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Review Article

Peel Seeds in Functional Food Innovation: A Review on Their Use in Protein Bars

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Abstract

The increasing demand for convenient and nutritious food options has led to the development of high-nutrient protein bars as potential meal replacements. These bars are formulated to provide a balanced mix of protein, carbohydrates, healthy fats, and essential vitamins and minerals. This review aims to evaluate the efficacy and safety of high-nutrient protein bars as meal replacements. A comprehensive literature review was conducted to identify relevant studies that investigated the nutritional and health outcomes of consuming these bars. The results suggest that high-nutrient protein bars can serve as a convenient and effective approach to support weight management, improve muscle function, and enhance overall nutrition. However, the quality and safety of these products can vary significantly depending on their ingredients, manufacturing processes, and labeling claims. Therefore, it is essential to critically assess the nutritional content and safety of high-nutrient protein bars before recommending them as meal replacements.

Keywords: Protein bars, Weight management, Muscle function, Nutritional adequacy, Protein supplements, Meal alternatives.

1. INTRODUCTION:

Nutraceuticals are food products that offer medicinal and health benefits, such as illness prevention and treatment. Antioxidants and phytochemicals are two major types of nutraceuticals. Studies have shown that foods containing phytochemicals, such as the carotenoids found in carrots, may help protect against conditions like cancer, diabetes, heart disease, and hypertension. The definition of nutraceuticals was broadened with the passage of the Dietary Supplement Health and Education Act to include vitamins, minerals, herbs and other botanicals, amino acids, and any dietary substances used by humans to enhance overall nutritional intake as dietary supplements. This expansion led to a significant increase in the use of nutraceuticals. Hippocrates appropriately emphasized over 2,000 years ago, “Let food be your medicine and medicine be your food.” Dr. Stephen L. Defelice originally coined the term “nutraceutical” to describe “a product isolated or purified from foods and sold in medicinal forms.” The term itself is a combination of “nutrition” and “pharmaceutical[1]. One product that satisfies consumer desires for a high-protein, low-carbohydrate diet is protein bars. Given the size of the protein bar market, manufacturers must determine the ideal levels of sweetness and texture to delight customers while maintaining a high-protein, low-carbohydrate bar[2]. The term "nutraceutical" to establish a product extracted or purified from foods and sold in healthful forms[3]. The body gains from them. The terms nutrition and pharmaceutical are combined to form the term nutraceutical[4]. Fruits and vegetables are significant sources of health-promoting components such as vitamins, minerals, antioxidants, and fiber. These valuable commodities are essential for ensuring food and nutritional security. Their consumption plays a vital role in providing a well-balanced and healthy diet[5]. Consumer acceptance has also been growing for five alternative protein sources: pulses, algae, insects, plant-based proteins, and cultured meat[6].

2. CLASSIFICATION OF NUTRACEUTICALS[7-9]

There are currently many nutraceuticals available on the market. The chart below provides an example. Nutraceuticals are non-specific biological therapies used to manage symptoms, prevent cancer, and promote overall wellness. These can be classified into four main categories, as listed below.

1. Herbs or botanical products in the form of extracts and concentrates.
2. Materials with known nutritional properties, including fatty acids, vitamins, minerals, and amino acids nutrients.
3. Reagents derived from other sources (e.g. pyruvate, chondroitin sulphate, and steroid hormone precursors) with particular uses, including meal replacements, weight-loss supplements and sports nutrition supplements for the diet.
4. Macronutrients and micronutrients.

1. Herbals: Since the beginning of human civilization, herbal treatments have been used to treat both acute and chronic illnesses. Over hundreds of years, herbal knowledge has expanded, providing us with numerous effective ways to ensure healthcare today.

2. The Nutrients: The most widely recognized nutrients include fat-soluble, water-soluble, and antioxidant vitamins. The use of antioxidants in food or supplements has been linked to numerous potential health benefits. In general, antioxidants may help prevent cerebrovascular diseases and cancer. Parkinson's disease, for instance, may be prevented by consuming high amounts of vitamin E. Vitamin C, in its oxidized form (dehydroascorbic acid), can readily cross the blood-brain barrier. Vitamin supplements are also known to stimulate T cells and macrophages and have been linked to enhanced antibody responses to vaccines such as hepatitis B and tetanus. Selenium supplementation is believed to help prevent pancreatic cancer, especially in genetically predisposed individuals who often have low serum levels of this mineral. Zinc is also an essential nutrient for immune function.

3. Supplements of Diet: Dietary supplements have been developed to treat a variety of health conditions. For example, prepackaged, nutritionally balanced meals that follow guidelines set by national health organizations have been shown to improve patient adherence to dietary recommendations and positively impact various risk factors in individuals with cardiovascular disease.

4. The macro and micronutrients: Macronutrients-fats, proteins, and carbohydrates-provide energy and are required in larger amounts. Micronutrients, which include vitamins and minerals, are equally essential but needed only in trace amounts. They are often consumed together with macronutrients. Nutrients are broadly classified into two types: macronutrients and micronutrients. Natural products are frequently used to supply an adequate amount of beneficial ingredients and additives. The addition of high-fiber components enhances the food's ability to retain water and improve its nutritional quality.

3. DEFINATIONS[10,11]

Nutrient: A nutrient is a microscopic messenger that delivers life-sustaining instructions to our cells, enabling them to function, grow, and thrive.

Feed: Feed refers to nourishing substances that fuel the body, supplying essential building blocks for optimal health, wellness, and performance.

Food: Food is a synergistic combination of nutrients, energy, and life-sustaining compounds that not only nourish the body but also delight the senses and foster a connection with the natural world.

4. TYPES OF BAR

a. Fruit bar: In the preparation of fruit bars, additives such as binders are mixed with fruit pulp in various proportions and then dried using a mechanical dehydrator. Dates and other fruit-based components have been associated with several significant health benefits, including improved gastrointestinal health and reduced risk of cardiovascular disease[12,13].

b. Fruit peel bar: Fruit peels are typically regarded as waste and pose an environmental challenge for many industries due to the difficulty of their disposal[14]. Peels from fruits and vegetables account for a substantial portion of kitchen waste generated annually. A growing population increases this waste through higher demand for raw materials[15]. However, fruit peels are rich in vitamins, minerals, and antioxidants. Fruit peel bars utilize this hidden nutritional potential, offering a boost of energy and wellness. For example, the potassium content in banana peels may help lower blood pressure and support heart health[16].

c. Nutritional bar: Nutritional bars are designed to enhance dietary quality and can serve as a replacement for morning or afternoon snacks, complementing main meals. These bars may include dates, peanuts, garden cress seeds, dry fruits, and honey-all of which are excellent sources of micronutrients[17]. Health-conscious consumers increasingly seek nutritious, convenient, and health-enhancing products, driving the growing demand for healthy snacks[18].

d. Weight loss bar: These bars can be used as dietary supplements to counteract the metabolic effects of obesity[19]. It has been demonstrated that regular consumption of oat-based products can help reduce cholesterol levels, thereby lowering the risk of cardiovascular disease[20].

e. Protein bar: Healthy individuals often require protein supplements to support muscle growth and maintain overall fitness, especially when engaging in regular physical activity[21]. Several randomized controlled trials have examined the nutritional effects of consuming commercial protein bars, as protein also plays an essential role in combating malnutrition[22].

5. FORMULATION OF FRUIT PEEL BAR[23]

Fruits were thoroughly washed with clean tap water. The formulation may include fruit pieces, fruit puree, or fruit powder. To prepare the protein bar, all ingredients were accurately weighed, placed into a container, and mixed evenly to form a uniform dough. This dough was then transferred into silicone molds to shape the bars. The molds were covered with aluminum foil to prevent contamination.

6. EVALUATION OF PROTEIN BAR

6.1. Physical evaluation

A panel of ten educated members was selected to evaluate the sensory characteristics of the protein bars, including color, flavor, taste, and overall acceptability. A nine-point Hedonic scale was used, with one point denoting "dislike extremely" and nine indicating "like extremely." Panelists were instructed to rinse their mouths with cold, filtered water before tasting each sample. Evaluations were conducted under natural daylight conditions[24,25].

6.2. Chemical evaluation

a. Ash content: The ash content evaluation test for a protein bar determines the percentage of residual minerals and inorganic compounds present in the bar. This test involves incinerating a sample of the protein bar at high temperatures (typically 500-600°C) and measuring the weight of the resulting ash. The ash content is then calculated as a percentage of the original sample weight[26].

b. Moisture content: The moisture content test determines the percentage of water present in the protein bar. This is done by drying a sample in a controlled environment (typically using a desiccator or oven) and measuring the weight loss, which corresponds to the moisture content. The result is expressed as a percentage of the original sample weight[27].

c. Fiber content: This test measures the amount of dietary fiber in the protein bar. It usually involves enzymatic digestion to break down digestible carbohydrates, followed by gravimetric analysis of the remaining fiber residue. The result is expressed as a percentage of the original sample weight[28].

d. Fat content: The fat content test involves extracting fat from a bar sample using solvents such as ether or hexane. The extracted fat is then weighed, and the result is expressed as a percentage of the original sample weight. Common methods include Soxhlet extraction or the Babcock method[29].

7. STORAGE

Dehydrated and shelf-stable products like fruit bars and fruit leathers are commonly used as confections. Fruit bars are made by combining fruit peels with additional ingredients and forming them into thin layers. Using naturally ripe fruit peels enhances flavor and adds valuable nutrients such as vitamins, minerals, and dietary fiber[30].

8. PACKAGING

Packaging of protein bars involves enclosing the product in protective materials such as plastic film, foil, or paper to preserve freshness and prevent contamination. The bar is typically placed in a rectangular or square-shaped wrapper, which is then sealed using heat, pressure, or adhesives. Proper packaging helps maintain the bar's texture, flavor, and nutritional integrity[31].

9. HEALTH BENEFIT OF HIGH NUTRIENT PROTEIN BAR[32-42]

1. Improved Bone Health: Some protein-rich bars contain calcium and other essential minerals that support bone strength and help reduce the risk of osteoporosis.
2. Enhanced Cognitive Function: These bars provide amino acids that are converted into neurotransmitters like dopamine and serotonin, which play a crucial role in brain function.
3. Muscle Growth and Repair: Protein is essential for muscle development and recovery, making these bars popular among athletes and bodybuilders.
4. Weight Management: High-protein bars promote satiety, reducing hunger and aiding in weight loss and maintenance.
5. Support for Bariatric Patients: These bars can be used in Bariatric care to support weight loss management post-surgery.
6. Nutritional supplements: Beneficial for individuals with nutritional deficiencies or mal-absorption issues.
7. Supports Immune Function: Protein bars may contain immunoglobulins and other components that support immune health and reduce the risk of infections.
8. Cost-Effective and Stable: Protein bars are valued for their reproducible synthesis, cost-effectiveness, thermal and chemical stability, reusability, and easy modification.
9. Global Consumer Advantage:The globalization of the food industry provides consumers access to a wide variety of high-quality nutritional products.
10. The amount of antioxidant and antibacterial compounds in discarded byproducts may be comparable to or even greater than that found in the final product.
11. Protein bars can align with the global goal of "zero waste" by utilizing food byproducts, contributing to sustainability and supporting a circular economy model.

10. CONCLUSION

n conclusion, protein bars made from natural ingredients offer a nutritious and convenient snack option for individuals seeking a healthy and sustainable alternative. By harnessing the power of natural

components, these bars deliver an energy boost, support muscle growth and recovery, and promote overall well-being.Their minimal use of artificial additives and preservatives makes them ideal for health-conscious consumers. Natural protein bars are particularly suited for fitness enthusiasts, busy professionals, and anyone seeking a wholesome snack to support an active lifestyle.Moreover, many natural protein bars cater to specific dietary needs-being gluten-free, vegan, or made with organic ingredients-making them accessible to a wide range of consumers. Their production methods often have a lower environmental impact compared to conventional protein bars, further enhancing their appeal as a guilt-free, sustainable choice.Overall, natural protein bars represent a superior snack option that combines health, environmental responsibility, and convenience-making them a valuable addition to a balanced and active lifestyle.

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