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A Review on Role of Polyherbal Formulation as Energy Booster in Traditional Medicine : Phytochemistry and Mechanism of Action

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Abstract: *Polyherbal formulations have long been employed in traditional medicine systems for their synergistic therapeutic effects, particularly in enhancing energy, vitality, and overall well-being. This review explores the role of polyherbal energy boosters composed of botanicals such as Withania somnifera (Ashwagandha), Cinnamomum verum (Cinnamon), Asparagus racemosus (Asparagus), Ocimum sanctum (Tulsi), Glycyrrhiza glabra (Liquorice), Emblica officinalis (Amla), and Mentha arvensis (Mentha), along with sugar and salt. These herbs are rich in bioactive compounds like withanolides, polyphenols, flavonoids, and saponins, which contribute to adaptogenic, antioxidant, immunomodulatory, and metabolic regulatory effects. These formulations combine several herbs, each contributing unique phytochemical constituents that work synergistically to promote vitality, improve metabolic balance, and regulate stress response. The mechanisms of action include modulation of the hypothalamic-pituitary-adrenal (HPA) axis, enhancement of mitochondrial function, support for hematopoiesis, and restoration of electrolyte balance. By integrating traditional knowledge with modern phytochemical insights, this review highlights the potential of polyherbal energy boosters as natural alternatives for improving physical and mental stamina, with promising applications in the field of nutraceuticals and functional health products.*

Keywords: Polyherbal energy booster, Traditional medicine, Adaptogens, Phytochemistry, Antioxidant activity, Herbal formulation, Nutraceuticals

Background: Traditional medicinal systems have long utilized polyherbal formulations to promote energy, resilience, and systemic balance. These formulations combine multiple botanicals to achieve synergistic therapeutic effects, offering an alternative to synthetic stimulants.
Objective: This review highlights the phytochemical composition and mechanisms of action of a traditional polyherbal formulation used as energy booster. It consists of Withania somnifera (Ashwagandha), Cinnamomum verum (Cinnamon), Asparagus racemosus (Asparagus), Ocimum sanctum (Tulsi), Glycyrrhiza glabra (Liquorice), Emblica officinalis (Amla), Mentha arvensis (Mentha), sugar, and salt as supportive components.
Methods: A narrative review methodology was adopted, sourcing data from scientific literature, classical Ayurvedic texts, and ethnopharmacological studies. Focus was placed on bioactive constituents, traditional usage, and evidence-based mechanisms contributing to energy enhancement.

I. INTRODUCTION

Traditional medicine systems worldwide have long utilized combinations of herbs to address various health conditions, with polyherbal formulations being a central element due to their enhanced therapeutic potential. Specifically, polyherbal energy boosters have been traditionally used to alleviate fatigue, increase endurance, and improve overall vitality. These formulations typically consist of multiple botanicals whose combined effects surpass those of individual components, offering a holistic approach to managing energy deficits.

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In contemporary society, increased stress levels, sedentary lifestyles, and chronic health issues have led to a heightened demand for natural remedies that safely support physical and mental energy. Herbs such as Withania somnifera (Ashwagandha), Cinnamomum verum (Cinnamon), Asparagus racemosus (Shatavari), Ocimum sanctum (Tulsi), Glycyrrhiza glabra (Liquorice), Emblica officinalis (Amla), and Mentha arvensis (Mentha), often combined with sugar and salt, have been traditionally incorporated in energy-enhancing blends.

These plants are rich in diverse bioactive compounds, including withanolides, flavonoids, saponins, polyphenols, and essential oils. Such phytochemicals contribute to their roles in regulating stress responses, combating oxidative damage, supporting immune function, and enhancing metabolic processes. The collective action of these compounds affects key physiological pathways—such as the hypothalamic-pituitary-adrenal (HPA) axis—and promotes mitochondrial health, blood formation, and electrolyte homeostasis.

Traditional systems of medicine have long employed polyherbal formulations to enhance energy and overall well-being through a holistic approach.

This review explores the phytochemical characteristics and underlying mechanisms of polyherbal energy boosters used in traditional medicine. It also considers their potential applications within modern nutraceutical industries and emphasizes the need for further research to validate their efficacy and safety.botanicals whose combined effects surpass those of individual components, offering a holistic approach to managing energy deficits.

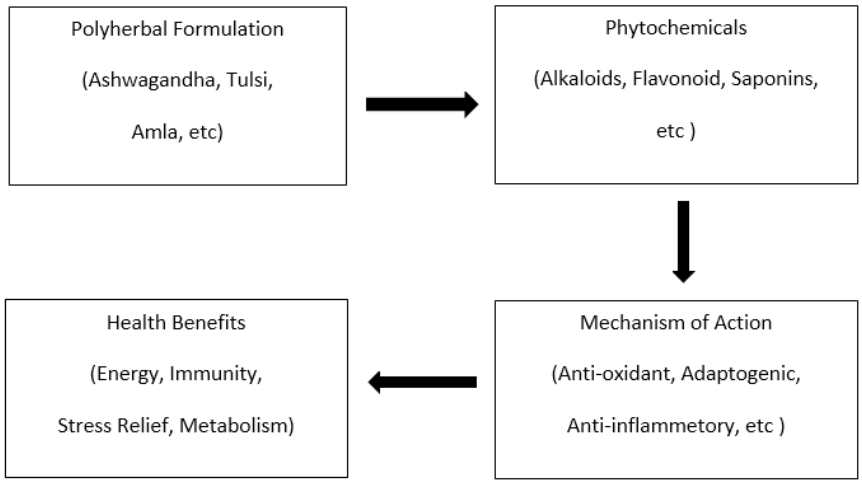
II. METHODOLOGY

This review was conducted by collecting and analyzing published studies related to polyherbal traditional medicines, with a focus on their phytochemical components and mechanisms of action. Literature published between 2000 and 2025 was considered, including both original research articles and review papers.

Relevant studies were selected using specific keywords related to polyherbal formulations, phytochemistry, and pharmacological mechanisms. Articles were included if they discussed formulations composed of two or more medicinal plants and provided information on their chemical constituents or biological activities. Studies focusing solely on single herbs or lacking relevant data were excluded.

It involves identifying plants that are widely recognized in traditional practices for their restorative, adaptogenic, and health-promoting properties. For this work, a group of commonly used herbs was considered, with attention given to their relevance in both cultural contexts and scientific reports.

COCEPTUAL FRAMEWORK OF POLYHERVBAL FORMULATION



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Focused on examining the chemical makeup of these plants. Particular importance was placed on secondary metabolites such as alkaloids, flavonoids, glycosides, tannins, and phenolic compounds, since these are generally regarded as the primary contributors to biological effects.

Analyze how these phytochemicals contribute to different mechanisms of action, such as antioxidant activity, immune support, metabolic regulation, and stress adaptation. Both traditional interpretations and modern experimental insights were included to present a balanced view. [1,2,3]

Phytochemical Composition of Selected Herbs

Polyherbal formulations derive their therapeutic efficacy from the rich and diverse phytochemical profiles of their individual herbal constituents. The synergistic interactions among these bioactive compounds enhance the formulation's ability to support energy metabolism, reduce fatigue, and improve resilience against physiological stressors. The selected herbs— Ashwagandha (Withania somnifera), Cinnamon (Cinnamomum verum), Asparagus (Asparagus racemosus), Tulsi (Ocimum sanctum), Liquorice (Glycyrrhiza glabra), Amla (Emblica officinalis), and Mentha (Mentha arvensis)—contain a wide range of secondary metabolites that contribute to their adaptogenic, antioxidant, immune-modulatory, and metabolic effects. Additionally, sugar and salt are included for their roles in energy replenishment and electrolyte balance.

HERB (Botanical Name)	COMMON NAME	MAJOR PHYTOCHEMICAL CONSTITUENTS	REPORTED ROLE IN ENERGY ENHANCEMENT
Withania somnifera	Ashwagandha	Withanolides, alkaloids, Flavonoids	Adaptogen, reduces stress and fatigue, improves stamina
Cinnamomum verum / C. cassia	Cinnamon	Cinnamaldehyde, eugenol, coumarin, volatile oils	Enhance glucose metabolism, support sustained energy release
Asparagus racemosus	Shatavari	Saponins, flavonoids, alkaloids, polyphenols	Improve vitality, supports hormonal balance, reduces fatigue
Ocimum sanctum	Tulsi	Eugenol, ursolic acid, rosemarinic acid, flavonoids, tannins	Adaptogen, reduces oxidative stress, enhances metabolic efficiency
Glycyrrhiza glabra	Liquorice	Glycyrrhizin, flavonoids, saponins, isoflavonoids	Supports adrenal function, reduces stress-induced fatigue
Emblica officinalis	Amla	Ascorbic acid (vit. C), tannins, gallic acid, ellagic acid	Potent antioxidant, improves mitochondrial activity
Mentha piperita / M. arvensis	Mint	Menthol, menthone, rosmarinic acid, flavonoids, tannins	Enhances alertness, improves digestion for better energy availability

1. Withania somnifera (Ashwagandha)

Ashwagandha is a well-documented adaptogenic herb, primarily known for its withanolide content—steroidal lactones with anti-stress and neuroprotective properties. Other notable constituents include alkaloids (somniferine, tropine), flavonoids, and sitoindosides, which contribute to its ability to modulate the hypothalamic-pituitary-adrenal (HPA) axis and enhance energy levels.

2. Cinnamomum verum (Cinnamon)

Cinnamon contains cinnamaldehyde, eugenol, and coumarins as its principal phytochemicals. These compounds possess antioxidant, anti-inflammatory, and insulin-sensitizing properties. By improving glucose uptake and mitochondrial activity, cinnamon aids in better energy utilization at the cellular level.

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3. Asparagus racemosus (Shatavari)
The pharmacologically active components of Asparagus racemosus include steroidal saponins (shatavarins I–IV), flavonoids, and alkaloids. These constituents have shown immunomodulatory, antioxidant, and adaptogenic activities, making the herb particularly useful in restoring vitality and reducing fatigue.

4. Ocimum sanctum (Tulsi)
Tulsi contains essential oils (eugenol, linalool), phenolic compounds, and flavonoids such as apigenin and rosmarinic acid. These phytochemicals support its adaptogenic, antimicrobial, and antioxidant actions, which help the body cope with physical and oxidative stress, thereby improving energy balance.

5. Glycyrrhiza glabra (Liquorice)
Liquorice root is rich in glycyrrhizin, glabridin, liquiritigenin, and various flavonoids. These compounds are known to exert anti-inflammatory, adrenal-supportive, and immunoregulatory effects. Glycyrrhizin, in particular, mimics the effects of cortisol, supporting energy levels during prolonged stress.

6. Emblica officinalis (Amla)
Amla is one of the most potent natural sources of vitamin C (ascorbic acid), along with gallic acid, ellagic acid, and emblicanin A and B. These antioxidants combat free radical damage, enhance mitochondrial function, and support red blood cell formation—factors that directly contribute to increased vitality and reduced fatigue.

7. Mentha arvensis (Mentha/Mint)
Mint contains volatile compounds such as menthol, menthone, and carvone, which are responsible for its refreshing and digestive properties. These phytochemicals stimulate appetite and digestive enzyme secretion, improving nutrient absorption and energy availability.

Sugar
Although not a herb, sugar provides a rapid source of glucose, which is vital for immediate energy production through glycolysis and ATP synthesis. In moderation, sugar enhances the palatability and efficacy of herbal formulations aimed at quick energy restoration.

Salt
Salt plays a crucial role in maintaining osmotic balance, nerve function, and muscle contraction. In energy-boosting formulations, it helps replenish electrolytes lost through sweat, especially in physically active individuals or in hot climates.[4,5,6]

Mechanisms of Action
Polyherbal formulations are foundational to many traditional medicine systems, particularly Ayurveda, due to their synergistic, multi-targeted therapeutic effects. Each herb contributes unique phytoconstituents that collectively exert pharmacological actions through various biochemical pathways. The following section elaborates on the mechanisms of action of key components used in polyherbal preparations, focusing on their phytochemistry and bioactivity.

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Ashwagandha

Phytochemicals: Withanolides, sitoindosides, alkaloids
Mechanism of Action: Ashwagandha exhibits adaptogenic, anxiolytic, and anti-inflammatory effects primarily via modulation of the hypothalamic-pituitary-adrenal (HPA) axis and reduction of cortisol levels. Withanolides downregulate pro-inflammatory cytokines (e.g., TNF-α, IL-6) and inhibit NF-κB signaling. Its neuroprotective actions involve enhancement of antioxidant enzymes (SOD, CAT) and promotion of GABAergic signaling.

Cinnamon

Phytochemicals: Cinnamaldehyde, eugenol, coumarin, procyanidins
Mechanism of Action: Cinnamon is known for its insulin-mimetic activity, improving glucose uptake via stimulation of GLUT-4 translocation in muscle and adipose tissue. Cinnamaldehyde activates PPARγ and inhibits α-glucosidase and aldose reductase, contributing to its antidiabetic and antioxidant roles. Additionally, its antimicrobial properties stem from membrane disruption and inhibition of bacterial quorum sensing.

Asparagus

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Phytochemicals: Saponins (shatavarins), flavonoids, polyphenols
Mechanism of Action: Asparagus racemosus modulates hormonal balance, especially in female reproductive health, by enhancing estrogenic activity through phytoestrogens. It shows immunomodulatory action by promoting macrophage activity and increasing immunoglobulin levels. Its adaptogenic and antioxidant properties are linked to increased glutathione levels and scavenging of ROS.

Tulsi

Phytochemicals: Eugenol, ursolic acid, apigenin, rosmarinic acid
Mechanism of Action: Tulsi demonstrates potent anti-inflammatory and antioxidant activities by suppressing COX-2 and iNOS expression. Eugenol inhibits lipid peroxidation and scavenges free radicals. Tulsi also affects the HPA axis and dopamine-serotonin systems, promoting stress resilience and mood regulation.

Liquorice

Phytochemicals: Glycyrrhizin, glabridin, liquiritigenin
Mechanism of Action: Glycyrrhizin inhibits 11β-hydroxysteroid dehydrogenase, prolonging cortisol activity and exerting anti-inflammatory and mineralocorticoid-like effects. It also possesses antiviral properties by inhibiting viral gene expression and replication (e.g., in hepatitis and herpes viruses). Glabridin has estrogenic activity and contributes to lipid metabolism regulation.

Amla

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Phytochemicals: Ascorbic acid, ellagic acid, gallic acid, emblicanin A & B
Mechanism of Action: Amla is a potent antioxidant, primarily due to its high ascorbate and polyphenol content. It enhances endogenous antioxidant enzyme activity and prevents oxidative DNA damage. It also modulates lipid profiles and has a hypoglycemic effect via inhibition of α-amylase and enhancement of insulin sensitivity.

Mentha

Phytochemicals: Menthol, menthone, flavonoids
Mechanism of Action: Menthol acts on TRPM8 cold receptors, resulting in a cooling sensation and analgesic effects. It also possesses spasmolytic activity on gastrointestinal smooth muscle via calcium channel blockade and anti-inflammatory effects through suppression of prostaglandin synthesis. [7,8]

Synergistic Interactions in Polyherbal Formulations

When combined, these ingredients often exhibit synergistic effects—amplifying individual actions while mitigating adverse effects. For instance:
Ashwagandha and tulsi both modulate the stress response via the HPA axis.
Cinnamon and amla together enhance glycemic control and antioxidant protection.
Liquorice and mentha may work synergistically to soothe gastrointestinal irritation.
Sugar and salt improve palatability and electrolyte restoration, facilitating compliance and nutrient absorption.
These interactions underlie the rationale behind polyherbal medicine: targeting multiple physiological systems concurrently with enhanced therapeutic efficacy and reduced toxicity compared to single-herb formulations.[7,9]

Traditional Uses and Formulations

Polyherbal medicine has been central to Ayurveda, Siddha, and Unani systems, where health is viewed as a balance of mind, body, and spirit. Instead of relying on a single herb, traditional healers often combined multiple plants to enhance therapeutic outcomes, reduce side effects, and create formulations that could address more than one health concern at a time.

General Traditional Uses

In traditional practice, polyherbal preparations were commonly prescribed for:
Enhancing vitality and stamina, often through tonic-like preparations.
Managing stress and fatigue, with adaptogenic herbs forming the base of many formulations.
Improving digestion and metabolism, using combinations that balanced heating and cooling properties of herbs.
Supporting immunity, particularly through rasayana (rejuvenating) formulations meant to strengthen overall resistance.
Restoring balance of doshas (Vata, Pitta, Kapha) to maintain long-term health.

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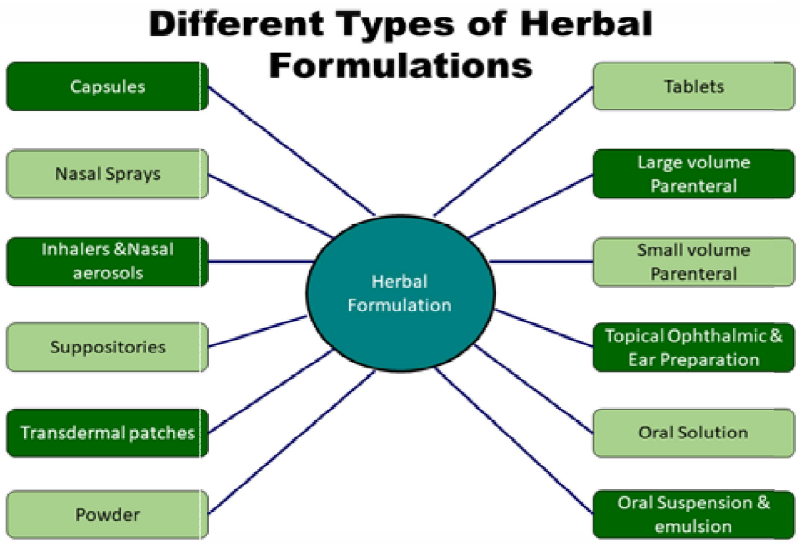
Role of Supportive Ingredients

Simple additives such as sugar and salt were not considered therapeutic agents but were added to improve palatability, stability, and absorption. Salt was also thought to balance electrolyte levels, while sugar was used to mask bitterness and provide quick energy.

They play functional roles that strengthen both the effectiveness and the acceptability of the preparation. Carbohydrate sources like sugar and honey provide readily available energy, which complements the slower, adaptogenic effects of herbs. This combination allows the formulation to deliver both immediate revitalization and longer-term improvements in stamina and recovery. Their natural sweetness also increases palatability, encouraging regular consumption and improving compliance, which is especially important in preventive and restorative healthcare.

Mineral salts, on the other hand, contribute to energy balance by replenishing electrolytes lost through physical exertion or stress. They support hydration, nerve conduction, and muscular activity, making the formulation more suitable for individuals experiencing fatigue or recovering from illness. Additionally, salts help maintain osmotic balance and enhance nutrient transport at the cellular level, thereby supporting the overall bioefficacy of herbal components.

From a formulation perspective, these supportive ingredients improve stability, extend shelf life, and facilitate uniform mixing of herbal extracts. Their contribution is therefore both physiological and technological, reinforcing the holistic design of polyherbal blends. In modern nutraceutical applications, the strategic inclusion of sugar and salts can transform traditional remedies into versatile energy-enhancing products that meet the expectations of contemporary consumers.[11]



Common Formulations

Traditional texts describe a wide variety of formulations, including:

Churnas (herbal powders): Mixtures of dried and powdered herbs, taken with water, ghee, or honey.

Kashayams (decoctions): Herbal extracts prepared by boiling mixtures in water, often used for respiratory, digestive, or metabolic conditions.

Avalehya or Lehyas (herbal pastes/jams): Semi-solid preparations such as Chyawanprash, where multiple herbs are blended with ghee, honey, and sugar for rejuvenation and immunity.

Arishtas and Asavas (fermented liquids): Mildly alcoholic preparations produced through natural fermentation, used for improving digestion, circulation, and vitality. [10,12]

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Potential Modern Nutraceuticals

The demand for nutraceuticals has grown rapidly worldwide, with increasing consumer interest in natural, plant-based products for preventive health and wellness. Polyherbal formulations are particularly well-suited for this sector because they combine multiple bioactive compounds that act on different physiological pathways. This allows them to address complex health conditions more effectively than single-ingredient supplements.

Polyherbal formulations hold immense potential in the modern nutraceutical industry, particularly in the domain of energy enhancement. With rising consumer interest in natural, plant-based alternatives to synthetic stimulants, these formulations are increasingly viewed as promising candidates for safe and effective vitality-boosting products. They can be incorporated into nutraceutical supplements such as capsules, powders, and syrups that provide sustained energy release without the side effects often associated with caffeine or chemical stimulants. Beyond supplements, polyherbal blends may also find application in functional beverages and fortified health drinks designed to restore vitality, support endurance, and aid recovery after fatigue or illness. Their adaptogenic and antioxidant properties make them suitable for use in sports nutrition, offering athletes and active individuals a natural way to improve stamina and reduce oxidative stress.

In addition, polyherbal nutraceuticals align well with preventive healthcare trends, as regular consumption could help in maintaining metabolic balance, enhancing resilience against stress, and promoting overall wellness. Advances in formulation technology, including nano-encapsulation and bioenhancer systems, further strengthen their potential by improving the bioavailability and consistency of active phytochemicals. In this way, polyherbal formulations are poised to evolve into reliable, consumer-friendly nutraceutical solutions that bridge traditional knowledge with modern scientific innovation.

Advantages of Polyherbal Nutraceuticals

- Synergistic activity: The combined effect of several herbs often produces broader therapeutic outcomes, such as improved energy, enhanced immunity, and balanced metabolism.
- Holistic approach: Unlike isolated compounds, polyherbal products maintain the complexity of natural systems, offering both therapeutic and supportive benefits.
- Consumer acceptance: Traditional use provides cultural credibility, making polyherbal supplements more appealing to consumers who prefer natural and time-tested remedies.
- Safety profile: When properly formulated, polyherbal preparations often balance the strong or undesirable effects of single herbs, leading to better tolerability.[13]

Modern Applications

In recent years, polyherbal principles have been adapted into nutraceuticals in various forms, including:

Capsules and tablets standardized to contain active phytochemicals.

Powdered blends for energy, digestion, and immunity support.

Used in formulations designed for endurance, quicker recovery, and reduced oxidative stress.

Provide a natural alternative to synthetic performance enhancers.

Functional beverages and tonics designed to reduce stress, enhance stamina, and provide antioxidant protection.

Incorporated into health supplements for regular use.

Support long-term vitality, metabolism, and resilience against lifestyle-related fatigue.

Herbal gummies and nutrition bars offering convenient delivery for younger and health-conscious consumers.

Herbal beverages and tonics – marketed for immunity, anti-stress effects, and overall wellness.[14,15]

Future Potential

With advances in formulation technology, polyherbal nutraceuticals can be integrated into nanoparticle carriers, fortified foods, and bio-enhanced delivery systems, improving bioavailability and consistency. Their broad scope also

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makes them promising candidates for managing lifestyle-related conditions such as metabolic disorders, chronic fatigue, and stress-related imbalances.

The role of polyherbal formulations in traditional medicine suggests strong possibilities for their expansion into modern therapeutic and wellness frameworks. As interest in natural health solutions continues to rise, these combinations of herbs could provide safer, more holistic alternatives or adjuncts to conventional treatments. Their future lies not only in preserving cultural practices but also in aligning them with the scientific rigor demanded by today's healthcare and nutraceutical industries.

One promising direction is the integration of polyherbal products into preventive healthcare. Instead of being used only for the management of illness, such formulations may find application in maintaining vitality, delaying age-related decline, and supporting resilience against chronic diseases. This fits well with the current global focus on lifestyle-related disorders such as diabetes, cardiovascular diseases, and stress-induced conditions.

Another potential lies in technological advancements. Improved extraction methods, standardization techniques, and nano-formulation strategies could help overcome issues of bioavailability and consistency. By enhancing delivery systems, the therapeutic efficacy of these herbs can be optimized while minimizing variability in patient response.

Polyherbal medicine also offers opportunities for evidence-based product development. With the application of modern tools such as metabolomics, systems biology, and artificial intelligence, it may become possible to unravel the synergistic interactions between different phytochemicals. This could guide the design of more targeted formulations and establish stronger credibility in both nutraceutical and pharmaceutical markets.[16,18]

Limitations and Future Directions

Although polyherbal formulations have been valued for centuries, their wider use in modern healthcare and nutraceuticals is still limited by certain challenges.

Limitations

One major issue is variability in phytochemical content, since the concentration of active compounds often changes with plant source, season, or method of preparation. This makes it difficult to ensure uniformity across batches. Another limitation is the absence of proper standardization, as most formulations do not have established quality markers or validated testing methods. This raises questions about reproducibility and safety.

The lack of large-scale clinical validation is another concern. While laboratory and small-scale studies suggest promising effects, evidence from well-structured human trials is limited. In addition, the complexity of herb–herb interactions makes it difficult to clearly explain how these combinations work together at the molecular level. Finally, regulatory differences between countries mean that products considered safe and acceptable in one region may face restrictions in another, slowing global acceptance.[18]

Future Directions

To overcome these challenges, future research and development should emphasize:

1. Phytochemical profiling and standardization through modern analytical tools to ensure consistency and quality.
2. Robust clinical trials to establish clear evidence of safety, dosage ranges, and therapeutic potential.
3. Mechanistic studies using omics technologies, bioinformatics, and molecular docking to unravel synergistic pathways.
4. Innovative delivery systems such as nanoformulations, fortified foods, and functional beverages to enhance bioavailability and consumer acceptance.
5. Harmonized global regulations to create standardized frameworks for safety and efficacy evaluation of polyherbal products.
6. Promote conservation, sustainable cultivation and biotechnological approaches for continuous phytochemical supply. [16,17]

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II. CONCLUSION

Polyherbal formulations represent one of the most enduring practices in traditional systems of medicine, where the combined use of multiple plants was seen as a way to achieve balance, enhance potency, and minimize side effects. This approach reflects a holistic philosophy of healing that remains highly relevant in today's search for natural and preventive health solutions.

The herbs considered in this review illustrate how diverse phytochemicals can contribute to multiple biological effects, including antioxidant protection, stress adaptation, metabolic regulation, and immune support. Even simple ingredients such as sugar and salt, though not medicinal in themselves, were traditionally included to improve stability, absorption, and palatability, showing the practical wisdom behind formulation design.

In the present context, the growing demand for nutraceuticals highlights the potential of polyherbal products to meet modern health needs. Their complex phytochemical profiles and synergistic effects make them suitable for addressing lifestyle-related concerns such as fatigue, stress, and chronic metabolic imbalance. However, their successful translation into mainstream healthcare is still limited by issues of standardization, variability, lack of clinical validation, and fragmented regulatory frameworks.

The way forward lies in bridging traditional wisdom with modern science. Standardized quality-control measures, well-designed clinical studies, and innovative delivery systems can help ensure safety and effectiveness. At the same time, clearer regulatory guidelines will be needed to promote wider acceptance and global recognition.

Overall, polyherbal formulations stand at the intersection of tradition and innovation. With proper validation and scientific refinement, they hold great promise not only as nutraceuticals but also as sustainable and holistic tools for promoting health and wellbeing in the modern era. [19,20,21]

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