorders such as inflammation, gout, rheumatism, obesity, and disorders of lipids metabolism. It is a mixture of phytoconstituents like volatile oil which contains terpenoidal constituents such as monoterpenoids, sesquiterpenoids, diterpenoids, and triterpenoids; steroids; flavonoids; guggultetrols; lignans; sugars; and amino acids. (Sarup, P. et.al., 2015)

7. Linum usitatissimum L.- (fig.8)

Local Name- Alsi Family-Linaceae Part used- seeds Area-Madhya Pradesh, Uttar Pradesh, West Bengal, Orissa, Assam. Flaxseed is a rich source of the omega-3 fatty acid, alpha linolenic acid, the lignan secoisolariciresinol diglucoside and fiber. These compounds provide bioactivity of value to the health of animals and humans through their anti-inflammatory action, anti-oxidative capacity and lipid modulating properties. (Parikh M. et.al., 2019) Flaxseed is a rich source of dietary fiber (40%), of which the soluble fiber accounts for 25% and insoluble fiber accounts for 75%. A soluble fiber including gums, pectin, and β-glucan plays an important role in reducing glycemia, and absorbing cholesterol and triglycerides, which are key factors in the prevention of

cardiovascular disease and diabetes. (Nowak W. et.al., 2023)

8. Pistia stratiotes L.- (fig.9)

Local Name- Jalkumbh, Family-Araceae, Part used- leaves, Area-Asia, Africa, America. The plant is considered antiseptic, antitubercular, and antidysentric. Leaves infusions have been mentioned in folklore to be used for dropsy, bladder complaints, kidney afflictions, hematuria, dysentery, and anemia. (Tripathi P et.al., 2010)

9. Withania somnifera L.- (fig.10)

Local Name- Ashwagandha, Family-Solanaceae, Part used- Roots Area-Africa, Sri Lanka, Drier parts of India Ashwagandha have a variety of metabolites such as steroids, flavones, alkaloids, carbohydrates, glycosides, saponins, tannins, terpenoids and coumarin. Eight different polyphenols (five phenolic acids, vanillic, benzoic, p-coumaric, gallic and syringic acid, and three types of flavonoids, naringenin, catechin and kaempferol) were reported from Ashwagandha. (Poojari P et.al., 2019). The active compound found in Withania Somnifera is Withaferin which helps to improve thyroid activity, engance antiperoxidation, and production of T4 hormone (Gupta et al., 2016b).

10. Zingiber officinale (Rpsc.): - (fig.11)

Local Name- Adrak, Family-Zingiberaceae, Part used- Rhizome, Area-Karnataka, Orrisa, Assam, Meghalaya. The main constituents are sesquiterpenoids with zingiberene as the main component. Lesser amounts of other sesquiterpenoids (beta- sesquiphellandrene, bisabolene and farnesene) and a small monoterpenoid fraction (beta-phellandrene, cineol and citral) have also been identified. Subacute thyroiditis may be induced due to an autoimmune process by ginger as an antigen, which changes the antigenic properties of thyroid follicular cells. (Sanavi S et.al., 2010)

Table 2 depicts the images of the herbs used to treat thyroidism.

 Fig. 1- Bael	 Fig.2-Aloe Vera	 Fig. 3- Javi	 Fig. 4- Bhrami	 Fig.5- Bladderwrack
 Fig. 6- Guggul	 Fig. 7- Alsi	 Fig.8- Jalkumbh	 Fig.9- Ashwagandha	 Fig.10- Ginger

DOSAGE

Dosage may vary among individuals, and establishing standards and guidelines for use is difficult. Tablespoon, teaspoon, hand palm, little finger index, cup, or glass measures are commonly used to carry out the specified prescriptions. A glass cup measure is used for decoction 21 and infusion, and a tablespoon of honey can be used to blend with it, but sugar must not be added. It is recommended that some mixes be made one or two hours before ingestion. Other preparations, on the other hand, should be ready and stored for a week before use. One to three teaspoons are usually taken one to three times per day by patients (Prachee F, 2022).

CONCLUSION

Hypothyroidism has influenced various cardiovascular risks followed by high blood pressure, cholesterol, and other various health problems. Physiological and pathophysiological processes of our body are being controlled by the thyroid gland. Therefore, treatment of this disorder is

essential to improve thyroid functioning in the human body. The treatment of hypothyroidism relies on the use of levothyroxine replacement therapy and is known to cause impairment in the neurocognitive functions that led to poor quality of life and life-long treatment causes poor patient compliance. Application of medicinal herbs has proven a great improvement in the functioning of thyroid gland. The herbs improve thyroid status and decrease serum TSH concentrations, improved production of T4, playing an important role in reducing glycemia, and absorbing cholesterol and triglycerides, which are key factors in the prevention of cardiovascular disease and diabetes. These herbs also increase the synthesis of T3 by boosting T4 to T3 conversion, anti-inflammatory effects, maintaining skin health, regulation of menstrual cycle patterns. Sesquiterpenoids bioactive compound found in ginger helps to improve functioning of thyroid by acting as an antigen to thyroid follicular cells. Withaferin, the active compound found in ashwagandha which helps to improve thyroid activity, engance antiperoxidation, and production of T4 hormone. Dosages vary among individuals depending on the severity and beliefs of the person. Generally, the measurements are carried out through tablespoon, teaspoon, hand palm, little finger index, cup or glass for the specified prescriptions by experts. Guggul (Commiphora mukul) possesses thyroid stimulating properties and helps in alleviating LDL levels in hypothyroidism cases.

Medicinal herbs should be used to improve thyroid functioning on natural basis. Some tablets are also made by the extraction of the active compounds from the herbs. Some of the current formulations available in the marketare: Nutrisage Thyroid Health which is a combination of aswagandha, bael, bacopa; another tablet is Bio Thyrobalance a mixture of many herbs namely Bhrami, Asagandha, Mulethi, Tulsi, Amla, Guggul, Giloy. A juice named Thyro Balance with the mixture of following herbs- Bhrami, Guggul, Sonth, Pippali, Giloy, Shatavri, Kanchnar is also available in the market. So awareness should be created among people to cure primary thyroid with the application of medicinal herb concoction or the use of tablets according to the prescription prescribed by the experts.

Declaration by Authors

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