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FORSKOLIN-A NATURAL ROOT EXTRACT OF COLEUS FORSKOHLII- A MINI REVIEW

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Introduction

Coleus plants, a naturally occurring tuber crop, are durable and easy to grow. They are best known for their bright colours, and variety of foliage forms. Although they are technically a "tender perennial" (even the slightest frost will cause them to die), they are most often considered to be an annual plant by growers and seed producers. In traditional Asian systems of medicine, Coleus is used for a variety of purposes, including treating skin rashes, asthma, bronchitis, insomnia, epilepsy and angina. Coleus Forskohlii Extract is an ayurvedic herb. It has been identified as the primary chemical of interest in the plant. Forskolin activates an enzyme cells known as adenylatecyclase. This enzyme increases the level of cyclic AMP which is the most important cell regulating compound in the body.

An increased level of cyclic AMP improves circulation, decreases histamine releases and allergic compounds, improves the contraction of heat muscle, relaxes arteries which promote normal blood pressure, increases insulin secretion which in turn supports normal sugar levels in the blood, promotes relaxation of bronchial muscles promoting normal breathing and lastly supports improved fat breakdown. It has been demonstrated that adipose tissue metabolism varies from one region of the body to another, for example, in severely obese women losing weight after the jejuno-ileal bypass surgery, fat was seen to be absorbed more slowly in the thigh region than the abdominal region. These differences lead to the hypothesis that localized application of agents

that trigger lipolysis or fat breakdown could help in cases of fat accumulation at specific subcutaneous sites. Forskolin accelerates lipolysis through the activation of hormone-sensitive lipase**.** Coleus forskohlii and other related species were used in Ayurvedic medicine under the name pashanabhedi for heart and lung diseases, intestinal spasms, insomnia, and convulsions. It was studied for cardiovascular activity in 1974 by scientists from Hoechst India and the Central Drug Research Institute of India in screening programs that examined medicinal plants.

Isolation and Quality Control

As a result of screening programs, forskolin has been identified as the major active hypotensive principle of the roots of *Coleus forskohlii* The absolute stereochemistry of forskolin was determined by X-ray crystallography The other most abundant diterpene in the plant, 1, 9-dideoxy-forskolin, had no hypotensive activity 11. Subsequently several closely related diterpenes have been isolated from the roots and aerial portions of the plant including stigmasterol Saleem *et al.* have described an isolation procedure that yields forskolin of 96.9% purity Because forskolin has been actively pursued as a drug development lead, there have been many analytical methods have been developed for analysis of the same. A gas-liquid chromatography (GLC) method was developed for quantitation of forskolin in plant tissues and in dosage forms Both thin layer and high performance liquid chromatographic (HPLC) methods have also been published The GLC method was more sensitive but the HPLC method was found to be more rapid The HPLC method has been used to monitor variation in forskolin content in different germplasms A monoclonal antibody specific for forskolin has been developed for affinity isolation of forskolin The same antibody also has been used for extremely sensitive quantitation of forskolin in plant tissues at different stages of developmen.Nuclear magnetic resonance (NMR) and gas chromatography-mass spectral methods have also been published for forskolin and its congeners Tissue culture methods for forskolin production have been successfully explored because the low content of forskolin in the plant has limited its development as a drug product Recently HPLC-ELSD fingerprint of *Coleus forskohlii* was described by Wu *et al*. Forskolin being a biomarker is considered for quantification as a parameter. Recently HPLC-ELSD fingerprint of *Coleus forskohlii* was described by Wu *et al*. . Forskolin being a biomarker is considered for quantification as a parameter for the quality control of products containing *Coleus forskohlii* root.

PHARMACOLOGICAL ACTIONS

Cardiovascular Disease

The platelet aggregation and inhibiting effects of forskolin add to its value in cardiovascular disordersForskolin significantly lowers blood pressure via relaxation of vascular smooth muscles . It reduces diastolic blood pressure without increasing myocardial oxygen consumption . Further it increases cerebral blood flow indicating it may be beneficial in cerebral vascular insufficiency and in enhancing post -stroke recovery . Due to its vasodilating properties,forskolin has been proposed for intercarvenosal treatment of erectile dysfunction based on small scale clinical studies have been reported.

Asthma and Allergies

Forskolin's activation of cAMP inhibits human basophil and mast cell degranulation , resulting in subse quent bronchodilation .Research has demonstrated aerosolized dry forskolin powder.

Cancer

Forskolin reduced tumor colonization (melanoma cell line – BF16F10) in the lungs by 70 % . Applied with rolipram, fors kolin provides a route to inhibition of colon cancer cell growth and survival.

Weight Loss

One clinical study reported forskolin's role in increasing lean mass, bone mass and testosterone in the subjects involved . This research has led to companies marketing forskolin as a bodybuilding supplement. *In vitro* and animal studies demonstrate lipolysis in fat cells is stimulated by forskolin via activation of adenylate cyclase and increased levels of cAMP. A patent claiming promotion of lean body mass and antidepressant activity of forskolin containing extract was granted to the supplement company Sabinsa in 1998.

Other Clinical Indications

Forskolin has been shown to stimulate digestive secretions, including hydrochloric acid, pepsin, amylase, and pancreatic enzymes , suggesting clinical benefit in digestive disorders and malabsorption. An *in vitro* research has indicated forskolin has potent immuno-stimulation properties . Forskolin increases skin's natural resistance to UV light and stimulates a tanning response when applied topically.

Drug Interactions

Forskolin should be avoided in conjunction with anticoagulant medications and with antihypert ensive agents as it may have a potentiating effect on these drugs.

Contraindications

Caution should be used cautiously in patients suffering from ulcers , low blood pressure , bleeding disorders or those on blood-thinning medication and in diabetics due to stimulation of lipid release and gluconeogenesis.

CONCLUSION

Forskolin, being a molecule that elevates cAMP in turn is responsible for most of the pharmacological actions of *Coleus forskohlii* root. This herb is used in various traditional medicine and thousands of products are available in market. Products are standardized on account of their forskolin content. Many of its derivatives have been synthesized in an effort to improve efficacy and safety. Molecules having effect on cardiovascular system, bronchodilatory effect, prevention of platelet aggregation, anti inflammatory effect Forskolin possesses all these properties and due to its versatility may be made into many formulations. This molecule can be taken as lead compound and could be further improved via quantitative structure activity relationship studies. It provides a vast scope of research in a variety of therapeutic areas and enjoyed market successes.

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