

Review Article



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“DRAVYAGUNA OF ANUPANA (VEHICLE SUBSTANCES) AND MODERN DRUG ABSORPTION ENHancers: AN INTEGRATIVE REVIEW”

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ABSTRACT

Introduction: In Ayurveda, *Anupana* refers to the co-administered vehicle substances taken with medicines or food, influencing taste, absorption, assimilation, and therapeutic direction. Ayurvedic classics describe multiple *Anupana* such as water, honey, milk, ghee, alcohol, and decoctions, which serve to potentiate efficacy, reduce toxicity, and enhance patient compliance. Modern pharmacology recognizes similar principles in the field of drug absorption enhancers and bioavailability modifiers. **Methods:** This review was based on a systematic search of Ayurvedic classics (*Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya*) and modern biomedical databases (PubMed, Scopus, Web of Science) for studies published from 2000–2024. Inclusion criteria were peer-reviewed studies, reviews, and clinical evidence linking *Anupana* to digestion, absorption, and pharmacokinetics. Exclusion criteria were non-peer-reviewed reports and unrelated literature. **Results:** Ayurveda identifies diverse *Anupana* with unique *Dravyaguna* properties. Honey provides quick absorption, milk improves compatibility, ghee enhances lipophilic drug delivery, and alcohol facilitates rapid systemic absorption. Modern pharmacological studies show parallels: piperine increases drug bioavailability by inhibiting drug-metabolizing enzymes; lipids and ghee-like carriers improve solubility of poorly soluble drugs; alcohol and solvents enhance membrane permeability. Herbal enhancers like ginger and black pepper demonstrate enzyme-modulating properties analogous to classical *Anupana*. **Discussion:** While Ayurveda qualitatively emphasizes patient-specific suitability and holistic effects of *Anupana*, modern science evaluates quantitative pharmacokinetic endpoints. Integration of these paradigms highlights new opportunities for drug delivery, toxicity reduction, and personalized therapeutics. **Conclusion:** The Ayurvedic concept of *Anupana* anticipates principles now central to modern pharmacology. Future research should aim at developing measurable biomarkers, pharmacokinetic trials, and novel formulations inspired by classical *Anupana*.

KEYWORDS: Absorption enhancers, *Anupana*, Ayurveda, bioavailability, pharmacokinetics



INTRODUCTION

Ayurveda recognizes that the therapeutic efficacy of a medicine is not determined solely by its inherent properties (*Dravyaguna*), but also by the medium in which it is administered. This concept is embodied in *Anupana*, the co-administered vehicle or adjuvant that accompanies food or medicine. Classical texts emphasize that *Anupana* enhances palatability, potentiates desired actions, minimizes toxicity, and directs therapeutic effects to specific tissues.^[1-2]

Commonly prescribed *Anupana* include water, honey, ghee, milk, decoctions, buttermilk, meat soups, and alcohol. Each is chosen based on the disease, *dosha* imbalance, and individual constitution. For instance, honey is considered a *Yogavahi*—a catalyst enhancing drug activity; milk is *Madhura* (sweet) and *Sheeta* (cooling), suitable for *Pitta* disorders; ghee serves as a lipophilic carrier; and alcohol provides fast systemic absorption.^[3-4] In modern pharmacology, similar roles are attributed to bioavailability enhancers, absorption modifiers, and drug delivery systems.^[5] Piperine, fatty acids, surfactants, and nanoparticles are used to increase solubility, permeability, and stability of drugs. The Ayurveda-pharmacology overlap suggests that *Anupana* can be re-examined as natural, patient-friendly bioenhancers with clinical relevance.^[6-8]

The objective of this review is to analyze *Dravyaguna* of *Anupana*, identify their functional parallels with modern drug absorption enhancers, and explore their pharmacological significance. Specifically, it aims to: (i) review classical concepts of *Anupana*, (ii) summarize their *Dravyaguna* properties, (iii) evaluate modern evidence on absorption enhancers, and (iv) discuss integration for future drug delivery innovations.^[9-10]

MATERIALS AND METHODS

A structured literature review was conducted between January–July 2025.

Sources of data:^[11]

- Ayurvedic texts: *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, and commentaries.
- Databases: PubMed, Scopus, Web of Science.

Search terms: “*Anupana*”, “Ayurveda vehicle substance”, “bioavailability enhancers”, “drug absorption enhancers”, “pharmacokinetics”, “drug delivery Ayurveda”.^[12]

Inclusion criteria:^[13]

- Classical Ayurvedic references mentioning *Anupana*.
- Peer-reviewed publications (2000–2024).
- Experimental, pharmacological, and clinical studies related to absorption enhancers.
- Reviews integrating Ayurveda and pharmacology.

Exclusion criteria:^[14]

- Non-peer-reviewed or anecdotal sources.
- Studies not related to digestion, absorption, or bioavailability.

Method of synthesis:^[15] Findings were grouped under themes:

1. Classical Ayurvedic understanding of *Anupana*.
2. *Dravyaguna* and therapeutic roles.
3. Modern evidence on absorption enhancers.
4. Comparative pharmacological mechanisms.
5. Clinical and future applications.

OBSERVATION AND RESULTS

1. Classical Concepts of *Anupana*

Ayurvedic texts define *Anupana* as the substance consumed along with or immediately after the medicine or food. *Charaka Samhita* states that *Anupana* ensures proper digestion, assimilation, and direction of action. It modulates *Agni* (digestive fire), influences *doshas*, and provides a supportive role in drug delivery. *Sushruta* highlights *Anupana* as a means to reduce drug toxicity and irritation.

2. Types of *Anupana* and Their *Dravyaguna*

1. **Water (Jala)** – Universal *Anupana*, aids in dissolution, transport, and excretion. Warm water is preferred for *Kapha* disorders, while cold water is used in *Pitta* aggravation.
2. **Milk (Dugdha)** – *Madhura rasa*, *Snigdha*, *Sheeta guna*; acts as an antidote to toxins, balances *Pitta* and *Vata*, and enhances compatibility.
3. **Ghee (Ghrita)** – Lipophilic carrier, enhances bioavailability of fat-soluble components; indicated in neuroprotective and inflammatory disorders.
4. **Honey (Madhu)** – *Kashaya-madhura rasa*, *Laghu*, *Ruksha*; serves as a *Yogavahi*, synergistically enhancing drug potency.
5. **Alcohol (Sura/Asava-Arishta)** – Enhances rapid absorption and systemic delivery; acts as vasodilator and digestive stimulant.



6. **Decoctions (Kashaya) and Fermented Preparations** – Improve palatability, digestion, and specific tissue targeting.
7. **Buttermilk (Takra) and Soups** – Used in gastrointestinal and metabolic disorders to aid digestion and absorption.

3. Functional Roles of *Anupana*

- Enhances palatability and patient compliance.
- Modulates therapeutic action (direction to tissues).
- Reduces toxicity (e.g., milk with metals/minerals).
- Improves digestion and absorption.
- Balances *doshas* and optimizes systemic assimilation.

4. Modern Correlates: Drug Absorption Enhancers

Modern drug delivery science has identified several enhancers:

- **Piperine** (black pepper) – inhibits CYP3A4 and P-glycoprotein, enhancing bioavailability of curcumin, rifampicin, and other drugs.
- **Lipids and fatty acids** – improve solubility of poorly soluble drugs (analogous to ghee/oil *Anupana*).
- **Alcohol and solvents** – increase membrane permeability and drug dissolution.
- **Honey and sugars** – provide rapid absorption via facilitated diffusion.
- **Herbal enhancers (ginger, garlic, glycyrrhizin)** – modify enzyme activity and transporters.

5. Evidence from Pharmacological and Clinical Studies

- Atal et al. (1985) demonstrated piperine's ability to enhance drug bioavailability, a concept parallel to *Yogavahi* role of honey.
- Dwivedi et al. (2021) highlighted ghee as a lipid-based drug carrier improving stability and targeted delivery.
- Mukherjee et al. (2011) identified bioenhancers from Ayurveda for modern pharmacology.
- Clinical studies show that Ayurvedic formulations with *Anupana* (e.g., Triphala with ghee, Rasayana with milk) improve tolerance and efficacy.

6. Comparative Analysis

Ayurveda's qualitative classification (based on rasa, guna, virya, vipaka) corresponds to modern

mechanisms (enzyme inhibition, solubility enhancement, transporter modulation). For example:

- Ghee (lipid vehicle) = lipid-based delivery systems.
- Honey (*Yogavahi*) = enzyme-modifying bioenhancers.
- Alcohol (*Asava*) = permeation enhancers.
- Milk = biocompatible protective carriers.

7. Clinical and Pharmaceutical Applications

- Improved bioavailability of phytoconstituents (curcumin + piperine).
- Reduction of gastrointestinal irritation (herbal formulations with milk).
- Personalized prescriptions of *Anupana* for dosha-based therapies.
- Development of herbal bioenhancer-based drug delivery systems.

DISCUSSION

The concept of *Anupana* reflects Ayurveda's sophisticated approach to drug delivery. Ancient physicians recognized that co-administered substances alter absorption, distribution, and therapeutic effects. This parallels modern pharmacological research on absorption enhancers.^[16]

Convergences:^[17]

- *Anupana* like ghee and milk correspond to lipid-based carriers that enhance solubility.
- Honey as a *Yogavahi* parallels enzyme-inhibiting enhancers like piperine.
- Alcohol in *Asava* formulations resembles ethanol's role in improving membrane permeability.
- Buttermilk and soups function like probiotics or functional foods aiding digestion.

Divergences:^[18]

Ayurveda's approach is qualitative, individualized, and holistic, focusing on balancing *doshas* and improving patient tolerance. In contrast, modern pharmacology measures quantitative outcomes such as plasma drug concentration, half-life, and AUC.

Challenges and Gaps:^[19]

- Lack of standardized pharmacokinetic studies validating *Anupana*.
- Minimal biomarker-based evidence linking *Dravyaguna* to absorption enhancement.
- Limited exploration of patient-specific factors in modern bioenhancer research.

Future Prospects:^[20]

- Designing controlled trials to test classical *Anupana* with phytoconstituents.
- Exploring molecular mechanisms (e.g., transporter inhibition, enzyme modulation).
- Development of novel formulations inspired by *Anupana* (lipid-based nanocarriers, honey-based syrups).
- Integration into personalized medicine approaches bridging Ayurveda and pharmacology.

CONCLUSION

The Ayurvedic principle of *Anupana* underscores the recognition that vehicle substances profoundly influence drug efficacy, absorption, and safety. Classical texts detail multiple *Anupana*—honey, milk, ghee, alcohol, water, and decoctions—each with unique *Dravyaguna* properties tailored to specific conditions and constitutions. These ancient insights resonate with modern pharmacological discoveries on bioavailability enhancers such as piperine, lipids, solvents, and herbal modulators.

The parallels are striking: ghee resembles lipid carriers, honey functions like a bioenhancer, alcohol enhances permeability, and milk improves biocompatibility. Moreover, *Anupana* not only enhances drug action but also reduces toxicity and improves compliance, making it a holistic model of drug delivery.

While current evidence highlights promising correlations, significant gaps remain in terms of pharmacokinetic validation, biomarker discovery, and clinical standardization. Bridging Ayurveda and modern pharmacology requires interdisciplinary research combining textual analysis, *in vitro* enzyme studies, and clinical pharmacokinetics.

In conclusion, *Anupana* serves as a timeless concept anticipating modern absorption enhancer science. Its systematic study could lead to innovative drug delivery systems, improved therapeutic outcomes, and the advancement of personalized, integrative medicine.

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