PHYTOCONSITUTENTS AS BIOENHANCERS: A REVIEW

Abstract

Bio-enhancers are the compounds that enhance the bioavailability of active pharmaceutical ingredients without itself having any mechanism of action. Many of them are of natural origin and do not have any side effects. They enhance the bioavailability by influencing many mechanisms of the body. Usage of these systems helps to reduce the dose frequency which in turn reduces the toxicity and cost-effective products. Present days they are widely used to enhance the bioavailability of anti-bacterial, anti-viral, antibiotic, anticancer, anti-inflammatory, cardiovascular drugs etc. The present review is to concise the importance of bio-enhancers, their classification based on type of origin and different types of available in the nature.

Keywords

Importance of bio-enhancers, classification, types of bio-enhancers

Introduction

Bio-enhancers are the molecule that enhances the plasma concentration and further promote the efficacy of drug. They have no pharmacological activity by themselves and easily eliminated from the body without causing any side effects.Not only increases the bioavailability of active pharmaceutical ingredients like anti-bacterial, anti-fungal, anti-viral, anti-inflammatory, antibiotics, cardiovascular drugs etc. and also for nutrients and vitamins. They promote the enhanced bioavailability by elevating intestinal absorption, blocking drug metabolising enzymes which further stops liver and intestinal degradation, blocking efflux mechanisms resulting in the block of drug elimination by gut and bile, increasing porosity towards micro-organisms and blocking their defence system, binding to DNA and proteins of pathogens, reducing the transport of drug molecules through blood – brain barrier system.

Importance of Bio-enhancers

Reduction in quantity of dose intake due to enhanced plasma drug concentrationCost reduction due to reduced intake of drugReduced side effects due to less usage of drugIncreased drug toleranceReduction in drug resistance due to increased drug toleranceProtecting the valuable plants due to less usage of drug constituents

Bio-enhancers classification

Table 1: Two types based on thesource of origin – Plant origin and animal origin

Plant origin	Piperine
	Quercetin
	Curcumin
	Allicin
	Ginger
	Glycyrrhizin
	Naringin

	Cuminum cyminum
	Carum carvi
	Stevia
	Niaziridin
	Lysergol
	Aloe vera
	Simomenine
	Genistein
	5-methoxy hydnocarpin
	Ammania multiflora
	Capsaicin
	Capmul
	Peppermint oil
	Gallic acid
	Ellagic acid
	Ferulic acid
Animal origin	Cow urine distillate

Piperine

Alkaloid obtained from the plant Piper nigrum and piper longum belonging to the family piperaceae. Raw form of pepper is blackcoloured,round shaped and normally used in house hold purpose as spice and condiment. Tastes pungent and not soluble in water. Piperine is the main constituent of pepper, other isomers like isopiperine, chavicine, isochavicine and piperanine are also available in these plants. Piperine is having bioavailability strengthening, Nervous system protection, anti-inflammatory, antioxidant and anticancer properties (1, 2). Found to have bio enhancing effect on vaccine, pyrazinamide, indomethacin, phenytoin, ciprofloxacin ibuprofen etc.(76)

Quercetin

Natural flavonoid, Polyphenol and antioxidant available in fruits (citrus fruits, apples, grapes, berry etc.), grains, vegetables (broccoli, onions etc.), wine, Coffee, Green Tea. Also available in medicinal plants like Hypericum perforatum, Ginkgo biloba and Sambucus Canadensis.It is having variable medicinal properties like Bio-availability improvement, anti-inflammatory, anti-allergy, lowering of Blood pressure, anti-cancer, and fighting heart problems, brain disorders, Anti-viral and antioxidant by fighting with free radicals. Also taken as supplement for Energy boostup(3,4). Found to enhance the bioavailability of verapamil, diltiazem, Paclitaxel, digoxin, tamoxifen etc.(77)

Curcumin

Brilliant yellow coloured compound obtained from Curcuma longa (turmeric plant) belonging to the family Zingiberaceae. It is the major compound of the turmeric extract (Curcumin - 60–70%, demethoxycurcumin - 20–27%, bisdemethoxycurcumin - 10–15%) and widely used in herbal medicines, cosmetics, food colouring and flavouring agent. Curcumin is a natural phenol compound which is in behind the yellow colour of turmeric. It is used as antiviral agent, antibiotic and in cancer chemotherapy.(5,6)

Allicin

Sulfur containing organic chemical compound obtained from garlic belonging to the family alliaceae. It is light yellow coloured oily substance that is accountable for distinctive odour of garlic. Biologically used as an antioxidant, normal cold and in the treatment of septicaemia by virus and fungus (7, 8). Found to have bio-enhancing effect on Amphotericin-B etc.(78)

Ginger

Rhizome derived from the plant Zingiber officinale belonging to family Zingiberaceae. The rhizomes are popularly used in food as spicing and flavouring agent. The colour inside the rhizome varies depending on the variety from yellowish, white and red colour.Traditionally ginger is provided with lots of health benefits like preventing motion sickness, headache, nausea, and voming during pregnancy, anti-inflammatory effects due to presence of gingerols, anti-cancer mainly towards colorectal cancer and kills tumor cells in ovarian cancer. Also helps in improving the immunity of the body (9,10,11,12,13). Found to have bioenhancing effect on Azithromycin, Erythromycin, Cephalexin, Cefadroxil, Amoxycillin, Cloxacillin etc.(78)

Glycyrrhizin

Sweetening constituent derived from the root of plant Glycyrrhiza glabra. Used as aromatic and flavouring agent in food and beverages, as conditioner in cosmetics for preserving moisture content. Medicinally useful in the treatment of severe hepatitis condition at predefined amounts. Using high doses leads to clinical hazards like high blood pressure and electrolyte imbalances (14, 15). Enhances the bioavailability of rifampicin, tetracycline, nalidixic acid, ampicillin etc.(78)

Naringin

Flavonoid naturally available in citrus fruits (bergamots, orange, lemons, mandarins), grapes and is the reason behind the sour taste of these fruits. It process powerful anti-inflammatory, antioxidant property and used in obesity treatment, sugar and high blood pressure. This composite system is probably used in food and pharmaceutical industry (16, 17). Enhances the bioavailability of Verapamil, Tamoxifen, Quinine, Clopidogrel, nimodipine, diltiazem etc(78)

Cuminum

Seeds derived from the plant cuminum cyminum belonging to the family apiaceae. These are dark brown colored seeds with aromatic flavor (cuminaldehyde, cymene, terpinoids) and used in food preparations. They help in reducing gas from stomach, gastric refreshment, helps in destruction of helminthes parasites. Oil derived

from the seeds is used in cosmetics (18, 19). Enhances the bioavailability of Ketoconazole, Erythromycin, Fluorouracil, Amoxycillin, Fluconazole, Cephalexin, Zidovudine etc.(78)

Carum carvi

Seeds derived from plant Carum carvi belonging to the family Apiaceae. These caraway seeds are having similarities with the cuminum cyminum seeds in shape and size. The aroma of the seeds is due to carvone oil, limonene and anethole and used as spice. Caraway seeds provide gas relief in stomach, loosen the bowel for easy defecation, formation of urine to eliminate excess body fluids. They improve the plasma concentration of antiviral, antifungal, antibiotics and chemotherapy drugs.(20, 21)

Stevia

Sweetener obtained from the leaves of Stevia rebaudiana. The sweetness is mainly due to two glycosides stevioside and rebaudioside which gives many times the sweetness than sugar. As an additive, food supplement and alternative usage of Stevia for sugar is benefit for diabetic patients and elderly people which help in low intake calories. (22, 23, 24, 25,26)

Niaziridin

Glycoside secluded from the leaves, pods and bark of the plant Moringa oleifera. Medicinally it is found to have arthritic pain relief activity, anti-teratogenic giving protection to the embryo and foetus, cholesterol reduction, liver protection, anti-fertility, anti-microbial, anti-fungal, anti-cancer, anti-inflammatory, spasmolytic, anti-fungal, anti-ulcer, antioxidant activity (27, 28). Found to have bio-enhancing effect on anti-fungal drugs etc.(78)

Lysergol

An alkaloid belonging to family Ergoline.Also seen as a small component in fungi, morning glory plant, seeds of Rivea corymbosa, seeds of Ipomoea muricata etc. Medicinally used for treating psychosis but found to have many side effects like diarrhoea, hallucinations, seizures, delirium, burning sensations and gangrene. Due to these side effects it is not being used in treatment.(29,30)

Aloe vera

Aloe vera is a herbal plant with succulent and thick leaves belonging to the family Asphodelaceae. The succulent leaves contain many constituents like anthraquinones (emodin, lectin), mannans and polymannans, anthrones. The gel and latex separated from the leaves is used in the commercial preparation of topical ointments for skin burns and cosmetic preparations(31, 32, 33, 34, 35). Enhances the absorption of vitamins and insulin.(78)

Simomenine

Alkaloid derived from the roots of climber sinomenium acutum. It is also called as cocculine and used in herbal medicine for the treatment of joint pains and inflammation (36). Have bio enhancing effect on digoxin, quinidine, paeniflorin, verapamil etc.(78)

Genistein

Isoflavone derived from the plant genista tinctoria. Also called as growth inhibitor and phytoestrogen. Biologically found to have antioxidant, anthelmintic, anti-cancer and atherosclerosis activities (37,38,39, 40). Shows bio enhancing effect on Paclitaxel, anti cancer drug etc.(78)

5-methoxy hydnocarpin

5-MHC is a chemical derived from the plant Hydnocarpus wightianus and Berberis. It is found to have anti-cancer activity and enhances the antimicrobial activity of berebrine.(41, 42, 43)

Ammania multiflora

Herbaceous plant often called as many flower ammannia belonging to family Lythraceae. Used commercially as decorative purpose and in the preparation of baked food. Found to have bio-enhancing effect on anti-microbial agents.(44, 45)

Capsaicin

Vital component of chilli powder. Capsaicin and its chemical constituents together called as capsaicinoids which creates irritation and burning feeling when comes in contact with the skin surface. Used topically for pain relief caused by aches, arthritis, back pain, psoriasis and prirutis etc. Also found to reduce peripheral neuropathy, post herpetic neuralgia, diabetic neuropathy and cardiovascular diseases. Shows bio-enhancing effect on theophylline etc.(46,47,48,49)

Capmul

Capmul is an emulsifying agent prepared from fats, oils, vegetable oils and widely used to enhance bioavailability, solubility, flexibility, as vehicle and drug delivery agent.(50)

Peppermint oil

Oil extracted from the plant menthe piperita. The two important chemical constituents of peppermint oil are menthone, pulegone and menthol which are used as insect repellents. Medicinally used in the treatment of irritable bowel syndrome, neuropathy, muscle pain, itching relief and to reduce heart burns.(51,52,53,54,55,56)

Gallic acid

Gallic acid is a solid phenolic acid found in sumac, witch, tea leaves, hazel, gallnuts, oak bark etc. It is formed by the hydrolysis of tannins and the products are called gallotannins and ellagitannins. It is used as antioxidant, anti-hyperlipidemic and commercially as writing ink, tanning process and manufacturing of paper. Have shown bio-enhancing effect on anti-viral drugs, diltiazem, metoprolol etc.(57,58,59)

Ellagic acid

Ellagic acid is a phenolic compound found in vegetables and fruits like walnuts, pecans, cranberries, raspberries, strawberries, chestnuts, grapes, peaches and pomegranates. Used as antioxidant and anti-proliferative agent. Medicinally used as dietary additive, anti-cancer agent and in curing heart diseases.(60,61, 62,63,64,65)

Ferulic acid

Ferulic acid is an organic phenol compound found in plant cell walls mainly fennel ferula communis. It is found in vegetables mainly bamboo shoot, popcorn, flaxseed and barley grain, bran, wheat. It is used in the treatment of osteoporosis, Alzheimer's disease, atherosclerosis, cancer, hyperlipidemic condition, diabetes, menopause problems, and anti-oxidant and in skin treatment.(66,67,68,69,70,71)

Cow urine distillate

Metabolic by-product of cows. It is used in traditional medicine for the treatment of fever, leprosy, ulcers, liver problems, kidney problems, psoriasis, anaemia, asthma and in as anticancer agent.(72,73,74,75)

Conclusion

Bio-enhancers are abundantly available materials in nature with low cost compared to other raw materials of the pharmaceuticals. The concept of usage of bio-enhancer is ingenious with respect to traditional Indian medicine. This results in reduction of drug cost, toxic side effects, more efficient therapeutic activity with less amount of drug dose. This makes the drug as absolute to the pharma industry with economical and safety aspect. So further research studies has to be continued in developing new formulations using these bio-enhancers with less cost that are available to all the weaker sections of the society.

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