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## A comprehensive review on exploring the potentials of medicinal coleus (*Coleus forskohlii* Briq.) in the pharmaceutical industry

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### Abstract

Medicinal coleus contains fasciculated tubers, which are used to extract a diterpenoid active compound known as forskolin. This plant is reported in Nepal, Burma, India and Thailand. The products of coleus and related products are exported to the USA, Poland, South Korea, Australia, Japan, Italy, Spain, South Africa, and Canada. The leaves of coleus contain rich quantities of flavones, flavonols and polyphenols besides their antioxidant properties. From *Coleus forskohlii* Briq., A and B forms forskoditerpenoside and supplementary forms of diterpenoids were also recorded besides traceable quantities of citronellal, a-amyrin,  $\beta$ -sitosterol, betulinic acid, a-cedrol, and a-cedren. For centuries, it has been used in Ayurvedic medicine to address conditions such as underactive thyroid, heart disease, and respiratory disorders. In modern clinical studies, it has been demonstrated that it may benefit the treatment of asthma, angina, psoriasis, as well as the prevention of cancer metastases. Forskolin significantly decreases body fat and promotes the leanness of the body and is believed to function as an antidepressant by increasing cAMP levels. Forskolin has the ability to prevent the synthesis of histamine, eotaxin, and interleukins and possesses a specific actions that hamper pathways involved in growth and survival of colon cancer cell. Forskolin is generally considered safe when used appropriately, but like any supplement, it can have side effects and potential toxicity, especially when taken in excessive amounts or combined with certain medications.

### 1. Introduction

Traditionally, medicinal plants have played a significant role in the rural and tribal lives of India, serving as one of the main sources of medicine. A traditional medicine is a summation of human experience in selecting herbal remedies for prevention and curative effects in healthcare systems, *i.e.*, natural healing through the use of plants (Vedavathy, 2007). Globally, since ancient times, the herbal plants have been used for different therapeutic properties (Alam, 2019; Alam *et al.*, 2019). The knowledge of sources and uses of different parts of medicinal plants has been acquired through generations. According to the monograph of the World Health Organisation (1999), medicinal herbs are used in about 90% of traditional medical formulations. It is considered safe for humans to consume a variety of novel medicines that are derived from plants and herbs (Shamna and Poyil, 2021; Patel *et al.*, 2022). The ethnomedicines involving botanicals or herbal extracts need their control of quality mainly for authentication purposes (Kumar *et al.*, 2022). An important aspect

of phytomedicine is the use of plant-derived compounds for therapeutic purposes, which includes plant extracts, essential oils, and isolated substances (Akhtar, 2024). As one of the oldest civilisations in the world, India is blessed with a wide range of biodiversity and climates (Somraj *et al.*, 2024).

The genus *Coleus*, part of the Lamiaceae (Labiatae) family, includes over 300 species, both annual and perennial. In “Flora Cochinchinensis”, Loureiro (1790) described this genus with its Greek name as ‘Koleos’ representing the meaning ‘sheath’ having stamens of monodelphous nature that were jointed at the base. *Coleus forskohlii* Briq., a significant medicinal plant, is noted for its fasciculated tubers, which are used to extract a diterpenoid active compound known as forskolin. According to the reports Willis (1966), it was projected that the genus *Coleus* is estimated to entail of about 150 species of which seven species found in India. Among these species, *C. amboinicus* (*C. aromaticus*), *C. forskohlii* (*C. barbatus*), *C. spicatus* (*C. canisus*), and the endemic *C. malabaricus* are occurring naturally. In South India, this genus contain edible types such as *C. rotundifolius* (*C. tuberosus*, *C. parviflorus*) and bushy ornamental herb *C. scutellarioides* (*C. blumei*) and a few cultivated species, such as *C. vittiveroides* (*Plectranthus tomentosus*). *C. barbatus* var. *barbatus* was reported in Eritrea to North Tanzania, Arabian Peninsula Indian Subcontinent to Southern Central China (Sudees *et al.*, 2004).

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The genus *Coleus* is closely related to *Plectranthus*, which lacks monodelphous stamens. Due to their similarities, some taxonomists do not distinguish between the two genera and instead classify all *Coleus* species under the genus *Plectranthus* (Morton, 1962; Launert, 1968; Codd, 1971). However, a number of modern taxonomists (Keng, 1969; Blake, 1971; Cramer, 1978) follow Loureiro's classification and regard *Coleus* as a separate genus. Shah (1996) examined species of *Coleus* across the Indian subcontinent and consistently found them to exhibit the distinct characteristic of connate filaments, leading to the unanimous decision to maintain *Coleus* as a separate genus. It thrives in the subtropical climate of the lesser Himalayas, between the latitudes of 8° and 31°N, from Shimla eastward to Bhutan, as well as the hills of Central India, the Deccan Plateau, the Eastern Plateau, and rain shadow regions of Western and Eastern hills. (Mukherjee, 1940). This plant is conserved and listed in Herbarium (No. 3902) by H.F. Mooney, Sambalpur, India during 13<sup>th</sup> July, 1950 and also reported in Royal Botanic Gardens, Kew (K005569132).

There are also records of the species in Egypt, Arabia, Ethiopia, tropical East Africa, Brazil, Sri Lanka, India, Nepal, Bhutan, and China (Cook, 1903; Cramer, 1978; Tandon *et al.*, 1977; Zelnik *et al.*, 1977; Willemese, 1985). Valdes *et al.* (1987) suggested that the Indian subcontinent is the origin of this species, though the high number of *Coleus* species in Africa indicates that it may be the potential centre of ancestry for the genus.

*C. forskohlii* is reported in Nepal, Burma, India and Thailand (Kavitha *et al.*, 2006; Kavitha *et al.*, 2010; Lakshmanan and Manikandan, 2015; Tamboli *et al.*, 2015). It has been reported in Africa (tropical east), Arabia, Pakistan, Sri Lanka, Egypt, Nepal and Brazil (Patel and Saraf, 2016). In the Lesser Himalayas, where altitudes range from 1300 to 1685 metres, *C. forskohlii* is most commonly found around 1450 metres, particularly in the Kumaon Himalayas and the adjacent northwest part of Nepal. In peninsular India, the species occurs at elevations between 600 and 2000 metres (Shah, 1989). In Karnataka, the plant is rare in the southern districts but is well-distributed in Chitradurga and parts of Belgaum, Dharwad, and Tumkur districts (Singh, 1989). It is also prevalent in the northwestern and Salem districts of Tamil Nadu (Rajamani, 2003). Exporting *C. forskohlii* extracts and associated products to the United States, Poland, South Korea, Australia, Japan, Italy, Spain, South Africa, and Canada are India's top export destinations (Bhowal and Mehta, 2017).

## 2. Pharmacognostical description

*C. forskohlii* is a herbaceous, pubescent, and aromatic species which can grow up to 45-60 cm height. The roots are tuberous, ranging from one to several, and are succulent and firm which were shaping straight, either smaller and stouter or longer and slender, reaching to the length of 56 cm. The varieties of the cultivated types has typically long, radially dispersed roots that are fleshy, succulent, spindle-shaped, or fusiform. The root tubers are aromatic and featured with bitter taste and contains flesh of white or orangish-pink in colour. Depending on the soil, the tuber skin might be papery, yellowish-brown, brownish, or brownish-black. Depending on the soil, the tuber skin might be papery, yellowish-brown, brownish, or brownish-black. The leaves are 3 to 5 cm wide and 7.5 to 12.5 cm long with racemose inflorescence, calyx were positioned inwards. The corolla is blue or lilac, bilabiate, with elongated and concave lower lobes that

enclose the vital organs and the calyx's top lip is widely oval in shape. In addition to the above, it contain two-lobed stigma and four-parted ovary (Bailey, 1942).

Vishwakarma *et al.* (1988) reported that 38 genotypes gathered from various sources and cultivated under consistent conditions and the results of the root yields ranged from 16.6 g to 203.3 g per plant. Later, Bahl and Tyagi (1989) also observed the presence of diverse morphotypes in their collection of germplasm. Shah (1989) provided a detailed account of the morphological variation in natural and cultivated ecotypes from 12 diverse eco-geographic locations, which were later evaluated in Bombay. The same twelve ecotypes were evaluated by Hegde (1992) under the climatic conditions of Bangalore and divided into two groups: fibrous-rooted types with abundant branching and tuberous-rooted types with relatively sparse branching, except for one tuberous-rooted type that showed profuse branching.

### 2.1 Leaves

The leaves of *coleus* contain rich quantities of flavones, flavonols and polyphenols besides their antioxidant properties. The leaf and stem extracts contain antioxidative polyphenols, and it was confirmed through the HPLC method. In addition to the above, leaves and stems contain tannins, as opined by Yao and Xu (2001).

### 2.2 Tubers

Abraham *et al.* (1989) discovered substances with yellowish to reddish-brown in the vesicles of pedicellate cytoplasmic region that stores secondary metabolites in the tuberous roots of *C. forskohlii*. They noted that this characteristic is unique to this plant, as such vesicles have not been reported in any other angiosperm. The cells containing these vesicles were observed to surround nematode-infected areas of the root, suggesting a protective role for the secondary metabolites in this plant. Narayanan *et al.* (2002) identified cork masses with yellow colour and reddish-brown colouration and similarly in cortex, regions of xylem and medullary rays that were later confirmed to be secondary metabolites (terpenoids) contained in the regions of cytoplasmic vesicles. Veeraragavathatham *et al.* (1985) reported high forskolin varieties of medicinal *coleus* such as Garmai and selection 1 in Attur, Salem District of Tamil Nadu. Harde *et al.* (2013) reported that the retrieval of forskolin was to the tune of 77.08% when pre-conditioned with ultrasonication and commercial enzymes and further, the use of methanol as an entrainer maximized the recovery of forskolin.

## 3. Pharmacological and therapeutic properties of forskolin

Forskohlin is an extract only from the root of the Indian plant *C. forskohlii*. Higher quantities of forskolin are noticed in the root portions rather than in other plant parts. The tuberous roots of the plant store the forskohlin within their cells that occurs especially in the bark region. From *C. forskohlii*, forskoditerpenoside with A and B forms together with other diterpenoids were also recorded besides traceable quantities of citronellal,  $\alpha$ -amyrin,  $\beta$ -sitosterol, and betulinic acid,  $\alpha$ -cedrol,  $\alpha$ -cedren (Salehi *et al.*, 2019). Over the centuries, Ayurvedic medicine were utilized to address conditions such as underactive thyroid, heart disease, and respiratory disorders. While laboratory studies have demonstrated its anti-inflammatory and blood-pressure-lowering effects. Furthermore, the use of forskolin as an oral supplement has proved with limited research

findings. Extracts of *C. forskohlii* from Brazil, Africa, and India were subjected to chromatographic examination, which showed that the plants in each region generate distinct chemicals (Tandon *et al.*, 1979). Srivastava *et al.* (1986) reported that plants with smaller leaf areas and higher dry root weights yielded more coleonol (forskolin). To identify forskolin-rich strains of *C. forskohlii* with higher root biomass, Vishwakarma *et al.* (1988) investigated and reported variants for genetic parameters such as forskolin content and yield of roots. They found that forskolin content varied from 0.01% to 0.44%, with the highest content of 0.44% (compared to the control average of 0.10%) recorded in genotype IH-1. In China, the naturally occurring *C. forskohlii* contains 1-acetyl-forskolin as a principal component and these variations were ascribed to either climate or genetic factors (Shah, 1996). Krishnan (2001) noted that the forskolin content in cultivated varieties was approximately 0.4%.

The main active ingredient in the Ayurvedic plant *C. forskohlii* (Labiatae), which has been utilized in India since ancient times, is forskolin, a labdane diterpene. Habitually, it has been used to treat

ailments like respiratory illnesses, dermatitis, colic, congestive heart failure, hypertension, painful urination, and insomnia (a disorder that causes problems getting to sleep, remaining asleep, or having non-restorative sleep) and convulsions (muscle contractions that can cause uncontrollable shaking or twitching). These conventional applications have been validated by contemporary clinical research, which also points to its possible therapeutic advantages in treating asthma, angina (a form of discomfort or soreness in the chest that arises when the heart muscle does not receive enough blood that is rich in oxygen), psoriasis, and preventing cancer metastases (Patel, 2010). A labdane diterpene called coleonol, which is produced in plant cells plastids and currently explored by the pharma industries for larger-scale extractions. Diterpene synthases use the substrate protonation of the first precursor, geranyl geranyl diphosphate, to synthesise forskolin. The presence of forskolin exhibited a bone conserving results mediated through osteogenic and anti-resorptive mechanisms resulting in the maintenance of bone mass, microarchitecture, material, and strength (Kulkarni *et al.*, 2023).



Figure 1: *Coleus forskohlii* Briq. - plant and tubers.

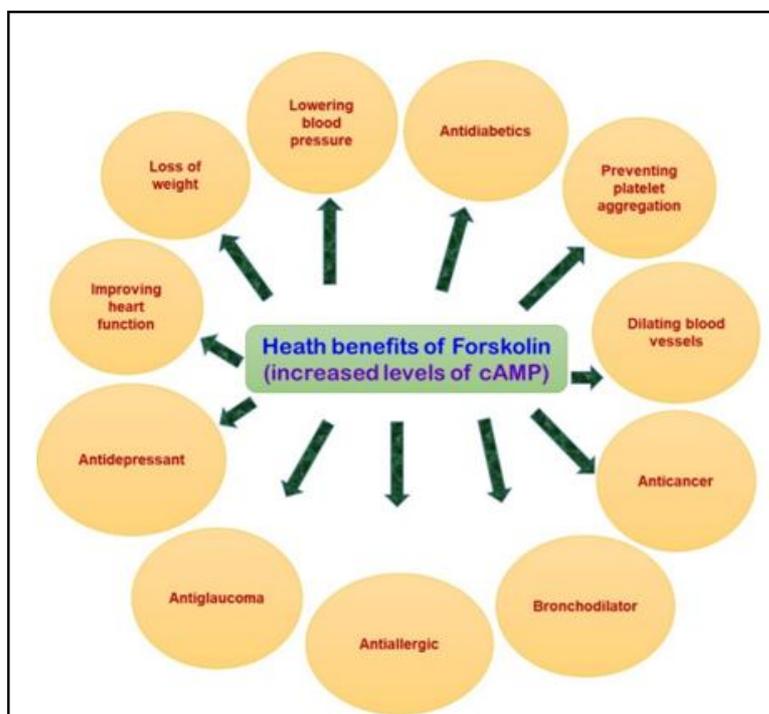


Figure 2: Health benefits of forskolin.

The various applications of forskolin in the pharmaceutical industry are appended hereunder:

### 3.1 Cardiovascular disease

Forskolin, the active compound found in *C. forskohlii*, has shown potential in the treatment of cardiovascular diseases due to its adroitness to stimulate the adenylate cyclase enzyme. This enzyme exaggerate levels of cyclic adenosine monophosphate (cAMP) in cells, which can lead to various beneficial effects on heart function and blood vessels. Some of the ways forskolin may help in managing cardiovascular diseases include:

**Lowering blood pressure:** Forskolin can help to lower blood pressure by tranquilizing the blood vessels muscles, which is beneficial for individuals with hypertension. Further, diastolic blood pressure is narrow down without any escalation in myocardial oxygen consumption.

**Improving heart function:** Forskolin can enhance myocardial contractility and helps in proper pumping of the heart. This can be particularly useful in conditions like congestive heart failure.

**Preventing platelet aggregation:** Forskolin reduce the platelet aggregation which subsequently helps to thwart blood clots that can end up to heart attacks or strokes. Forskolin has been shown to reduce the aggregation of platelets by directly activating the enzyme adenylate cyclase in platelet membranes, leading to an increase in intracellular cAMP. The antiplatelet properties of forskolin plays a significant role in preventing the cancer metastasis and managing conditions, *viz.*, occlusive arterial diseases. Further, it has been reported that forskolin can function synergistically with other antiplatelet agents like prostaglandin E1 (PGE1) and adenosine, further augmenting its inhibitory effects on platelet aggregation.

**Dilating blood vessels:** By increasing cAMP levels, forskolin encouraging blood artery dilatation, besides enhancing the flow of blood and minimizes the strains in the heart. At lower concentrations, forskohlin responds as a vasodilating substance (Schlepper *et al.*, 1989).

### 3.2 Glaucoma

A category of eye diseases called glaucoma that harm the optic nerve and are responsible for blindness and loss of vision. A class of eye disorders known as ‘glaucoma’ that harms the optic nerve, which is necessary for healthy vision. This impairment is frequently caused by an anomalous high pressure in the eye, known as intraocular pressure (IOP). Further, Forskolin at 1% concentration was found to be better at curing open-angle glaucoma. The regulation of alterations in the quantity of aqueous humour is significantly influenced by intraocular pressure (IOP) (Kaik *et al.*, 2014).

### 3.3 Bronchodilator and antiallergy

Allergic reactions happen when a person’s immune system responds to an allergen and the best examples for allergens include food items, mould growth, pollens, insect bites, ticks from pets and mainly through the medication (drugs). The process of relaxing the lung muscles to facilitate airways to aid the better way of breathing is known as bronchodilation. Forskohlin possesses bronchodilator activity besides antiallergic properties, and it has antioxidant properties as well. The stimulation of cAMP by forskolin prevents human mast cell and basophil degranulation (Marone *et al.*, 1986). Additionally, forskolin has the ability to prevent the synthesis of histamine, eotaxin, and interleukins (Eleno *et al.*, 1999; Yoshida *et al.*, 2001; Couve *et al.*, 2002).

The consumption of forskohlin improves bronchodilator, which in turn helps the asthma patients to have better curative effects (Salehi *et al.*, 2019).

### 3.4 Anticancer

Cancer is an universal term that refers to a vast spectrum of disorders that can develop in any part of the body in a rapid manner, which are also recognized as ‘neoplasms’ otherwise called as ‘malignant tumours’. A key characteristic of cancer is the expeditious production of unusual and uncharacteristic cells that grow out with their normal limits, potentially occupying nearby tissues and proliferate to other organs. This spread is recognized as metastasis, which is the main root cause of cancer associated deaths. Cancer is one of the main causes of death worldwide, accounting for over ten million deaths in 2020 (Ferlay *et al.*, 2020). During 2018, a greater number of cancer patients were detected, and this was one of the major issues in countries having income sources between low and middle (De Martel *et al.*, 2020). There is a significant disparity and divergence in the availability of treatment between nations with different wealth levels. Over 90% of high-income countries supposedly receive full treatment comprehensively, whereas less than 15% of low-income countries do not had these oppurtunities (World Health Organisation, 2020). Through cAMP signalling mechanism, forskohlin provides anticancerous effects in humans. Forskolin also provides a potential mechanism to inhibit the cell growth and survival of colon cancer (McEwan *et al.*, 2007; Sapio *et al.*, 2017). Colonisation of the tumour was greatly suppressed by the intake of forskolin (Agarwal, 1983).

### 3.5 Antidiabetics

A chronic, metabolic disorder characterized by higher amounts of glucose levels in blood (or blood sugar), which can affect the heart, blood vessels, eyes, nerves, and kidneys over time. As stated by World Health Organisation, globally, there were 422 million diabetic people reported to dwell in low to middle earning nations and diabetes causes 1.5 million fatalities per year. The intake of forskolin controls the diabetics through the enhanced levels of elevated cAMP (Holz *et al.*, 2004).

### 3.6 Loss of weight

The amount of energy consumed as food and the amount of energy expended during daily activities determine body weight. A lifestyle with unhealthy food habits aggravates the accumulation of fat, which in turn leads to life-threatening diseases. Forskohlin significantly decreases body fat and promotes the leanness of the body (Godard *et al.*, 2005; Han *et al.*, 2005; Henderson *et al.*, 2005; Shivaprasad *et al.*, 2014). Further, it possesses the bodybuilding mechanism for humans. The extract of *C. forskohlii* showed significant effects on weight loss and was safe and effective in reducing body fat in obese and overweight individuals (Kamohara, 2016).

### 3.7 Antidepressant

Depression is a usual mental health condition having a persistent feeling of despondency, wretchedness, and a lack of curiosity in actions that were once pleasurable. The transitory feelings goes beyond the sadness or misery and affects a person’s thoughts, feelings, behaviours, and overall functioning. Depression is a mental condition characterized by a constant feeling of sadness and a loss of interest in activities. This is also called as major depressive disorder and it influences your emotions, thoughts, and behaviour, potentially causing

a range of emotional and physical issues. Globally, 280 million people have depression which affects around 3.8% of the population, including adults @ 5% (males @ 4% and women @ 6%) and 5.7% of those above the age of sixty (Woody *et al.*, 2017; Institute of Health Metrics and Evaluation, 2023). Forskolin is believed to function as an antidepressant by increasing cAMP levels (Patel and Saraf, 2016).

### 3.8 Antipsoriasis

A lingering autoimmune skin condition called psoriasis that has distinctness by the quick growth of skin cells, spearheading to dense, red, scaly flecks on the skin. This is a long-term disorder in the skin that triggers an overactive immune response, causing skin cells to multiply rapidly. This results in inflamed, scaly patches, typically found on the scalp, elbows, or knees. It affects people of all ages, genders, and ethnic backgrounds across all countries. Psoriasis was found in the range of 0.09 to 11.4% (Gibbs, 1996; Danielsen *et al.*, 2013), and it was in the range of 1.5 to 5 in the developed nations (Parisi *et al.*, 2013). The consumption of forskolin regulates the skin cAMP levels and exerts better curative effects on the affected persons.

### 3.9 Hypothyroidism

Forskolin increases the quantity of stimulatory guanine nucleotide-binding proteins in the body, resulting in increased thyroid hormone production and release (Bauer *et al.*, 1993; Patel and Saraf, 2016). Forskolin promotes normal body weight through its mechanism of action by stimulating the thyroid to increase metabolism. Forskolin can regulate the thyroid function, which in turn reduces the depression in humans. Further, forskolin was reported to enhance the production and release of thyroid hormone. Forskolin is a strong activator of adenylate cyclase in thyroid gland and its secretion was considerably increased than TSH stimulation (Laurberg, 1984). Later Kasai *et al.* (1985) opined that forskolin stimulates adenylate cyclase in human thyroid membranes about 7-fold increase with half-maximal stimulation occurring between 5 to 10  $\mu\text{m}$  and supported that the diterpene forskolin stimulates adenylate cyclase in human thyroid membranes by a novel mechanism that differs from TSH- or Gpp (NH) p-stimulation.

### 3.10 Asthma

Forskolin has been investigated as a bronchodilator for its potential use in asthma treatment (Bauer *et al.*, 1993). In humans the findings of Marone *et al.* (1986) affirmed that the release of histamine and leukotriene was blocked by forskolin. In patients with mild persistent or moderate persistent asthma attacks the investigation of Sanchez *et al.* (2006) proved that oral consumption of forskolin in the form of capsules (10 mg/day) is more effective than sodium cromoglycate treatments with two inhalations at every 8 hours (three times a day) respectively. Huerta *et al.* (2010) reported that there was no statistically significant difference between the forskolin and beclomethasone treatment for any lung function parameter at baseline or after treatment period. The intratracheally admission of forskolin inhibited the bronchospasm with a short duration of action and *in vitro* forskolin inhibited contractions of lung parenchyma provoked by histamine, LTC<sub>4</sub> or antigen (Kreutner *et al.*, 1985). The production of interleukins (IL-13, IL-5, and IL-1 $\beta$ ), eotaxin and histamine was inhibited by the forskolin activity (Hiramitsu *et al.*, 1994).

### 3.11 Other effects

Fibrosis of the liver was characterized by the excessive accumulation of scar tissue in the liver. Chronic liver injury or inflammation is usually the cause of liver fibrosis. Cirrhosis, liver failure, and even liver cancer can sometimes be caused by this type of scar tissue that disrupts normal liver function and blood flow. Forskolin considerably reduces the hepatic fibrosis induced by CCl<sub>4</sub> as specified by lower levels of  $\alpha$ -SMA expression and collagen deposition. Forskolin co-treatment significantly reduced the oxidative stress and inflammation, reduced TGF- $\beta$ 1 levels considerably and down-regulated mRNA expressions. Forskolin has promising antifibrotic effects which could be partly attributed to its antioxidant and anti-inflammatory properties as well as the inhibition of Hh signalling, mediated by cAMP-dependent activation of PKA (Agroudy *et al.*, 2016). Umegaki *et al.* (2014) reported that the extracts of *C.forskohlii* known to induce the fatty liver through the higher level of expression of specific lipogenic mRNAs. This was evident by enhanced levels of multiple transcripts containing mRNAs encoding enzymes acetyl-CoA carboxylase and long-chain elongase; transcription factor peroxisome proliferator-activated receptor gamma (PPAR $\gamma$ ) and lipid-droplet-associated fat-specific protein 27 (Fsp27). In a rat model experiment by Agroudy (2015) reported that forskolin is more effective against liver injury and exhibited showed preventive effect against carbon tetrachloride (CCl<sub>4</sub>) induced liver damages.

### 3.12 Potential side effects and toxicity

The intake of forskolin induces the production of thyroid hormones in the human system, which can be observed through the gain in body weight, thereby normalising the body functions. Forskolin when administered intravenously, it leads to risks *viz.*, low blood pressure, flushing, and fast heartbeats. Haritha Yadav *et al.* (2022) found that forskohlin does not produce any side effects when administered through oral exposure. Forskolin is generally considered safe when used appropriately, but like any supplement, it can have side effects and potential toxicity, especially when taken in excessive amounts or combined with certain medications. It can cause a significant drop in blood pressure because it may act as a vasodilator and may lead to symptoms such as dizziness, light-headedness, and fainting. Further, forskolin can interrelate with certain prescriptions, *viz.*, blood thinners, anti-hypertensive drugs, and medications for heart conditions, which may intensify the threat of adversative effects. In addition to the above, intake of forskolin might escalate the jeopardy of bleeding, predominantly in people with bleeding ailments or those taking medications for anticoagulant or antiplatelet activity. Under these circumstances, notable care must be taken before consumption to achieve the appropriate health benefits.

## 4. Conclusion

Coleus, a member of the Lamiaceae (Labiatae) family, includes around 300 species, both annual and perennial. In India, *C. forskohlii* is found across a wide geographic range, flourishing in the semi-tropical (sub-tropical) and mild to balmy (warm) climates of the lesser Himalayas and also reported in Nepal, Burma, India and Thailand. The leaves of coleus contain rich quantities of flavones, flavonols and polyphenols besides their antioxidant properties. Forskohlin is an extract only from *C. forskohlii*. Higher quantities of forskolin are noticed in the root portions rather than in other plant parts. The tuberous roots of the plant store the forskohlin within their cells

that occurs especially in the bark region. This Ayurvedic herb has been utilized in India since antiquity. Traditionally, forskolin was employed to manage conditions such as hypertension, acute heart failure, eczema (atopic dermatitis), colic, respiratory complaints, painful urination, insomnia (suffering asleep situations) and convulsions (contraction of muscles involuntarily). Recent clinical findings have supported these conventional (orthodox) uses and suggested its potential healing benefits in treating asthma, angina, and psoriasis and preventing cancer metastases. Forskolin is generally considered safe when used appropriately, but like any supplement, it can have side effects and potential toxicity, especially when taken in excessive amounts or combined with certain medications.

### Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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