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THE MEDICAL SIGNIFICANCE OF BIOLOGICALLY ACTIVE SUPPLEMENTS

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Abstract
This paper examines the significance of biologically active supplements (BAS) in maintaining and improving human health. Particular emphasis is placed on their clinical effectiveness, safety profile, and evidence-based use as reported in contemporary scientific literature.

Keywords: Dietary supplements (DS), antioxidants, nutrigenomics, drug–supplement interactions, prevention, metabolism.

Introduction

In recent years, Biologically Active Supplements (BAS) have gained a prominent position within modern healthcare and preventive medicine. Their widespread use is driven by changes in lifestyle, dietary habits, and the increasing burden of chronic diseases. Due to urbanization and globalization, many individuals are unable to obtain sufficient nutrients solely from their daily diet. The frequent consumption of processed and fast foods, along with excessive refinement of food products, leads to inadequate intake of essential vitamins, minerals, dietary fiber, and biologically active compounds. BAS provide an effective strategy to compensate for these deficiencies. Non-communicable diseases such as cardiovascular disorders, diabetes mellitus, hypertension, and neurodegenerative

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conditions remain major global health challenges. Numerous BAS contain antioxidant, anti-inflammatory, and metabolically active substances that contribute to reducing disease risk and supporting long-term health maintenance. Over the past decades, scientific interest in BAS has increased substantially. Data from randomized controlled trials and systematic reviews demonstrate the beneficial effects of specific supplements, including omega-3 fatty acids, vitamin D, and probiotics, in disease prevention and adjunctive therapy. Contemporary medicine increasingly focuses on personalized approaches that consider individual genetic and metabolic characteristics. The rational selection of BAS based on nutrigenomic principles allows for improved therapeutic outcomes and reduced likelihood of adverse reactions.

Biologically Active Supplements are natural or synthetic substances designed to support physiological functions in the human body. They are administered orally in various forms, such as capsules, tablets, powders, or liquids, and are intended to supplement the diet rather than replace conventional pharmacotherapy.

The physiological effects of BAS are determined by their chemical composition and include the following key functions:

- Maintenance of Health and Energy Balance: Correction of nutrient deficiencies contributes to improved vitality and overall well-being.
- Regulation of Physiological Processes: BAS influence enzymatic reactions, metabolic pathways, cellular activity, and immune system regulation. For instance, probiotics help maintain intestinal microbiota balance, which affects both digestion and immune defense.
- Preventive Effects: By enhancing adaptive capacity and limiting oxidative damage, BAS may reduce the likelihood of chronic disease development.

Classification of BAS

Nutritional Supplements

- Vitamins (A, B-complex, C, D, E)
- Minerals (calcium, magnesium, zinc, selenium)

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- Essential fatty acids (omega-3)

Parapharmaceutical Supplements

- Herbal extracts
- Bee-derived products
- Marine-origin compounds

These substances often demonstrate biological activity comparable to certain pharmacological agents.

One of the primary medical applications of BAS is the correction of nutrient insufficiencies, which is achieved through several mechanisms.

Nutrient deficiencies associated with inadequate dietary intake, pathological conditions, or specific life stages—such as pregnancy, lactation, or aging—can be effectively addressed through BAS.

- Iron: Widely used for the prevention and treatment of iron-deficiency anemia.
- Calcium and Vitamin D: Essential for bone health, particularly in elderly populations, and for reducing the risk of osteoporosis.

Many BAS act as cofactors or components of enzymes, thereby facilitating normal metabolic function.

- B-group vitamins: Crucial for energy production and proper nervous system activity.
- Folic acid (vitamin B9): Necessary for DNA synthesis and cellular proliferation.

Adequate nutrition is a fundamental determinant of immune competence. BAS support immune responses by stimulating immune cell development and activity.

- Vitamin C, Vitamin D, and Zinc: Play a central role in immune regulation and resistance to infectious diseases.

In addition to correcting deficiencies, BAS contribute to protecting the body from oxidative and inflammatory damage.

Oxidative stress occurs when free radical production exceeds antioxidant capacity. BAS containing antioxidants help restore balance by:

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- Protecting cellular structures such as membranes, proteins, and nucleic acids
- Reducing the risk of diseases associated with oxidative damage, including cardiovascular disorders and metabolic diseases

Key antioxidants include:

- Vitamins C and E
- Carotenoids (lutein, lycopene, beta-carotene)
- Polyphenolic compounds (flavonoids, catechins)

Persistent inflammation contributes to tissue damage and disease progression. BAS may modulate inflammatory responses by:

- Decreasing the synthesis of pro-inflammatory mediators
- Regulating immune cell activity
- Supporting tissue regeneration and repair

Disease Prevention and Health Maintenance

- Calcium and vitamin D for bone health
- Folic acid for prevention of neural tube defects during pregnancy
- Antioxidants for cardiovascular risk reduction

Adjunctive Treatment

- Probiotics to restore intestinal microflora during antibiotic therapy
- Omega-3 fatty acids to alleviate inflammatory conditions

Metabolic and Cardiovascular Support

- Omega-3 fatty acids for lipid regulation and cardiovascular protection
- L-carnitine and polyphenols for improved glucose and lipid metabolism

Immune System Support

- Vitamins C and D and zinc to enhance immune defense mechanisms

Despite their benefits, BAS should be used with caution.

Although often perceived as safe, BAS can produce adverse effects if consumed excessively or inappropriately.

- Overconsumption: Fat-soluble vitamins (A, D, E) may accumulate and cause toxicity.

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• Hypersensitivity reactions: Certain herbal and bee-derived products may induce allergic responses.

BAS can influence drug metabolism and efficacy.

• Anticoagulant therapy: Herbal supplements such as Ginkgo biloba may increase bleeding risk.

• Antidiabetic therapy: Ginseng may potentiate hypoglycemic effects.

In many regions, BAS are subject to less stringent regulatory oversight than pharmaceuticals, which may result in variability in product composition and labeling accuracy.

Conclusion

Current evidence highlights the supportive role of Biologically Active Supplements in modern healthcare. Their primary benefits include correction of nutrient deficiencies, modulation of metabolic and immune processes, and reduction of chronic disease risk. However, rational, evidence-based, and individualized use is essential to maximize benefits while minimizing potential risks.

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