

Forskolin - A Natural Root Extract of *Coleus forskohlii***Balaram Ghosh¹, Manas Chakraborty^{2*} and Arindam Chakraborty²**¹Department of Pharmaceutics, Calcutta Institute of Pharmaceutical Technology and AHS, Banitabla, Uluberia, Howrah, West Bengal, India²Department of Pharmaceutical Biotechnology, Calcutta Institute of Pharmaceutical Technology and AHS, Banitabla, Uluberia, Howrah, West Bengal, India***Corresponding Author:** Manas Chakraborty, Department of Pharmaceutical Biotechnology, Calcutta Institute of Pharmaceutical Technology and AHS, Banitabla, Uluberia, Howrah, West Bengal, India.**Received:** May 06, 2021**Published:** June 11, 2021© All rights are reserved by **Manas Chakraborty, et al.****Abstract**

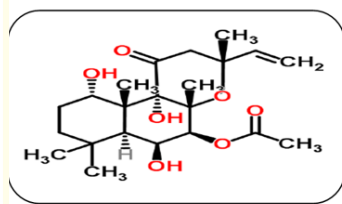
Novel drug delivery system is one of the novel approach towards the drug delivery system. Through this, the limitations of traditional drug delivery systems has been addresses. Limited studies have shown that the extract of *Coleus forskohlii* may helps in weight management. Some randomized double blind placebo- controlled study shows that the effects of the *Coleus forskohlii* extract with supplementations will be one of the key markers of different metabolic parameters of overweight and obesity. Countries like Africa, UAE, Brazil, *coleus forskohlii* used as a medicine whereas in India the root tubers of *coleus forskohlii* plant has been prepared and eaten as a seasoning food and in some part of India it is used a traditional Ayurvedic medicine. There are some chemical studies also indicates that the alcoholic extract of *Coleus barbatus* root tubes generated in the isolation of labdane diterpene forskolin (Coleonol), which has a great impact in the research of the roles of enzyme adenylate cyclase and cyclic- AMP in human cellular physiology. Diseases like hypertension, asthma, glaucoma as well as some of the certain cancers we can use this compound eventually. *Coleus forskohlii* root extract used in different drug development studies for proper and better bioavailability which serving superior patients' compliance. So, this review gives a glimpse of studies of this traditional herb in human welfare.

Keywords: *Coleus forskohlii*; Forskolin; Placebo Controlled, Bioavailability, Anti-obesity, Coleonol**Introduction**

Coleus forskohlii one of the predominant indigenous medicinal herb in India. It has been uses as a traditional medicinal plant in Countries like Africa, UAE, Brazil but in India it has been used a traditional Ayurvedic medicine healing different disorders, not only that *Coleus forskohlii* is only source of the diterpenoid forskolin. Diseases like eczema, psoriasis, asthma, cardiovascular disorders, hypertension, etc. are treated by using Forskolin and it also assumed that decreased intracellular cAMP level is a dominant factor in development of disease process [1]. This herb in different formulations has long been used for development of lean muscles in athletes as it is found to reduce fat in obese patients with its im-

portant role in enzymes adenylate cyclase and cyclic AMP in cellular physiology. Naturopathic treatment for obesity has been increasing in recent times because major amount of anti-obesity drug which are approved in market most of the drugs been withdrawn because of various adverse effects. So using of different traditional herbs and their active phytoconstituents have been used for treating obesity and different other diseases. Some of the medicinal plants and it's active constituents were also passed in clinical trials in the treatment of obesity. Some of the clinical trials are going on [2,3]. Forskolin was developed as floating drug delivery system for gastro retentive activity and attempt is also being made to develop into phytosome that is nanosomal drug delivery system whereby

particle size is reduced to target the drug for specific therapeutic purpose. Forskolin activates adenylatecyclase, an enzyme cells. Adenylatecyclase helps to increase the cyclic-AMP level. This increased cyclic-AMP level enhance circulation, decreased the release of histamine and different allergic compounds helps to relaxes arteries and improves blood flows and pressure, improves relaxation of bronchial muscles and helps in breathing, increasing the insulin secretion level control blood sugar level and at last it's helps to fat breakdown. So different studies are going on to find morphology, pharmacological activities, phytochemical activities, biotechnological approaches, analytical methods for *coleus forskohlii* [4].



(a) Chemical structure of Forskolin

(b) Indian coleus plant (*Coleus forskohlii*)

Figure

Review of Literature

Novel drug delivery system is novel approach to overcome the various limitations of traditional drug delivery system. Phytosomes are recently introduced herbal formulation that are better absorbed and as a result produce better bioavailability and actions than the conventional phytosomes molecules or botanical extracts. In the recent days, most of the prevailing diseases and nutritional disorders are treated with natural medicines. For a long time herbal medicines were not considered for development as novel formulation owing to lack of scientific justification and difficult in processing like identification, extraction and standardization of that individual drug components. If the term 'Phytosome' separated into two part then the term 'phyto' means plant or herb and other term 'somes' means cell-like. So Phytosome have enhanced different pharmacological parameter which makes improvement on the treatment of acute and chronic liver disease [5].

The basic objective of this study to identify the antimicrobial activities, different phytochemicals constituents, and Gas-Chroma-

tography- mass spectrometry (GC-MC) analysis of *Coleus forskohlii*. Aqueous extract of *coleus forskohlii* with different solvents such as chloroform, acetone, ethanol found to be a pharmacologically important and its antimicrobial activities were also studied. In the phytochemical studies it shows that most of the ethanol extract with leaf, root and stem having secondary metabolites such as flavonoids, alkaloids, terpenoids, steroid, tannins, saponins. Ethanol extract of *coleus forskohlii* root was studied by GC-MS analysis. In the antimicrobial studies it shows that ethanol extract of *coleus forskohlii* root showed maximum activity. The maximum activity was observed against *Klebsiella pneumonia* (19 mm) and *Candida albicans* (16 mm) in ethanol extract of the *coleus forskohlii* root [6,7].

Forskolin have topical ocular application also. Diterpene in *coleus forskohlii* increases adenosine monophosphate by reviving adenylatecyclase without intraocular pressure, mediation of cell surface in different volunteers, monkeys, rabbits those were cured from eye disease. In a man 50 microlitres of topical solution of 1% *Coleus forskohlii* extract outstandingly lowered intracellular ocular pressure (IOP) within 1 hour and the peak of the effect shown on 2 hour but the total effect was significant for 5hours. Outflow pressure fell by 70% on the average. Forskolin and its analogues represent a replacement class of medicine active against glaucoma which differ in their molecular actions from any previously [8].

Forskolin is a potent platelet aggregation inhibitor. And some studies has been done for its effects on (a) Pulmonary tumor colonization in mice (b) Tumor induced human platelet aggregation. This studies performed a subline of B16 murine melanoma. 2 μM of Forskolin heavily inhibits melanoma cell which induced human platelet aggregation. 82 μM /per mice single dose of Forskolin introduced traperitoneally 30 or 60 min earlier of the tail vein injection of B16F10 cells and its decreased tumor colonization in lungs more than 70%. Some others studies also had same result. So, from these studies it raise the probabilities that forskolin could have effects for the prevention of cancermetastasis [9,10].

In India *Coleus forskohlii* used as an ayurvedic medicine for many years. Many clinical trials reported that *Coleus forskohlii* extract has weight loss property. A study has performed for checking safety and efficacy of the *Coleus forskohlii* extract. On that study 29 healthy subjects were introduced for the trail and over a 4 week

period increasing the rate of the dose from 250 to 1000 mg. After the study reported that for the intake of *Coleus forskohlii* extract some of subjects associated with minor gastrointestinal side effects like diarrhea and soft stool. After taking each dose 6 - 7 subjects reported minor gastrointestinal events and also reported that the *Coleus forskohlii* formulation will be tolerated up to 1000mg daily basis orally [11].

Ocular solution have a poor bioavailability due to their dilution and drainage from the eye. This problem can be overcome by using in situ gel forming ocular Drug Delivery System which can be prepared by polymers and will exhibit sol to gel transition. The main aim of the study was to prepare a solution of in situ gel of forskolin which is an antiglaucoma agent by using an activated polymer carbopol 940, sodium alginate hydroxypropyl methyl cellulose as gelling agent and viscosity enhancing polymer respectively. The solid dispersion of forskolin can be prepared by kneading method with beta cyclodextrins as solubility enhancing agent. 1:4 ratio solid dispersion has been selected for further preparation of ocular solution dependent on pH and ion activated in situ gels. 23 factorial design has been employed to prepare the solution considering different Polymers as independent variables sol to gel transition time in seconds, in vitro percentage of drug release as dependent variables. The final formulation has been prepared successfully and assessed for further appearance, gelling capacity, pH, drug release, drug content, viscosity and after all the assessment the f-9 formulation has been found to be the best optimized formulation which has been developed by 23 factorial design and the antiglaucoma activity of this formulation is found to be up to eight hours [12,13].

DCGI first approved forskolin in 2006 as a the first pharmaceutical drugs derived from plant southwest. The plant origin of forskolin is *Coleus forskohlii*, which is diterpenoid in nature. Forskolin has lipid soluble property by which it can penetrate cell membranes also stimulates adenylatecyclase enzyme, which help to stimulate ciliary epithelium for the activation of cyclic adenosine monophosphate, in which aqueous humor inflow were reduced by decreasing of intraocular pressure (IOP). Effects of some anti-clotting medication such as aspirin, enoxaparin, warfarin etc. may be enhanced by forskolin. Forskolin has excellent shelf-life of almost five years [14].

Glaucoma is one of the most common progressive optic neuropathies leading to blindness. There are different studies have stated about forskolin which increases the cyclic AMP concentration in the ciliary body epithelium of the eye results in decreased aqueous humour production and increased ciliary body blood flow. In the

study the forskolin can be a natural source of treatment to lower the intraocular pressure.

Methods

19 subjects without any systemic ocular conditions with normal intraocular pressure have completed the study. Subjects were introduced to 500 mg oral forskolin taken daily before dinner for 28 days. Blood pressure, heart rate, monocular visual activities were evaluated at the beginning and after the test.

Results

Total 38 eyes were evaluated. Amongst these 38 eyes 18 eyes were treated with forskolin and 20 eyes were treated with the placebo drug. In the forskolin treated group the intraocular pressure before the test and after the test was 18.3 mmhg and 15.2 mmhg respectively and the P value was 0.000. For the placebo treated group the intraocular pressure was initially and after the test was 15.9 mmhg and 15.2 mmhg respectively and the P value was 0.054.

Conclusion: According to the hypothesis the forskolin can lower the intraocular pressure but practically it is significant after the test. Forskolin has a great potential to be the alternative medication to treat glaucoma in the future [15,16].

Discussion on Different Literature Reviews

Based on different formulation development studies, it is opined that traditional herb forskolin with a potent anti obesity effect can be formulated in different dosage forms. As a gastroretentive floating delivery it can be successfully employed as a controlled release formulation for athlete lean muscles. Apart from this, as an improved ophthalmic gel it is used for better management of glaucoma which is an alarming disease in different parts of world. Formulation development as anhydrotroph, the solubility parameters of the herb may be greatly increased. Various extraction methods of extraction of this drug from roots of *Coleus forskohlii* have been standardized to get the drug in pure form for various formulation development studies. An attempt is initiated to develop a phytosomal drug delivery system of forskolin which is natural mode of delivery of nanosome for better patient compliance with less side effects. This extract can be successfully applied for ocular treatment specially in the case of glaucoma. It reduces intraocular pressure thus reducing glaucoma to a great extent. The management of obesity can be successfully done with this extract with no side effects.

Conclusion

Different formulation development approaches with respect to the traditional herb forskolin improve the bioavailability of the drug and also target the drug towards the specific site of action with better patient compliance. The herb being a root extract of *Coleus forskohlii* and diterpenoid in nature has various pharmacological effect including effects on lean muscle and traditionally used by athletes since long. With the advancement of modern pharmaceutical technology, this traditional herb is being attempted to develop into a nanosomal drug delivery system better called as phytosome which is a new approach to use the herb as an anti-obesity drug. Obesity is a worldwide problem leading to generation of cardiovascular disorders, diabetes and other life threatening diseases. India being a rich source of natural herbs can play an important role in applying modern technology to natural resources for a wider and novel approach to drug development.

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