INDIAN SPICES: AS NATURAL BIOENHANCER

Abstract

A Bio-enhancer is an agent capable of enhancing bio availability and efficacy of a drug without any pharmacological activity of its own at therapeutic dose used. They become very useful for modern therapy because they reduced drug cost, the drug adverse effects and they also increases the efficacy of drug. The use of natural product for bio availability enhancement because these are non-toxic, economical, non-addictive and non-allergenic in nature. Up to now research classified them in two manners; first according to their origin and second to their mechanisms. The various bio-enhancer available are Piperine, Allicin, Cumin seeds, Carum Carvi, Turmeric, Cow urine distillate, Cuminum Cyminum, Aloe Vera, Liquorice, Stevia, Hiaziridin etc. Bio-enhancers are recently used many novel drug formulations such as liposomes, ethosomes, transferosomes etc. Herbal bio-enhancer are used for various categouries of drug like neutraceuticals, antibiotics and cardiovascular for immediate effects. They also reduces the dose dependent poisonous of the drug such as anti-cancer drugs. Reduction in drug dose as well as drug cost has been possible only for Indian Spices.

Keywords: Spices, Bioenhancers, Therapeutic ,Efficacy, Bioavailability.

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I. INTRODUCTION

Bioenhancer are substance which enhance the bioavailability properties of the drug. In 1979, Piperine became the first bioavailability enhancer in the world. Natural plant-based products are more frequently used because they are non-toxic, have no side effects, are inexpensive, and are not allergic-causing. Low bioavailability, low lipophilicity, poor ionic properties, poor water solubility, and low membrane permeability are common issues with herbal medications. The main issue is low bioavailability. Risorine is the most often used brand formulation. Many naturally occurring substances found in medicinal plants have the ability to increase a drug's bioavailability when supplied alongside it. Bio-potentiation or bio-enhancement is the term used to describe the phenomena of boosting the overall availability of any chemical entity (drug molecule) in systemic circulation. Due to their reduced risk-benefit ratio as compared to current allopathic treatments, herbal sources are being used at a very high rate. When taken at the prescribed therapeutic dose, bioenhancers do not replace the genuine active principle with their own therapeutic action. Enhancing bio-efficacy decreases dosage, toxicity, and side effects, which cuts down on treatment time and expense. Therefore, bioenhancers are chemical substances that do not have a synergistic impact with the medicine but instead work to enhance and promote the bioavailability of the drugs that are coupled with them.

II. IDEAL PROPERTIES

Bioenhancer should have novel properties such as:

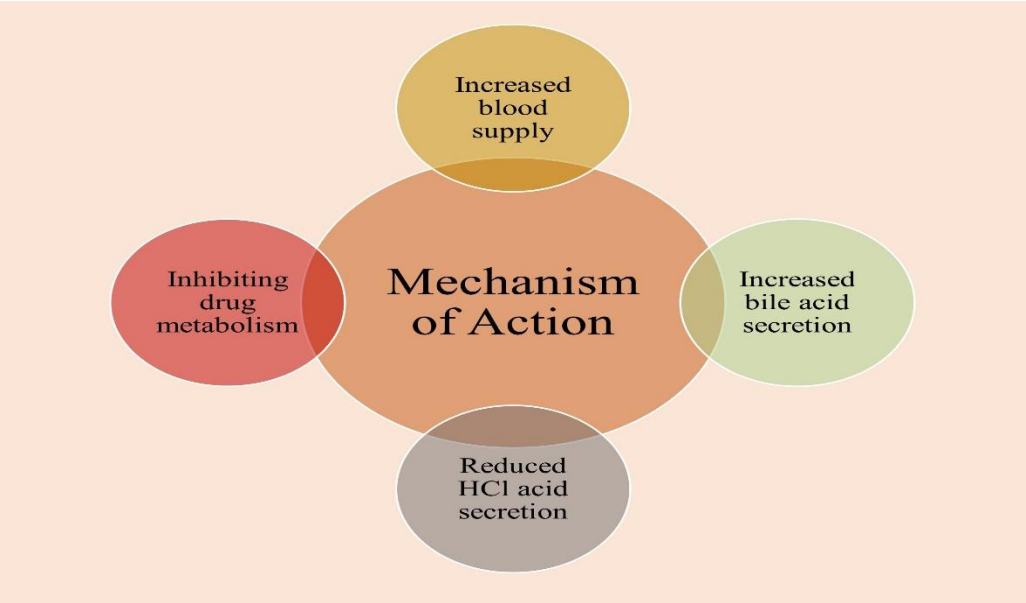
- It should be affordable and widely accessible.
- Should be consistent with environment and time.
- Should be compatible with other active medicinal components.
- Should be nontoxic, nonallergenic, and nonirritating.
- Should not have any pharmacological effects of its own.
- Should have predictable, repeatable behavior that is quick-acting.
- Must be simple to manufacture into a range of dosage forms.
- Should work well with other pharmaceutical active components.
- It shouldn't have any hazardous or detrimental effects on the body.

Concept of Bioavailability Enhancers: The term "bioavailability enhancer" originates from the traditional medical system of Ayurveda. Trikatu, which in Sanskrit means "three acrids," is the name given to black pepper, long pepper, and ginger. Indian scientists initially used the phrase "bioavailability enhancer" in 1979 after identifying piperine as the first bioavailability enhancer in the globe.The amount and pace at which the active medication enters systemic circulation, and subsequently the accessing of site action, is referred to as bioavailability. The following general order describes how the mode of administration affects a drug's bioavailability: **Parental>Oral> Rectal > Topical**

III. MECHANISM OF ACTION OF BIOENHANCER

The drug molecules are affected by the bioenhancer's abilities to increase bioavailability. The mechanisms of action of bioenhancers can be the same or different. To increase absorption, nutritional bioenhancers work on the digestive system. The main impact

of antimicrobial bioenhancers on medication metabolism. The primary mechanisms of bioenhancers boost the medicinal component's bioavailability.



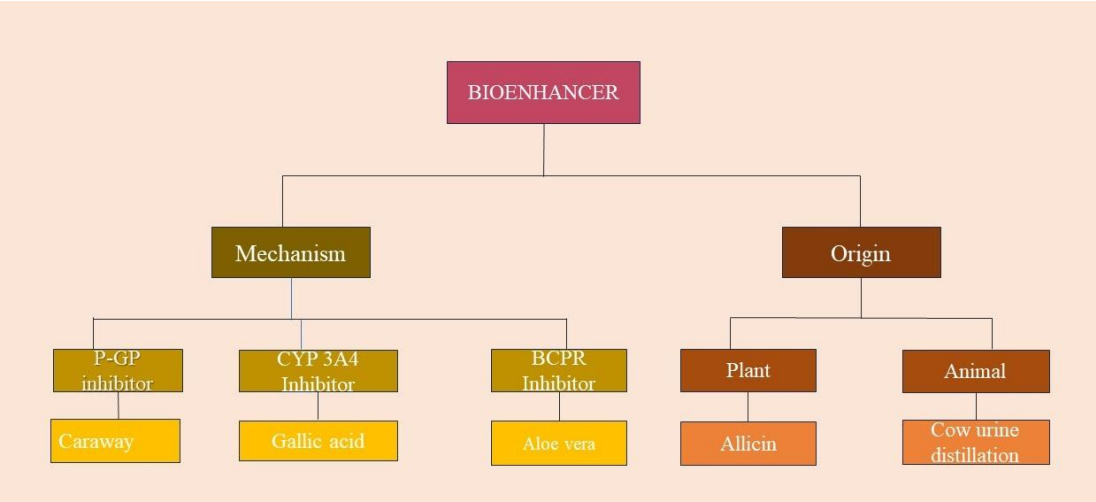
1. Drug metabolism is mostly affected by antimicrobial bioenhancers.
2. Blocking drug-metabolizing enzymes in the liver, intestines, lungs, and other organs, such as CYP 3A4, CYP 1A1, CYP 1B2, and CYP 2E1.
3. Blocking P-gp and promoting passive tubular reabsorption to decrease renal clearance by preventing glomerular filtration and active tubular secretion.
4. By increasing blood flow, which improves the gastrointestinal tract's ability to absorb medications taken orally.
5. By making it easier for drugs to attach to receptors, proteins, DNA, and RNA, potentiating and extending their effects.

IV. CLASSIFICATION OF BIOENHANCERS

Bioenhancers can be classified based on origin and mechanism of action.
Classification of bioenhancer according to source

1. **Plant origin:** Niaziridin, Cuminum cyminum, Carum carvi, Stevia, Glycerrhizin, Ginger, Allicin etc.

2. **Animal origin:** Cow urine distillate.
   Classification of Bioenhancers Based on Mechanism of Action:
   - **Inhibition of p-gp efflux pump and other efflux pump:**
     Ex - Carumcarvi (Caraway), Cuminum cyminum etc.
   - **Suppressors of CYP-450 enzyme and its isoenzyme:**
     Ex- Gallic acid and its esters etc.
   - **Regulators of GIT function to facillated better absorption:**
     Ex - Aloe vera,Ginger etc.



V. BIOENHANCER FROM INDIAN SPICES

Bioenhacers: Based on plant origin

1. **Piperine:** It is an amide alkaloid that is derived from piper longum, piper nigrum, and black pepper. It works by boosting quick absorption of minerals and medications by blocking enzymes necessary for drug biotransformation. Propranol, phenobarbitone, etoposide, diclofenac sodium, ibuprofen, phenytoin, cyclosporine A, Amphicillin, tetracycline, and other medications are among those increased by piperine. It was coupled with nevirapine, an anti-HIV reverse transcriptase non-nucleoside inhibitor that was used in conjunction with other anti-retroviral medications to treat HIV infection. It demonstrates anti-inflammatory and antioxidant effects.

2. **Carum Curvi:** It contains moderate anti-histamine chemicals from microorganisms that aid in relaxing the muscles responsible for coughing spasms. It works well to relieve congestion. Caraway seeds provide therapeutic benefits for treating conditions like rheumatism and eye infections. At a dose of 1-55 mg/kg body weight, caraway also improves the bioavailability of antibiotics, antifungal, antiviral, and anti-cancer medications.

3. **Indian Aloe:** Aloe leaf extract and the inner gel-filled portion are frequently utilized because they improve vitamin C and vitamin E absorption. Aloes increase the

bioavailability of Vitamin C and E in humans because of the slower absorption and prolonged vitamin retention in plasma. It is also capable of preventing human neutrophils that have been stimulated from releasing reactive oxygen free radicals.

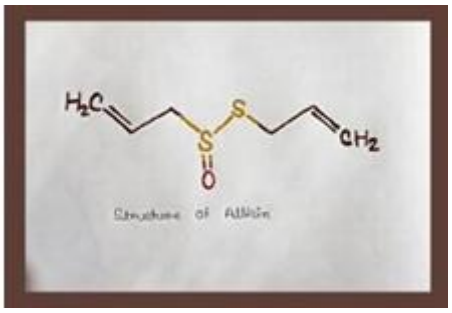
4. **Liquorice:** It was derived from the Glycyrrhia glabra (licorice) plant, specifically from the roots. Licorice has antioxidant, anti-inflammatory, and antibacterial qualities because it contains glycyrrhizin, which is what gives it those abilities. It has been used to heal upper respiratory issues and calm an upset stomach in traditional Chinese and Greek medicine. Licorice root extract is frequently used to treat peptic ulcers as well as symptoms of acid reflux and heartburn. Rifampicin, tetracycline, aconitin, ampicillin, clotrimazol, taxol, vitamin B1, B12, and nalidixic acid are a few examples of medications that it affects by boosting absorption and blocking p-gp.
   In the contemporary system of herbalism, it might once:
   - Helps in treat hepatitis C
   - Aid diabetes
   - Reduce menopause symptoms
   - Boost weight loss

5. **Ginger:** Because ginger contains saponins, flavonoids, and alkaloids, which regulate GI tract function, it improves absorption. Ethionamide's bioavailability is improved. It demonstrates the medicinal efficacy of anti-TB medications like rifampicin. Additionally, it improves the bioavailability of cancer, antiviral, antifungal, and antibiotic medications. It increases the bioavailability of numerous antibiotics, including azithromycin, erythromycin, cephalexin, cefadroxil, amoxycillin, and cloxacillin.

6. **Pepermint Oil:** It is mostly made from the peppermint plant, a hybrid of spearmint and water mint, specifically the leaves. Peppermint essential oil is used in aromatherapy. Irritable bowel syndrome can be lessened by peppermint oil when it has been diluted, claims an NCCIHTrusted source.
   It can be utilized in Ayurveda to:
   - Reduce muscle spasms
   - Reduce itchiness
   - Encourage sweating
   - Prevent throwing up
   - Increase blood flow

7. **Niaziridin:** A nitrile glycoside known as niaziridin was discovered in Moringa oleifera pods. When used against gram-positive bacteria like Bacillus subtilis and gram-negative bacteria like Escherichia coli, it increases the bioactivity of commonly used antibiotics. Rifampicin, ampicillin, and antifungal medications all have their effectiveness increased by it. It increases vitamin B12 absorption. In order to improve absorption, it controls GIT operations.

8. **Allicin:** It is an alkyl sulfur compound made from allium sativum, or garlic. By preventing ergosterol from moving from the plasma membrane to the vacuole membrane, it increases the damage that AmB causes to the membrane. Amphotericin B's bioavailability is improved.



9. **Stevia:** Stevia leaves are primarily used. It works as an anti-hypertensive. Stevioside is the chemical component of Stevia that enhances biological function. By exerting a direct influence on beta cells, Stevia's ingredients stevioside and steviol promote the release of insulin. The bioavailability of anti-tubercular, anti-leprotic, anti-cancer, anti-fungal, anti-leprosy, anti-arthritic agents, and anti-viral medications is improved despite the lack of a clear mechanism of action.

10. **Sinomenine:** It was initially mentioned as a herbal medication in the "Compendium of Materia Medica" and has been utilized in traditional Chinese medicine systems ever since.The Sinomenium acutum plant contains it. Its sinomenine active chemical component has been utilized to treat autoimmune illnesses, including "Rheumatoid arthritis." Its intricate chemical makeup gives rise to a variety of pharmacological actions.

- **Effects on immune system**

➢ **Effects on T-cells:** Sinomenine may suppress the immune system in rat kidney allograft models by reducing CD4+ T-cell proliferation and INF- and TNF- levels.Sinomenine may have an immunological suppressive impact by maintaining the equilibrium of the CD4+/CD8+ ratio of T lymphocyte subtype and increasing the spleen lymphocyte apoptosis ratio.

- **Effects on Cardiovascular system**

➢ **Effects on arrhythmia:** Sinomenine inhibits INa in its inactive form and blocks INa and ICa-L in a concentration-dependent manner, which may help explain why it has an anti-arrhythmic effect.

- **Effects on nervous system**

➢ **Effects on CNS:** Sinomenine shows analgesic, sedative, and anxiolytic properties.

11. **Genistein:** It is an isoflavone, a type of phytoestrogen that is a part of the flavonoids family. It was produced from the plants Glycine max Linn. (soyaben) and Pueraria lobata Willd. It can prevent the P-gp, BCRP-2, and MRP-22 efflux pumps from working. The intestinal absorption of paclitaxel and epigallocatechin-3-gallate was significantly improved when co-administered with Genistein.

12. **Black Cumin:** Cumin seeds are mostly employed. Cumin seeds are frequently used to treat moderate digestive issues such diarrhea, dyspepsia, flatulence, morning sickness, colic, dyspeptic headache, and bloating. They are also thought to be carminative, eupeptic, antispasmodic, and astringent. Cumin seeds are frequently used to treat moderate digestive issues, such as diarrhea, dyspepsia, flatulence, morning sickness,

colic, dyspeptic headache, and bloating. They are also widely recognized as being carminative, eupeptic, antispasmodic, and astringent. Gram-positive and Gram-negative bacteria are found to be both susceptible to its antimicrobial effects. Cumin oil works by damaging cell membranes and releasing intracellular DNA and protein.

13. **Turmeric:** An everyday item in most homes is turmeric. Curcumin shares piperine's characteristics as a bioenhancer. The UDP-glucuronyl transferase level in the tissues of the gut and liver is suppressed by curcumin. Additionally, it alters the gastrointestinal tract's physiological activity, which improves drug absorption. It also facilitates quick blood clotting.

14. Bioenhancer : Based on animal origin

Cow Urine Distillation: Cow urine distillate is used nowadays as a powerful bioenhancer. It is referred to as "Sanjivani" and "Elixir of life" in Ayurveda. It has an antiseptic effect. Treatment of injections into the liver or kidney is where it works best. In medicines like rifampicin, amphicillin, cyanocobalamine, tetracycline, and mercaptopurine, among others, it functions as a bioenhancer. It can be utilized as a bioenhancer of zinc and has antitoxic effect against the toxicity of cadmium chloride. The bioenhancing ability is achieved by making it easier for medications to cross cell membranes.

VI. ADVANTAGES OF BIOENHANCER

- It improved a medicine's bioavailability and decreased adverse drug responses.
- Drug resistance is less likely when a bioenhancer is supplied with a medication.
- The lesser dose will result in less drug toxicity and adverse drug reactions or side effects.

1. Disadvantages

- Newer bioenhancers need regulations that control their physiochemical and pharmacokinetic properties.
- Creating bioenhancer for large-scale manufacturing requires extensive research and development.

2. Benefits of Utiling Bioenhancers

- It boosts a drug's effectiveness.

- Decrease in medication resistance
- Decreased use of raw materials
- Drug dose can be decreased because the drug's bioavailability has risen.
- Cost will decrease as a result of the lower dose
- Improving oral bioavailability

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