सामूहिक दायित्व है ,क्योंकि आदिवासियों का पर्यावरण से सहजीवी संबंध है जो पूरी मानवता व सृष्टि के लिए हितकर है। हाल के उत्तराखंड के चमोली जिले के जोशीमठ में होने वाली घटनाओं को देखकर हमें सीख लेने की जरुरत है। जितना जरूरी प्राकृतिक संसाधनों का संरक्षण है उतना ही जरूरी उन प्राकृतिक स्थलों पर रहने वाले लोगों के संरक्षण की भी जरूरत है क्योंकि ये प्राकृतिक स्थल उन्हीं लोगों की बदौलत सुरक्षित है।

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अन्य आंकड़ों संबंधी जानकारी pib.gov.in भारत सरकार के राष्ट्रीय पोर्टल से ली गई है।

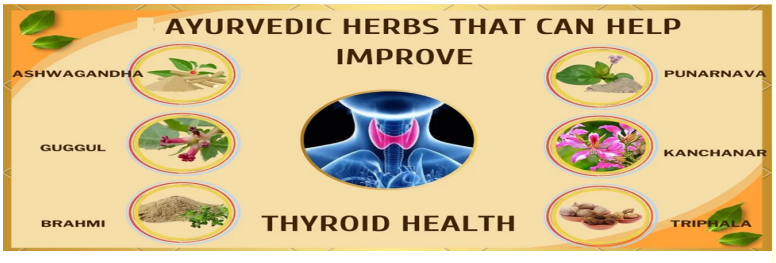
## A potential medical strategy treating hypothyroidism is the combination of herbal medicine and conventional medical therapies

**Ashutosh Pathak[1]*, Priya Rai[2], Nilesh Kumar Upadhyay[3]**

[1]Institute of Pharmacy, Dr. Shakuntala Misra National Rehabilitation University, Mohan Rd, Sarosa Bharosa, Lucknow, Uttar Pradesh India – 226017.
[2]Dr M. C. Saxena College of Pharmacy, 171 Barawankala, Mall Road, IIM Road, Dubagga, Lucknow, Uttar Pradesh 226101
[3]Shri Vishwanath college of pharmacy, Kalan,

**Abstract-**Thyroid problems are among the most prevalent and difficult endocrine illnesses that we face globally. Goitre/iodine deficiency, Hashimoto's thyroiditis, hypothyroidism, hyperthyroidism, also thyroid malignancy are among the major thyroid conditions because of its varied clinical appearance, hypothyroidism is possibly the most difficult of them to diagnose. A lack of the thyroid hormones triiodothyronine (T3) and thyroxine (T4) in the body is the cause of hypothyroidism. The condition known as mild or subclinical hypothyroidism occurs when blood thyroid-stimulating hormone (TSH) stages are slightly high but peripheral thyroid hormone equals remain outside the normal range. There is currently little information on the through investigational, pharmacologic, otherwise preclinical forms of proof that using herbal and Ayurvedic medications to treat hypothyroidism is effective. This manuscript's scope includes the effectiveness of herbal medications or traditional Ayurvedic treatments in reducing the pathophysiological symptoms of hypothyroidism.

**Graphical Abstract**




**Keywords:** hypothyroidism, thyrotropin, triiodothyronine T3, thyroxine T4, thyroid diseases.

**Introduction**

Hypothyroidism, which is caused by low thyroid hormone levels. Nearby remain two core categories of hypothyroidism: primary along with secondary (occasionally acknowledged as per essential) hypothyroidism. Thyroid hormone production is insufficient in primary hypothyroidism [1]. Hypothyroidism is caused by faulty pituitary or hypothalamic activity,

but the less frequent secondary or central hypothyroidism happens when the thyroid gland works correctly. Morbidity and mortality are increased when hypothyroidism is left untreated [2]. Lack of iodine in the diet is the most prevalent cause of hypothyroidism worldwide, but in the United States, the most common cause is autoimmune thyroid disease, often known as Hashimoto thyroiditis. Hypothyroidism can manifest in a variety of ways, ranging from an asymptomatic patient whose illness is only detected by regular blood work to the severe manifestation of myxoedema coma. Treatment with herbs has gained attention recently as a possible supplement to traditional treatments for hyperthyroidism. Botanicals like Withania somniferous (ashwagandha), Commiphora mukul (guggul), and Fucus vesiculosus (bladderwrack) have long been used in conventional practices like Ayurveda, which is based on Traditional Chinese Medicine (TCM), and natural healthcare to promote thyroid health and improve metabolic function. Although early research points to potential advantages of several herbs in regulating the function of the thyroid, concerns about their effectiveness, safety, and modes of action when combined with conventional pharmaceutical therapies still exist [3-5].

**Anatomy -**In the anterior neck, directly under the laryngeal prominence (Adam's apple), lies the thyroid gland, a ductless alveolar gland. With two lobes around the trachea and joined in the centre by an isthmus, it resembles a butterfly, Typically, the thyroid gland cannot be felt. Its lymphatic system is abundant, and its superior and inferior thyroid arteries supply it with blood. Its superior, middle, and inferior thyroid veins drain it [6].

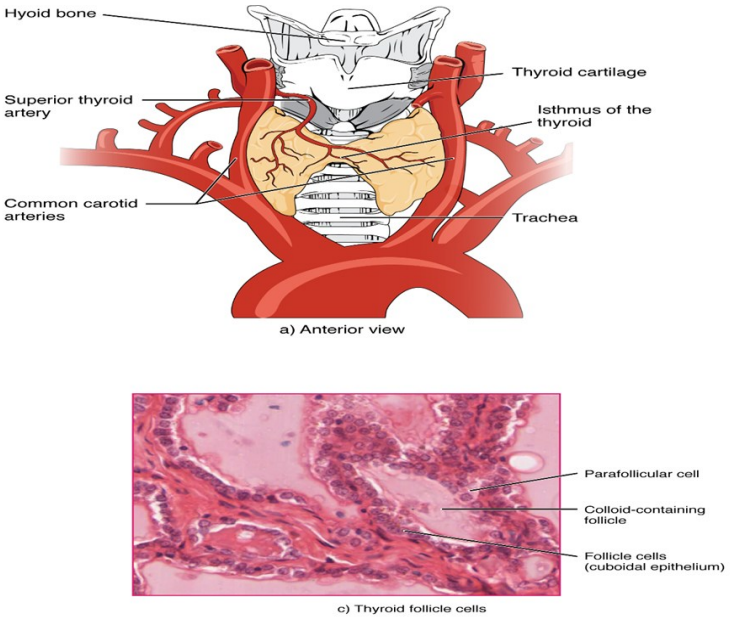



**Fig. 1** The gland that houses the thyroid may be found in the neck, where it encircles the trachea.

The pituitary gland's trophic hormone, also known as thyroid-stimulating hormone (TSH), stimulates the production and release of thyroid hormone. TSH production is regulated by the thyroid hormones' negative feedback, which alters the pituitary's reaction to the hypothalamic hormone thyrotrophin-releasing hormone (TRH) [7]. T3, which is generated when iodothyronine deiodinase acts on T4 in the anterior pituitary's thyrotrope cells, is the main mediator of this feedback. Dopamine, somatostatin, and glucocorticoids all suppress the release of TSH. This may have some relevance to the thyroid hormone disruptions that can occur in non-thyroidal sickness, although its physiological importance is unknown (see p. 160). As a result of the feedback processes, thyroid stimulating hormone concentrations in plasma are kept constant [8].

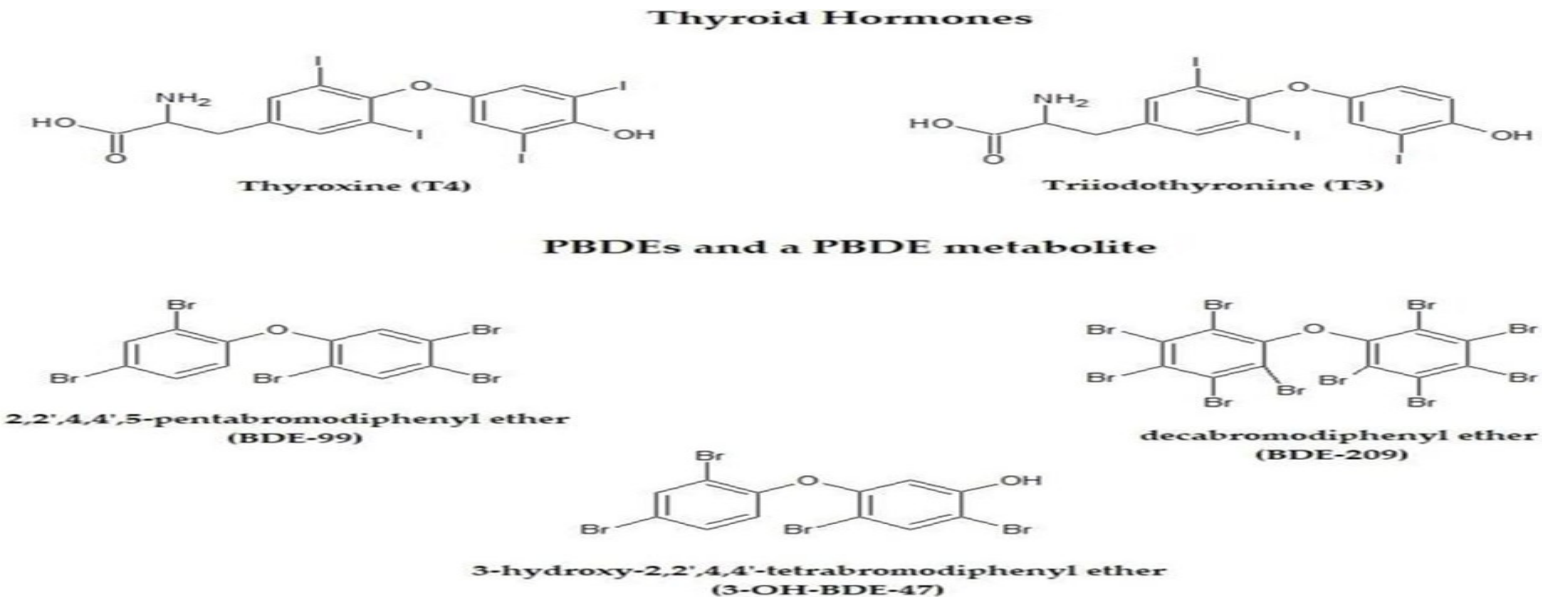
**Etiology -**Worldwide, the most frequent cause of hypothyroidism is iodine deficiency. However, the most prevalent aetiology in iodine-sufficient nations, such as the USA and Australia, is autoimmune thyroid illnesses (the most common of these being Hashimoto thyroiditis). There is a chance that autoimmune thyroid illness is inherited. Similar to many other autoimmune diseases, it is more prone to coexist with diseases of other organ systems [9]. The degree to which environmental variables contribute to the development of autoimmune thyroid illnesses is unknown, however they may include infections, excessive iodine consumption, or adverse drug reactions [10].

**Methods and Materials -** An evidence-based study was created by compiling research articles from a variety of offline and online peer-reviewed journals and databases, including PubMed, MedlinePlus, Sodhganga, Google Scholar, and others, that contained data on the pharmacological activities and preclinical efficacy of chemically induced hypothyroidism in mammals. The Charaka Samhita and Sushruta Samhita, two traditional Ayurvedic classics, were also examined in order to get insightful inferences from the classical data [11-15].

**Traditional Ayurvedic treatment of hypothyroidism**

According to Ayurveda, the thyroid gland is a Lymphatic channel (rasabaha srotas). A comprehensive approach to the mind, behaviour, body, and environment is used in the treatment. In order to balance tridoshas and transition to rasayana (rejuvenative) therapy, its primary goal is to unclog the body's obstructed channels before beginning any oral therapy[8]. One of the fundamental principles, known as "Saamanya Vishesh Siddhanta," states that similar conditions exacerbate the disease condition, while dissimilar conditions alleviate it. This treatment methodology aids in the reduction of kapha through the use of kapha-inhibiting drugs, the elevation of

dhatugata (tissue level), or pitta, through the use of pitta-enhancing drugs, and the reduction of meda (fat) through the use of meda Neutralising drugs. All of these techniques aid in the restoration of the body's equilibrium and metabolic activity, which were changed when kapha blocked the channels[16].




Starting through the thyroid gland's absorption of iodide and ending with the iodination of tyrosine residues in the protein thyroglobulin (**Fig. 2)**

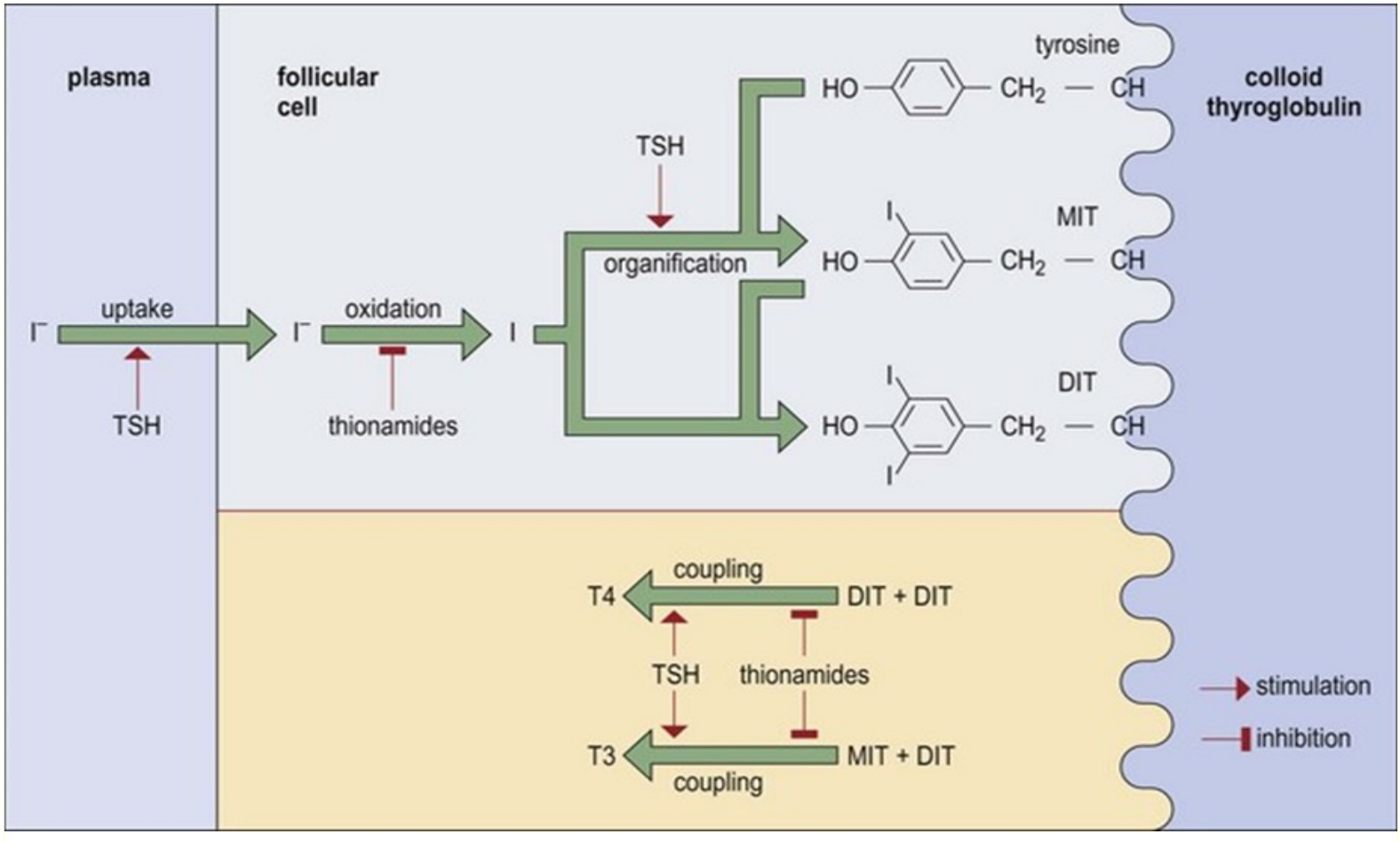



**Fig.** 3 production of hormones produced by the thyroid. Tyrosine amino acid residues, which are an essential component of the thyroglobulin polypeptide, are involved in the hydrogenation along with condensing processes.

| S. N. | Botanical Name/Family | Common Name | Used part | Action | Pharmacological Activity |
|---|---|---|---|---|---|
| 1 | *Nigella sativa L.* Ranunculaceae | Kalonji | Seeds | Thyroid stimulating hormone (TSH) and antithyroid peroxidase (anti-TPO) antibody levels in the blood dropped as serum T3 levels rose[10]. | Antioxidant Activity, Antimicrobial/Antibacterial Activity, Antiviral Activity, Antiparasitic, Anticancer Activity, Anti-Inflammatory and Immunomodulatory Activity, Cardioprotective and Antihypertensive Activity, Antidiabetic Activity. |
| 2 | *Morus alba* Moraceae | Shahtoot | Leaf | It cured goitre. | Analgesic,Anthelmintic, Antibacterial, Anti-Rheumatic, Diuretic, Hypotensive, Hypoglycaemia, Purgative, Restorative, Sedative Tonic, Blood Stimulant. |
| 3 | *Bauhinia purpurea* Fabaceae | Kaniar | Bark | It reduced cholesterol levels and increased thyroid hormone levels. | cardiac activity, antifungal, wound healing, antidiabetic, antiulcer, antioxidant, antinociceptive, hepatoprotective, nephroprotective, antidiarrhoeal, anti-inflammatory, antipyretic, analgesic, antimalarial, gastro protective and cytoprotective activity. |
| 4 | *Bacopa monnieri* Scrophulariaceae | Brahmi | Whole plant | It increased T3 and T4, decreased oxidative stress, and enhanced focus and memory. | Antibacterial, Anti-Fungal, Anti-Cancer, Anti-Oxidant, Anti-Inflammatory, Antihyperglycemic, Anti-Depressant, Anti-Epileptic, Memory Enhancer, Anti-Ulcer, Hepatoprotective, Anti-Hypertensive. |
| 5 | *Commiphora mukul* Burseraceae | Guggulu | Oleorasin | It increased the T3 and T4 ratios and enhanced thyroid histology. | Arthritis, Anti-hyper lipidemic, Anti-diabetic, Anti-helminthic activity, Anti-neoplastic activity. |
| 6 | *Withania somnifera* Solanaceae | Ashwagandha | Root | It reduced oxidative stress, increased thyroid hormone levels, and decreased cortisol. | Antimicrobial and antifungal activities, Pesticidal and larvicidal activities, Anti-inflammatory, cytotoxic activities, hepatoprotective activities, Immunomodulatory activity, Cardioprotective activity. |
| 7 | *Moringa oleifera* Moringaceae | Shigru | Roots, seeds, leaf | Thyroid hormone levels were elevated. | Anti-cancer Activity, Anti-diabetic activities, Cardioprotective Activity, Neuroprotective Activity, Immunomodulatory Activity, Hepatoprotective Activity, Anti-hypertensive Activity, Anti-Asthmatic Activity |
| 8 | *Achyranthes aspera* Amaranthaceae | Apamarga | Whole plant | It decreased oxidative stress and increased glucose and thyroid hormones. | Anti-inflammatory, Antioxidant, Antimicrobial Activity, Antidiabetic Effects, Analgesic Properties, Hepatoprotective Activity |
| 9 | *Bauhinia variegate* Fabaceae | Kachanara | Bark | It improved thyroid histology, lowered cholesterol, raised blood thyroid hormone levels, and decreased neck oedema. | Anticancer, antioxidant, hypolipidemic, antimicrobial, anti-inflammatory, nephroprotective, antiulcer, immunomodulating, wound healing effect. |
| 10 | *Magnifera indicum* Anacardiaceae | Mango | Fruit peel | It decreased oxidative stress and increased thyroid hormone levels. | antibacterial, anti-tumours, antispasmodic, antipyretic, antidiarrheal, antiallergic, immunomodulation, hypolipidemic, anti-microbial, hepatoprotective, gastroprotective. |

**Medicinal Plants for Treatment of Hypothyroidism-** Gotu Kola (*Centella asiatica*) The traditional Chinese medicinal plant, *Centella asiatica*, commonly known as *Centella asiatica (L.)* or Gotu kola, is used to cure a range of diseases in China and Southeast Asia. The active components of the plant have been the subject of several animal and cell investigations. It includes a number of pentacyclic triterpenoids, such as Asiatic side, brahmoside, and madecassic acid, as well as additional compounds including centellose, centelloside, and madecassoside. Triterpenes, primarily asiatic acid, Asiatic side, madecassoside, and madecassic acid, are the major chemical components which gives pharmacological effect [23].

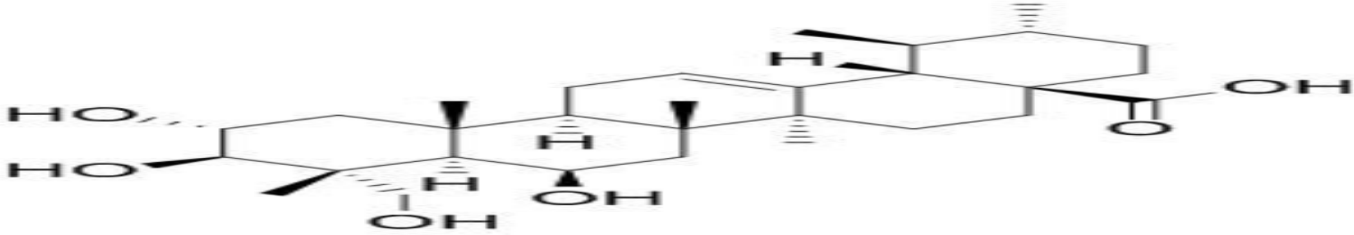


**Fig. 4** Chemical Structure of Madecassic acid

The gotu kola leaf is widely used to treat hypothyroidism. Asiatic side, asiatic acid, Brahmo side, and brahmic acid, sometimes known as madecassoside acid (Figure 7), are all found in it. It's more likely that the plant has the ability in increasing synthesis of T4. Also, it is utilized to boost energy and stamina by regulating the neurological system. As a result of the herbs' energizing action, T4 synthesis is enhanced or stimulated. The tincture of gotu leaf is commonly used to treat hypothyroidism [24].

**Ashwagandha (*Withania Somnifera*)-**Ashwagandha, often known as Indian ginseng or winter cherry, is a saponin glycoside found in the Solanaceae family of plants. Pharmacological research has shown that ashwagandha's plant preparation possesses anti-inflammatory, antioxidant, anticancer, anxiolytic, and immunomodulatory properties. It contains alkaloids, saponin and steroidal compounds, all of those are necessary for different pathways of hormone to function properly. These chemical components aid in the conversion of T4 to T3 and hence promote T4 hormone synthesis. According to a study, Ashwagandha extract has the ability to increase thyroid activity as well as tissue ant peroxidation activity. Ashwagandha (*Withania somnifera*) is an adaptogen plant that is said to help prevent and treat stress-related symptoms. Adults with mild cognitive impairment benefit from the use of ashwagandha. Supplementing with Ashwagandha has been demonstrated to be safe and beneficial to cortisol levels, cognitive abilities, and self-reported stress, anxiety, sadness, and food cravings [25].

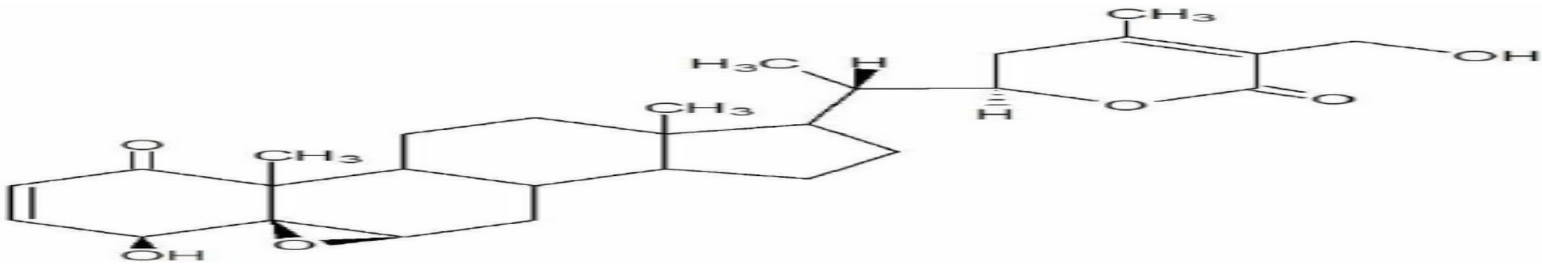
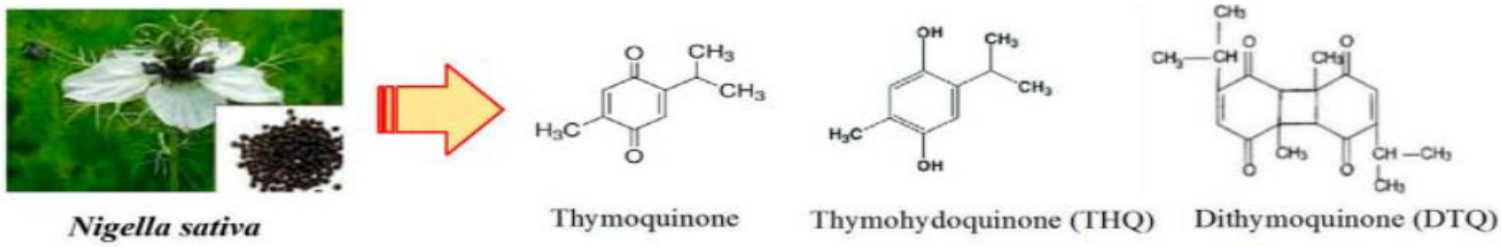


**Fig.5** Chemical structure of warfarin

**Black Cumin (*Nigella sativa L*)-** *Nigella sativa* also known as black cumin is from family of Ranunculaceae, is an annual herb with a variety of medicinal qualities. The constituent of this plant which is most prevalent is the volatile oil of *Nigella sativa* (N. sativa) seeds is thymoquinone (TQ), that is also the constituent to which most of the herb's characteristics are attributed. Black seed and TQ have been found to have a variety of beneficial effects in the treatment of various metabolic syndrome, inflammatory and auto-immune disorders in patients. Because of the many benefits of this herbal medicine, its negative effects appear to be minor. As a result, it can be used in clinical trials. Some other effects like its hypolipidemic and hypoglycaemics effects, is studied and are understood to allow for clinical trials in case of drug developments. In case of thyroid disorder, the impact of NS in a recent study stated that black seeds oil was found to have antioxidant properties, reducing oxidative stress and thyroid follicular damage induced by medications like propylthiouracil (PTU). Another study found that NS oil raises T3, T4, LH, and oestrogen levels [26].




Main bioactive compounds with chemical structure

**Future Prospect-**The subject of how crucial it is to treat subclinical hypothyroidism has set off a series of endless discussions**.** It is evident that hypothyroidism has influenced various key cardiovascular risk variables as high blood pressure, cholesterol, and coagulability along with various health problems. It is central of controlling the physiological and pathophysiological processes of our body. Therefore, treatment of hypothyroidism is essential for improving thyroid function in human. For treatment purpose, application of medicinal plants has proven to be effective with less adverse effect. It improves hypothyroid status and decreases serum TSH concentrations along with improvement

of cholesterol profile. Moreover, there are other plants with medicinal properties which can also be used in case of hypothyroidism. However, treatment with thyroxin replacement therapy with levothyroxine is the first choice for treatment. But this is a lifelong process with limitations. So, application of medicinal plants can be in addition to disease-specific drugs, a useful herbal supplement. Therefore, for its popular usage, it's high time to step up scientific research into the mechanisms of action of these medicinal plants evidently.

**Conclusion -**Herbal medication therapy presents a promising adjunctive strategy for the treatment of hypothyroidism, especially in mild or subclinical instances, or as a supportive measure in conjunction with traditional therapies. Herbs with the ability to modulate thyroid function and alleviate symptoms include guggul, bacopa, and ashwagandha. However, to guarantee safety and efficacy, customised therapy and medical monitoring are necessary due to the intricacy of thyroid problems. To confirm these plants' medicinal potential and provide standardised treatment procedures, more clinical research is required. Since herbal remedies are natural and have the ability to promote thyroid function, they have become more and more popular as complementary and alternative therapies for treating hypothyroidism. Numerous herbs include adaptogenic, anti-inflammatory, and thyroid-stimulating qualities that can have a beneficial effect on the endocrine system.

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