

## ENHANCING HEALTH ACROSS THE LIFESPAN: THE ROLE OF NUTRACEUTICALS IN PEDIATRICS, GERIATRICS, AND ATHLETICS

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### ABSTRACT

Nutraceuticals, a word established by Stephen De Felice in 1989, represent the intersection of nutrition and medicines, providing health advantages beyond basic nutrition, such as illness prevention and treatment. In this study, the roles of nutraceuticals are examined in three important populations: athletics, geriatrics, and pediatrics. Nutraceuticals such as omega-3 fatty acids, probiotics, vitamin D, iron, multivitamins, and prebiotics have important roles in pediatric development, cognitive function, and immunological health. Nutraceuticals such as antioxidants, plant polyphenols, calcium, vitamin D, prebiotics, probiotics, and whey protein are critical for the elderly in fighting the effects of aging, maintaining bone and muscle function, and improving gut health. Among athletes, nutraceuticals like whey proteins, branched-chain amino acids (BCAAs), essential fats, vitamins, minerals, glutamine, and creatine play a pivotal role in enhancing performance, accelerating recovery, and maintaining muscle mass. This review underscores the growing importance of nutraceuticals in promoting health and preventing diseases, driven by increasing consumer awareness and scientific advancements. The findings highlight the potential of nutraceuticals to address specific nutritional needs across different life stages, contributing to overall health and well-being.

**KEYWORDS:** Nutraceuticals, Pediatrics, geriatrics, Athletes.

### INTRODUCTION

By fusing the terms "medication" and "nutrition," Stephen De Felice created the word "nutraceuticals" in 1989. Nutraceuticals are foods or portions of foods that have health or medicinal properties, such as the ability to prevent or treat disease. Hippocrates is credited with popularizing this idea when he suggested utilizing food as medicine. To avoid goiter, iodine was added to salt in the United States in the early 1900s.<sup>[1]</sup> Nutraceuticals in pediatrics highlight the potential health advantages of a diet rich in physiologically active components, which go beyond simple nourishment. To promote health and fend against disease, functional foods include vital vitamins, minerals, fibers, and fatty acids.<sup>[2]</sup> For elderly folks to be healthy, they need fewer calories but more nutrients. Aging causes people to lose muscle mass and require less energy, yet they still have a high need for several nutrients. For these purposes and to encourage healthy aging, nutrient-fortified goods are indispensable. Aging has a serious negative impact on health and is a factor in

around 50 million deaths globally each year. Because they include important nutrients, nutraceuticals can aid with some of these health issues. Athletes are the target audience for nutraceuticals because of their ability to safely and organically improve performance.<sup>[4]</sup> The market for sports nutrition products is predicted to increase at a rate of 24.1% this year, reaching \$91.18 billion globally, driven by consumer acceptance and knowledge of these supplements. Nutraceuticals can help athletes perform better in addition to preventing and treating common illnesses.<sup>[1]</sup> There is disagreement on the value of nutraceuticals in preventing infections, particularly respiratory infections. This is especially important in light of the COVID-19 pandemic, which has had a major influence on views on global health.<sup>[2]</sup>

### Nutraceuticals for Pediatrics

#### Omega-3 Fatty Acids

Essential fats called omega-3 fatty acids are vital for children's brain growth and function.

- **Sources:** Walnuts, flaxseeds, chia seeds, and fish oil.
- **Benefits:** Enhance cognitive performance, promote neurological and visual development, and lessen ADHD (Attention Deficit Hyperactivity Disorder) symptoms.<sup>[5]</sup>

### Probiotics

Live probiotics are good bacteria that support a balanced microbiome in the gut.

- **Sources:** Lactobacillus and Bifidobacterium strain-containing supplements, yogurt, and kefir.
- **Benefits:** Improve immunological function, strengthen the intestinal tract, and lower the risk of eczema and gastrointestinal illnesses.<sup>[6]</sup>

### Vitamin D

Bone health and immune system performance depends on vitamin D.

- **Sources:** supplements, fortified dairy products, and sunlight.
- **Benefits:** bolstering the immune system, promoting bone formation, and assisting with calcium absorption.<sup>[7]</sup>

### Iron

Iron is essential for cognitive development and preventing anemia.

- **Sources:** Red meat, spinach, lentils, and iron-fortified cereals.
- **Benefits:** Prevents iron-deficiency anemia, supports cognitive development, and improves energy levels.<sup>[8]</sup>

### Multivitamins

To assist general growth and development, multivitamins offer a mix of vital vitamins and minerals.

- **sources:** children's specific over-the-counter multivitamin supplements.
- **Benefits:** Boost the immune system, fill nutritional deficiencies in finicky eaters, and guarantee proper intake of vital nutrients.<sup>[9]</sup>

### Prebiotics

Non-digestible fibers called prebiotics encourage the development of beneficial gut flora.

- **Sources:** Bananas, onions, garlic, and supplements containing fructo-oligosaccharides or inulin.
- **Benefits:** Boost immune system function, improve gut health, and improve calcium absorption.<sup>[10]</sup>

### Nutraceuticals for Geriatrics

#### Antioxidants

The free radical theory of aging and chronic disease suggests that free radicals damage cells, contributing to aging and various diseases. Two antioxidant defense systems protect cells from this damage: antioxidant enzymes (like superoxide dismutase, catalase, and glutathione peroxidase) and low molecular weight nonenzymatic antioxidants (like thioredoxin, glutathione,

vitamins A, C, and E, lycopene, lutein, polyphenols, and quercetin).<sup>[11,12]</sup>

- **Sources:** Green leafy vegetables, fruits, and vegetables high in antioxidants like  $\beta$ -carotene, and vitamins A, C, and E.
- **Health Benefits:** Diets rich in antioxidants help combat free radical damage, potentially improving health and preventing diseases such as cardiovascular disease and cancer.<sup>[13]</sup>

#### Plant Polyphenols and Catechins

Numerous foods, such as fruits, vegetables, legumes, grains, and drinks, naturally contain chemicals called polyphenols. Their anti-inflammatory, anticancer, and antioxidant qualities are strong.

The following are some of the sources: red wine, coffee, tea, chocolate, pears, apples, grapes, cherries, and berries. The amount consumed each day might go up to 1 g.<sup>[13]</sup>

#### Essential Ingredients

- Green tea's polyphenol content: has substantial anticancer effects, especially against hormone-sensitive tumors, and contains epigallocatechin-3-gallate (EGCG).<sup>[14]</sup>
- Strong in polyphenols, grape seed extract (GSE) may be able to enhance circulation and guard against oxidative stress.<sup>[13]</sup>

#### Calcium and Vitamin D

The metabolism of skeletal tissue and the prevention of osteoporosis depend on vitamin D as well as calcium. Recent studies emphasize their non-skeletal functions, which include lowering the risk of colon cancer and colonic polyp recurrence, as well as their connections to conditions including diabetes and cancer.<sup>[15]</sup>

#### Prebiotics and Probiotics

Prebiotics and probiotics are beneficial in preventing certain diseases and promoting health, particularly in the elderly.

- **Benefits:** Improve malnutrition, lactose intolerance, calcium absorption, and constipation. They also enhance immunity in the elderly by restoring the bacterial balance in the gut.
- **Common Combinations:** Synbiotic formulations often include oligosaccharides, glutamine, vitamin B6, and zinc, with probiotic strains like *Lactobacillus plantarum*, *L. paracasei*, *L. rhamnosus*, *Bifidobacterium bifidum*, and *B. lactis*.<sup>[16]</sup>

#### Whey Protein

High-quality protein like whey can help seniors preserve and increase their muscle mass, which can help offset the effects of sarcopenia, which is the age-related decrease of lean body mass.

Benefits: Promotes muscle protein synthesis and amino acid uptake. Additional nutrients including  $\alpha$ -lactalbumin

are present in whey protein, which contributes to overall health support.

Suggested Intake: Eating meals with 35 g or more of whey protein can dramatically increase the synthesis of muscle protein in older people.<sup>[17]</sup>

### **Nutraceutical for Athletes**

#### **Muscle Building Supplements**

Muscle-building supplements are crucial for athletes, aiding in testosterone production, growth hormone levels, and maintaining metabolic rate.<sup>[1]</sup> Its supplements include.

#### **Whey Proteins (WP)**

Whey Proteins, which are vital for energy during protracted activity and prevent the development of atrophy of the muscle, are abundant in whey proteins. One to one and a half grams of amino acids per kg of body weight is the suggested daily intake (RDA).<sup>[1]</sup> Microfiltration and the ion exchange process are two techniques used to produce whey protein isolate, which has a protein concentration of over 90%.<sup>[18]</sup> Using lactalbumin as an example.

#### **Branched-Chain Amino Acids (BCAAs)**

BCAAs are essential for both muscle growth and repair. The three essential BCAAs are valine, isoleucine, and leucine. Leucine is very useful in promoting protein synthesis. The 2:1:1 ratio proportion of 10–15 g of BCAAs should be consumed daily, both before and after exercise.<sup>[19]</sup>

#### **Essential Fats**

Fatty acids with a high molecular weight, such as omega-3 and omega-6 fatty acids, support immune system function, muscle function, and faster healing.

Sources: Fish liver oil contains omega-3 polyunsaturated fats that improve cardiovascular health and sports performance.

The suggested daily consumption of fish oil is 1-2 grams in a 2:1 EPA ratio.<sup>[1]</sup>

#### **Vitamins and Minerals**

The immune system, bone health, energy production, hemoglobin formation, and protection against oxidative damage all depend on micronutrients. They aid in the synthesis and restoration of muscle tissue, both during exercise and recovery. Essential minerals and vitamins are made up of.

Strong bones require calcium and vitamin D.

B vitamins: for energy release, tissue development, and red blood cell maintenance.

Muscles cannot get oxygen unless they have iron.

The body is shielded from oxidative damage by antioxidants such as beta-carotene, selenium, and vitamins C and E.

Rather than relying on supplements, athletes should consume a diet rich in nutrients to obtain their antioxidant needs.<sup>[20-22]</sup>

### **Specific Nutraceutical Supplements for Athletes<sup>[1]</sup>**

#### **Glutamine**

Glutamine, a non-essential amino acid, is important for gut health, muscle growth, and immune function. Intense exercise can deplete glutamine levels, making supplementation beneficial. Athletes may require more glutamine than what is obtained from a protein-rich diet, especially vegetarians or vegans.

#### **Creatine**

An athlete's natural body synthesizes creatine, which is well-liked for building muscle, strength, and performance in high-intensity exercises. Usually, supplementation entails starting at 10–20 g daily and then reducing to 2–5 g daily for maintenance. Natural food sources such as beef, poultry, and fish contain creatine.

### **General Dietary Guidelines for Active Individuals**

Optimal training and avoidance of overtraining depend on a carefully planned diet that satisfies energy intake requirements and includes appropriate nutrition timing. Important elements consist of.

#### **Energy Intake**

Athletes should consume enough calories to offset energy expenditure, preventing weight loss, illness, and overtraining symptoms. Consuming 4-6 meals per day with snacks, including nutrient-dense energy bars and high-calorie supplements, helps maintain energy intake.<sup>[23]</sup>

#### **Carbohydrate**

Proper carbohydrate intake is essential for training and performance. Athletes are recommended to consume concentrated carbohydrate drinks and high carbohydrate supplements to meet their needs.<sup>[24]</sup>

#### **Water**

Proper hydration is crucial, as exercise performance can be impaired with a 2% or more loss of body weight through sweat. Athletes should be educated on hydration methods and supervised fluid intake during training and competition.<sup>[25]</sup>

### **CONCLUSION**

Nutraceuticals are essential for promoting health and preventing diseases across various age groups and lifestyles. In pediatrics, essential nutrients like omega-3 fatty acids, probiotics, vitamin D, iron, multivitamins, and prebiotics are crucial for cognitive development, immune system enhancement, and overall growth. These nutrients help bridge nutritional gaps, especially in children with selective eating habits. For geriatrics, nutraceuticals like antioxidants, plant polyphenols, calcium, vitamin D, prebiotics, probiotics, and whey protein are indispensable for combating oxidative stress, supporting bone health, improving gut health, and enhancing muscle mass. These compounds can mitigate adverse health effects associated with aging and improve

the quality of life for elderly individuals. In athletes, nutraceuticals like whey proteins, BCAAs, essential fats, vitamins, minerals, glutamine, and creatine are essential for enhancing performance, accelerating recovery, and building muscle mass. A well-balanced diet supplemented with these nutraceuticals ensures athletes can perform at their peak and recover efficiently. As nutraceuticals' understanding expands, their application in various health and medicine fields is expected to grow, providing more targeted and effective solutions for maintaining health and preventing diseases.

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