



## Exploring Novel Indian Herbal Bioenhancers for Enhanced Therapeutic Efficacy Abstract

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### **Abstract:**

Bioenhancers are specialized substances that, on their own, do not possess medicinal properties but when combined with an active drug, enhance the pharmacological effects of that drug. Each year, numerous drug molecules are introduced into the market, but many of them face challenges such as poor solubility, stability, bioavailability, and adverse side effects. Among these issues, low bioavailability is a significant problem that can be addressed. Several factors contribute to low bioavailability, including low lipophilicity, zwitterionic nature at physiological pH, and poor water solubility. Herbal bioenhancers have demonstrated the ability to improve the bioavailability and efficacy of various drug classes, including antibiotics, antituberculosis drugs, antivirals, antifungals, and anticancer medications, at lower doses. They have also been effective in enhancing the oral absorption of nutraceuticals such as vitamins, minerals, amino acids, and certain organic compounds. Examples of compounds used as bioenhancers include curcumin,

piperine, quercetin, cow urine, cinnamon bark, black cumin seeds, and capsicum fruits. It is noteworthy that nearly all spices exhibit bioenhancing activity. Currently, herbal bioenhancers represent a novel approach in modern medicine due to their advantages such as improved bioavailability, safety, absence of side effects, reduced drug toxicity, shortened treatment duration, and lowered treatment costs. This review explores various herbal bioenhancers and their mechanisms of action in detail.

Keywords: *Bioenhancer, zwitterionic, Bioavailability, Enhancers, Additive*

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### **Introduction:**

Bioavailability is the tempo and level to which a therapeutically active substance enters systemic circulation and becomes accessible at the required site of action. Intravenous drugs attain maximum bioavailability, while it was noticed that oral administration yields a reduced percentage due to unfinished drug absorption and first-pass metabolism<sup>1</sup>. The idea of bioenhancer is called *Yogvahi* in Ayurveda. Synergism, that is, increase in the action of one bimolecule by another unrelated chemical is the hallmark of polyherbal formulations of ayurveda<sup>2</sup>. The drug administered through oral route undergoes various steps such as partial drug absorption and first-pass metabolism which eventually leads to low bioavailability. Enhanced bioavailability leads to increase in the level of drug in the blood stream and thus increase effectiveness and lessen the drug dosage<sup>3</sup>. Medicines from plant are used by greater part of world's population Ayurveda has mentioned thousands of drugs from plant source for various diseases. Almost 25% of modern pharmacopoeias too contain drugs of plant origin<sup>4</sup>

A bioenhancer is a mediator accomplished of enhancing bioavailability and bioefficacy of a particular drug with which it is collective, with no any characteristic pharmacological action of its own at the dose used<sup>5</sup>. For a long period of time plants have been a valuable source of natural producers for maintaining human health. Some of the natural product which is used as a bioenhancers also used to reduce dose of Antibiotics<sup>6</sup> Bioavailability is the speed and scope to which a matter enters systemic circulation and becomes available at the required site of action<sup>7</sup>. Perfect bioenhancers should have original properties such as: They should be nontoxic to humans or animals, should be helpful at a very low concentration in a grouping, and should be easy to put together, most prominently, they should improve absorption and activity of the drug

molecules<sup>8</sup> Water solubility most likely is the reason for the drugs having low membrane permeability<sup>9</sup> Bioenhancers like piperine can increase bioavailability of Rifampicin by about 60%<sup>10</sup>. Cumin Seeds & Capsaicin Fruits shows promising effect as Enhancer<sup>11</sup>

Bio-enhancers are such media, which by themselves are not therapeutic molecule but when pooled with an active ingredient continue to the increase in the activity of the original drug<sup>12</sup>.

Release of drugs through the skin for systemic effect, called Transdermal delivery was first used in 1981<sup>13</sup>

### **Concept<sup>14</sup>:**

The idea of 'bioavailability enhancers' is gotten from the old conventional framework such as Ayurveda (which implies study of life). In this conventional framework, dark pepper, long pepper and ginger are all in all known as "Trikatu". In Sanskrit it implies three bitter. The activity of bio enhancers was first archived by Bose who characterized the long pepper's action to leaves of Adhatoda vasika, which expanded the counter asthmatic properties of Adhatoda vasika leaves

### **Ideal properties of Bioenhancer<sup>15</sup>:**

The commitment of bioenhancers have been audited which expresses that the ideal bioenhancers.

- a) It must be non-toxic, non-allergenic and non-aggravating.
- b) Should not deliver own pharmacological impacts?
- c) Should be quick-acting with unsurprising and reproducible action.
- d) Should be unidirectional in real life.
- e) Should be viable with other dynamic drug fixings.
- f) Should be steady with time and climate.
- g) Should be handily figured into a different dose structure.
- h) Should be effectively accessible and practical.

**Classification<sup>16</sup>****Classification of bioenhancer according to source**

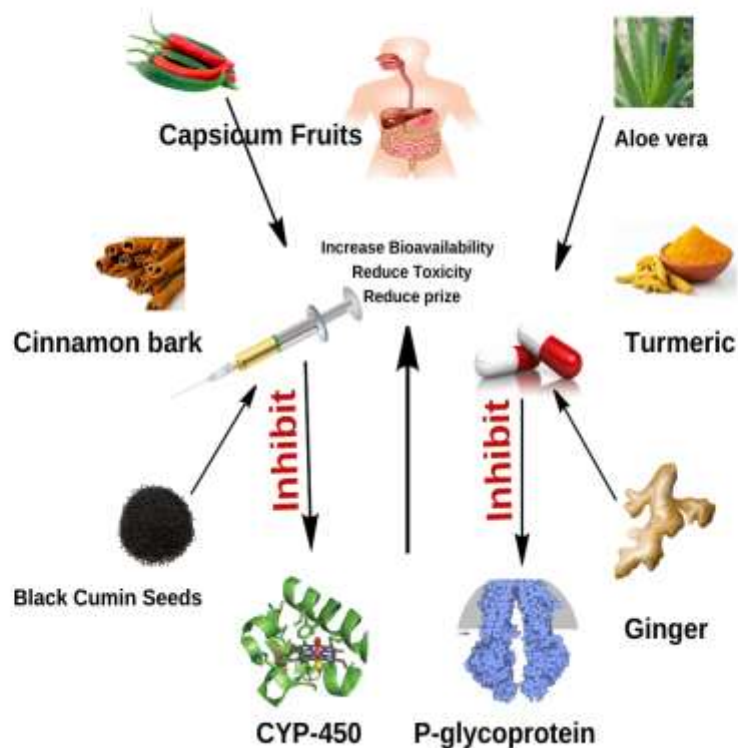
BASED ON ORIGIN (TABLE-I)

ORIGIN	EXAMPLES
Plant origin	Cuminumcyminum, Carumcarvi , Allicin, Aloe vera, Stevia, Lysergol, Glycerrhizin, Ginger, genistein Simomenine, cinnamon bark, black cumin seeds, capsicum fruits etc.
Animal origin	Cow urine

**Classification of Bioenhancers Based on their Mechanism of Action<sup>17</sup>**

TABLE-II

MECHANISM OF ACTION	EXAMPLES
Regulators of GIT function to facilitate better absorption	E.g. Aloe Vera, , Niaziridin, Liquorice Ginger
Inhibitors of P-gp efflux pump and other efflux pump	Genistein, Quercetin, Black Cumin Sinomenine, Caraway, Naringin,
Suppressors of CYP-450 enzyme and its isoenzymes	Gallic acid, Naringin, Quercetin.

**Fig. 1 Bioavailability Enhancement Mechanism**

### Obstacles with Bioenhancers <sup>18</sup>

In spite of the fact that bio-enhancers in medication conveyance have been fruitful, not all methodologies have met with a similar achievement. New bio-enhancers being created accompanied difficulties which must be overcome. One of the difficulties is to enhance properties of medication definitions, for example, long course in the blood, expanded utilitarian surface zone, assurance of consolidated drug from debasement, intersection of organic boundaries and site-specific focusing on.

Another test of innovative work of natural bioenhancers is huge scope creation. There is consistently a need to scale up research center or pilot advances for possible commercialization. The difficulties of scaling up incorporate low centralization of nanomaterial, agglomeration and the science measure; it is simpler to adjust nanomaterial at research facility scale for improved execution than everywhere scale. Advances in home grown bio-enhancers additionally give new

difficulties to administrative control. There is an expanding need to have guidelines that would represent physicochemical and pharmacokinetic properties of nano drug items, which are not the same as customary medication items

### **Need of bioenhancers<sup>19</sup>:**

To pass natural layer particles need to pass – solvency and atomic size. Particles having helpless lipid

solvency and inappropriate atomic size or both give poor assimilation and helpless bioavailability.

Bioenhancers builds entrance through layers and assists with tackling issue of helpless assimilation and poor

bioavailability

### **Benefits of Bioenhancer<sup>20</sup>**

As it builds bioavailability drug portion can be diminished Because of decreased portion cost will likewise diminish

It diminishes drug obstruction

Likewise diminishes results and antagonistic medication responses

It builds adequacy of medication

In short, abatements complete treatment cost

### **PLANT PROFILE**

a) Cinnamon Bark:<sup>21</sup>

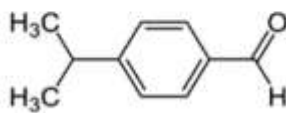


Biological Source: It consists of dried bark inner bark of *Cinnamomum zeylanicum* Nees, belonging to family Lauraceae.

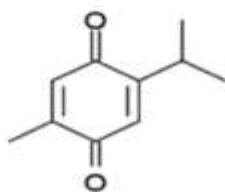
Chemical Constituents: 0.5 to 1.0% of volatile oil, 1.2 % of tannis mucilage, calcium oxalate, starch and a sweet substance is known as mannitol

Uses: Cinnamon bark is used for gastrointestinal upset, diarrhea, and gas. It is also used for stimulating appetite; for infections caused by bacteria and parasitic worm.

b) Black Cumin Seeds:<sup>22</sup>



Cuminaldehyde



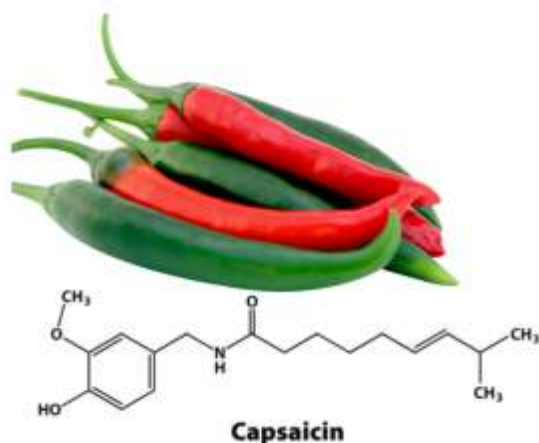
Thymoquinone

Biological Source: It consists of dried seeds of *Nigella sativa* belonging to family Ranunculaceae.

Chemical Constituents: Carvone, Alpha Pinene, p-cymene, oleic acid.

Uses: Appetizer, Stimulant, Diuretic, Carminative, Deodorant

c) Capsicum fruits<sup>21</sup>:



Biological source: It consists of dried ripe fruits of *capsicum annum* belonging to family solanaceae.

Chemical constituent: It contains Capsaicin 0.5 to 0.9%. Capsicum also contains fixed oil 4 to 16% and ascorbic acid are the other content of the drug.

Uses: It is used as carminative, an appetizer and a stomachic, externally; it is used as a counter irritant in the treatment of rheumatism, lumbago and neuralgia. It is also used in spices.

**There are different points of interest of utilizing bio-enhancer in mix treatment are as per the following<sup>23</sup>**

Viability of medication is increment because of expansion in bioavailability.



Mix of bio-enhancer with drug lessens the dose and risks of medication obstruction can be limited. Unfavorable medication response/result and poisonousness of medication will be limited on account of decreased dose. This is particularly valid for anticancer medications like Taxol.

There are natural advantages too eg. Taxol used to treat ovarian malignant growth or bosom disease is gotten from bark of Pacific yew tree, one of the slowest developing trees on the planet. At present to treat one patient, six trees, 25-100 years of age should be felled with bio-enhancers less trees will be pulverized They can decrease between singular fluctuation just as intra-singular inconstancy as they increment the bioavailability of medication

### **Future lookouts<sup>24</sup>**

The idea of bioenhancer which has begun from the utilization of "trikatu" from Ayurveda has effectively started to lead the pack to different present day medications to improve their bioavailability. The Ayurvedic idea of hupaan and sehpaan should be consolidated into the cutting edge medication moreover. The scientists are presently pointed toward utilizing bioenhancer alongside the primary pharmacological medication as a technique for decrease of medication measurement, and in this way drug treatment cost making treatment accessible for monetarily tested people groups. Different explores related with the advancement of bioenhancers of home grown and non-natural root are in cycle.

### **Conclusion**

The imaginative idea of Bioenhancers which was the consequence of a conventional arrangement of prescriptions made an extraordinary upset in the field of medications. Utilization of bioenhancer alongside the fundamental medication has prompted a decrease in medication cost, expanded bioavailability and has<sup>25</sup>

limited medication dose. Different examination works have been accomplished for creating Piperine subsidiaries and other novel bioenhancers. Common bioenhancers are protected, liberated from a different result, powerful, practical, effectively secured, and has a generally put together impact with respect to a few classes of medication. Bioenhancers additionally bring down the medication opposition and along these lines decrease the expense of treatment. A manufactured cycle for its business creation has been produced for modern use<sup>26,27</sup>

It fulfills all vital measures to be viewed as an ideal drug. It is protected, compelling, and prudent, effectively acquired, non-addictive, and has a generally put together impact with respect to a few classes of medication. A manufactured cycle for its business creation has been produced for mechanical use.<sup>28,29</sup>

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