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Review Article

Comparative Health Impacts of Animal and Plant Proteins: An Exploration of Cardiovascular Risks and Benefits

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ABSTRACT

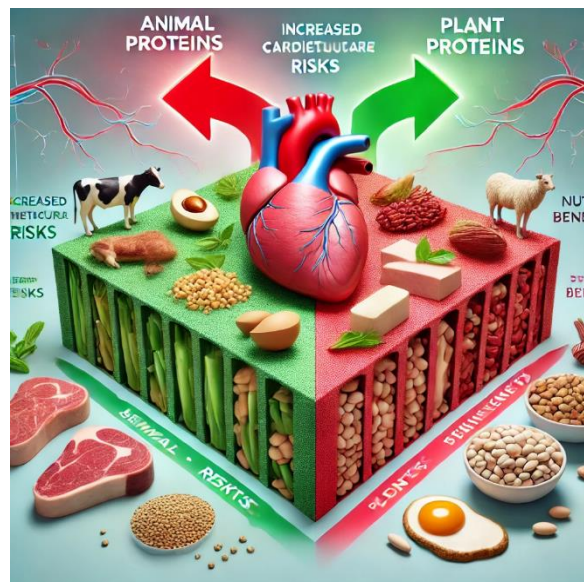
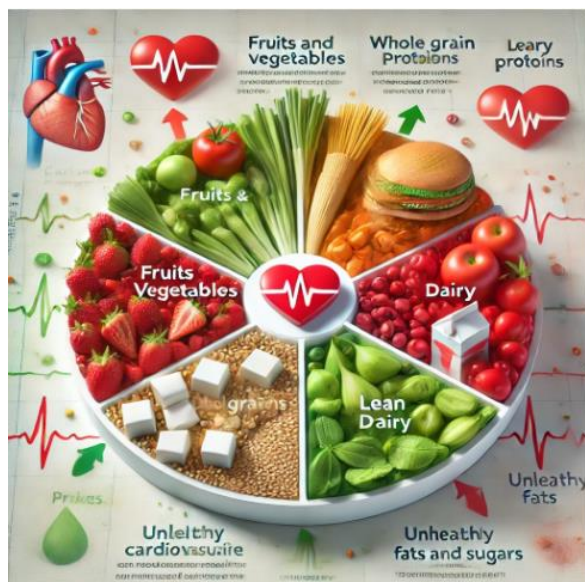
The comparative exploration of animal and plant proteins highlights their respective nutritional benefits, health impacts, and broader implications for sustainability and ethics. Animal proteins, known for their complete amino acid profile and essential nutrients like vitamin B12, heme iron, and omega-3 fatty acids, play a crucial role in muscle repair and overall health. However, excessive consumption of red and processed meats is linked to health risks such as cardiovascular diseases, type 2 diabetes, and certain cancers, while contributing significantly to environmental degradation through greenhouse gas emissions and deforestation. In contrast, plant proteins are associated with reduced cholesterol levels, improved heart health, and a lower risk of chronic diseases, making them a healthier alternative for long-term well-being. Their environmental sustainability, lower resource requirements, and smaller ecological footprint further position them as a vital component in combating climate change and ensuring global food security. Despite their benefits, plant proteins face challenges such as incomplete amino acid profiles and the presence of anti-nutrients, which can impact nutrient absorption if not addressed through proper preparation techniques. Scientific comparisons underscore the importance of balance and moderation in dietary choices, emphasizing the role of plant-based proteins in reducing health risks while supplementing with animal proteins where necessary to meet specific nutritional needs. Ethical concerns regarding animal welfare and the unsustainable practices of industrial farming add another layer to the ongoing discourse.

1. Introduction

Proteins are fundamental macronutrients essential for human health, playing a critical role in muscle repair, enzyme production, and overall cellular function. The debate between animal and plant protein sources has gained significant attention in recent years due to their distinct nutritional profiles and health implications. Animal proteins are often praised for their complete amino acid composition, making them highly effective for muscle growth and recovery (Maleky & Ahmadi, 2025). However, excessive consumption of red and processed meats has been linked to increased risks of cardiovascular diseases and certain cancers (Visioli, 2024). On the other hand, plant proteins, while sometimes lacking one or more essential amino acids, offer unique advantages such as being rich in fiber and heart-healthy nutrients (VNutrition and Wellness, 2025). This section explores the growing interest in balancing these protein sources to optimize health outcomes.

The shift toward plant-based diets is driven by both health and environmental considerations. Research indicates that greater consumption of plant proteins is associated with reduced risks of chronic diseases, including type 2 diabetes and cardiovascular conditions (Visioli, 2024). Additionally, plant-based protein sources have a significantly lower environmental footprint compared to animal proteins, contributing to sustainability goals (Maleky & Ahmadi, 2025). Innovations in plant protein production, such as precision fermentation and recombinant protein technology, are further enhancing their nutritional value and accessibility (GreyB, 2025). These advancements highlight the potential of plant proteins to meet global dietary needs while addressing ethical and ecological concerns.

Despite the benefits of plant proteins, animal proteins remain a vital component of many diets worldwide. They provide essential nutrients like vitamin B12, heme iron, and omega-3 fatty acids, which are less abundant in plant-based sources (VNutrition and Wellness, 2025). However, the health



Graphical Abstract

risks associated with excessive meat consumption underscore the importance of moderation and variety in dietary choices. The convergence of health, environmental, and ethical factors suggests that future dietary guidelines should emphasize a balanced approach, integrating both animal and plant proteins to promote optimal health and sustainability (Visioli, 2024). This review aims to provide a comprehensive analysis of the benefits and risks associated with these protein sources, offering practical recommendations for informed dietary decisions.

2. Animal Proteins: Benefits and Risks

2.1. Benefits of Animal Proteins

Animal proteins are highly regarded as one of the richest and most efficient dietary sources of essential nutrients. They are considered *complete proteins* because they contain all nine essential amino acids that the human body cannot produce on its own. This makes them ideal for supporting muscle repair, immune function, and the production of enzymes and hormones (Maleky & Ahmadi, 2025). For individuals with increased protein needs, such as athletes, pregnant women, or individuals recovering from illness, animal proteins provide a concentrated and readily available source of high-quality nutrition.

In addition to their complete amino acid profile, animal proteins are rich in several key nutrients. Vitamin B12, found almost exclusively in animal-based foods, plays a critical role in red blood cell production and nervous system function (Visioli, 2024). Animal proteins are also a significant source of *heme iron*, which is more easily absorbed by the body than the non-heme iron found in plants. Furthermore, omega-3 fatty acids, abundant in fatty fish like salmon and mackerel, are essential for brain health, reducing inflammation, and promoting heart health (Harvard T.H. Chan School of Public Health, 2025). These nutrients make animal proteins indispensable for individuals who may otherwise face nutritional deficiencies on plant-exclusive diets.

Another advantage of animal proteins is their digestibility. Animal-based protein sources such as eggs, dairy, and meat are

more easily digested and absorbed than some plant-based proteins, which may contain fiber and anti-nutrients like phytates that inhibit absorption. This high bioavailability makes animal proteins particularly effective for meeting the nutritional demands of those who require optimal nutrient intake in small quantities.

2.2. Risks of Animal Proteins

Despite their benefits, consuming excessive amounts of animal proteins—particularly red and processed meats—poses significant health risks. Studies have shown that frequent consumption of red and processed meats is associated with an increased risk of cardiovascular diseases, type 2 diabetes, and certain cancers, including colorectal and breast cancer (Mass General Brigham, 2025). Processed meats, such as bacon, sausages, and salami, are especially concerning due to their high levels of saturated fats, sodium, and added preservatives. These compounds can contribute to inflammation, oxidative stress, and plaque buildup in arteries, thereby increasing the risk of chronic diseases.

Emerging research has also linked red meat consumption to cognitive health risks, such as a higher likelihood of dementia and accelerated brain aging (ScienceAlert, 2025). These findings raise questions about the long-term effects of diets heavily reliant on animal proteins. Additionally, the consumption of certain animal products, like full-fat dairy and fatty cuts of red meat, is associated with increased cholesterol levels, which can contribute to heart disease if not balanced by healthy lifestyle choices (Visioli, 2024).

Environmental and ethical concerns further highlight the drawbacks of animal protein consumption. The livestock industry is a major contributor to greenhouse gas emissions, deforestation, and water pollution, making it a significant factor in climate change. Ethical considerations regarding animal welfare also lead many individuals to question the sustainability of relying on animal proteins as a primary source of nutrition. These risks, coupled with health concerns, emphasize the need for moderation and a shift toward integrating plant-based alternatives.

Scientific studies have consistently highlighted the differences in the nutritional profiles of animal and plant proteins. Animal proteins are considered complete proteins, containing all nine essential amino acids required for human health. This makes them particularly effective for muscle repair and growth, especially in younger individuals (Reid-McCann et al., 2025). In contrast, plant proteins often lack one or more essential amino acids, requiring careful food pairing to achieve a complete amino acid profile. For example, combining legumes with grains can provide a balanced protein intake (Maleky & Ahmadi, 2025). However, plant proteins offer additional benefits, such as being rich in fiber and phytochemicals, which contribute to overall health and reduce the risk of chronic diseases like cardiovascular conditions (Visioli, 2024).

4.2. Health Impacts

The health impacts of animal and plant proteins have been extensively studied. While animal proteins are associated with higher muscle mass and strength, excessive consumption of red and processed meats has been linked to increased risks of cardiovascular diseases, type 2 diabetes, and certain cancers (Harvard T.H. Chan School of Public Health, 2025). On the other hand, plant proteins are associated with lower cholesterol levels and reduced risks of chronic diseases. A higher ratio of plant protein to animal protein in the diet has been shown to improve heart health and reduce the risk of coronary heart disease (Glenn et al., 2025). These findings suggest that while both protein sources have their merits, moderation and balance are key to optimizing health outcomes.

4.3. Environmental Sustainability

The environmental impact of protein production is another critical area of comparison. Livestock farming, which supports animal protein production, is a major contributor to greenhouse gas emissions, deforestation, and water pollution (Gil et al., 2024). In contrast, plant protein production has a significantly lower environmental footprint, requiring fewer resources and producing less waste. This makes plant proteins a more sustainable option for meeting global dietary needs, especially as the population continues to grow (Drewnowski & Hooker, 2025). Innovations in plant protein production, such as precision fermentation and recombinant protein technology, are further enhancing their sustainability and nutritional value (Visioli, 2024; Gujjeti et al., 2013).

5. Sustainability and Ethical Considerations

5.1. Sustainability

The environmental impact of protein production has become a critical concern in the context of climate change and resource conservation. Animal protein production, particularly from livestock, is a significant contributor to greenhouse gas emissions, deforestation, and water pollution. For instance, cattle farming alone accounts for a substantial portion of methane emissions, a potent greenhouse gas (Hussain & Li, 2025). Additionally, the land and water resources required for raising livestock far exceed those needed for plant-based protein production. This inefficiency has led to calls for a shift toward more sustainable protein sources, such as plant-based and alternative proteins.

Plant proteins, on the other hand, have a much lower environmental footprint. They require fewer resources and produce significantly less waste during production. Emerging

technologies, such as precision fermentation and lab-grown meat, are further reducing the environmental impact of protein production by minimizing land use and emissions (Becker, 2025). These innovations are paving the way for a more sustainable food system that can meet the protein demands of a growing global population while mitigating environmental degradation.

5.2. Ethical Considerations

Ethical concerns surrounding animal protein production primarily focus on animal welfare and the moral implications of industrial farming practices. The conditions in which animals are raised for meat, dairy, and eggs often involve overcrowding, limited mobility, and inhumane treatment. These practices have sparked debates about the ethics of consuming animal products and have driven interest in plant-based and cultured meat alternatives (Becker, 2025; Gujjeti et al., 2014).

Cultured meat, produced from animal cells without the need for slaughter, offers a promising solution to ethical concerns. It mimics the taste and texture of traditional meat while eliminating the need for factory farming. Similarly, plant-based meat substitutes provide an ethical alternative for consumers seeking to reduce their reliance on animal products. These developments align with the growing consumer demand for cruelty-free and environmentally friendly food options.

6. Practical Recommendations

6.1. Balanced Dietary Choices

To optimize health and sustainability, individuals are encouraged to adopt a balanced approach to protein consumption. This involves integrating both animal and plant proteins into the diet while prioritizing plant-based sources. For example, replacing red and processed meats with legumes, nuts, and seeds can significantly reduce health risks and environmental impact (Drewnowski & Hooker, 2025). Flexitarian diets, which emphasize plant-based foods while allowing occasional consumption of animal products, are gaining popularity as a practical and sustainable dietary model.

6.2. Food Pairing for Complete Proteins

For those relying on plant proteins, combining complementary foods is essential to achieve a complete amino acid profile. Pairing grains with legumes, such as rice and beans or lentils and quinoa, ensures that all essential amino acids are consumed. This strategy is particularly important for vegetarians and vegans who may not consume animal proteins.

6.3. Policy and Education

Governments and organizations play a crucial role in promoting sustainable protein consumption. Policies that incentivize the production and consumption of plant-based proteins, such as subsidies for legumes and tax breaks for sustainable farming practices, can drive change at a systemic level. Public education campaigns highlighting the health and environmental benefits of plant-based diets can also encourage individuals to make informed dietary choices (Becker, 2025).

6.4. Innovations in Food Technology

Investing in food technology is vital for improving the taste, texture, and nutritional value of plant-based and alternative

proteins. Advances in fermentation, extrusion, and cell culture technologies are making these products more appealing and accessible to consumers. Continued research and development in this field will be essential for scaling up production and meeting global protein demands sustainably (Hussain & Li, 2025; Anjali et al., 2022).

7. Conclusion

The comparative health impacts of animal and plant proteins highlight the intricate balance between their nutritional benefits and associated risks, particularly in relation to cardiovascular health. While animal proteins provide a complete amino acid profile and essential nutrients like vitamin B12 and heme iron, excessive consumption—especially of red and processed meats—has been strongly linked to cardiovascular diseases and certain cancers. Conversely, plant proteins offer numerous health advantages, including reduced cholesterol levels, improved heart health, and a lower risk of chronic diseases, making them a favorable alternative for cardiovascular benefits. However, challenges such as incomplete amino acid profiles in plant proteins can be addressed through proper food combinations and dietary planning. By adopting a balanced approach that incorporates both protein sources in moderation, individuals can optimize cardiovascular health while addressing broader concerns about sustainability and ethical considerations. This balanced integration underscores the importance of informed dietary choices tailored to individual health goals and environmental priorities.

Conflicting Interests

The authors have declared that no conflicting interests exist.

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