

Functional Nutrition: Carotenoids' Impact on Animal Growth and Immunity

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Introduction

Carotenoids are natural pigments widely present in plants and algae, responsible for the vibrant colors seen in various fruits, vegetables, and flowers. These compounds have gained significant attention due to their potential health benefits and physiological functions in animals, including farm animals. Carotenoids can be obtained through dietary sources or synthesized by certain animals, while others rely on external dietary intake. In farm animal production, the inclusion of carotenoids in animal diets has garnered interest as a means to enhance health, performance, and product quality. Carotenoids have been recognized for their antioxidant properties, which play a crucial role in combating oxidative stress and promoting overall well-being. Additionally, they have immunomodulatory effects, potentially improving immune responses and disease resistance in animals. Furthermore, carotenoids contribute to the visual appeal of animal tissues, affecting consumer perception of product quality. The characteristic red, orange, and yellow colors imparted by carotenoids in animal-derived products, such as eggs and meat, can influence consumer preferences and willingness to purchase.

Understanding the implications of carotenoid inclusion in farm animal diets is vital for optimizing animal health, performance, and product quality. Therefore, this review aims to comprehensively examine the potential health benefits of carotenoids in farm animals, as well as their impacts on growth, immunity, reproduction, and product quality. Moreover, this review explores the underlying mechanisms behind the observed effects and discusses challenges and future perspectives in utilizing carotenoids in farm animal production [1].

Description

Carotenoids in farm animal diets can originate from various sources, including natural feedstuffs and synthetic supplements. Natural sources of carotenoids include green forages, vegetables, fruits, and certain algae. Common carotenoid types found in these sources include β -carotene, lutein, zeaxanthin, lycopene, and astaxanthin. Additionally, carotenoid-rich byproducts from the food and agricultural industries, such as marigold petals and tomato pomace, are often utilized as feed ingredients. Synthetic carotenoid supplements derived from chemical synthesis or fermentation processes are also available. The selection of carotenoid sources and types in farm animal diets depends on factors such as cost, availability, stability, and desired physiological effects. Careful consideration of these factors is essential to ensure optimal carotenoid inclusion and achieve desired health and performance outcomes in farm animals [2].

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Carotenoids, the pigments responsible for the vibrant colors seen in various fruits, vegetables, and plants, are abundant in natural food sources. Green forages, such as grasses and leafy vegetables, are rich sources of carotenoids like β -carotene, lutein, and zeaxanthin. Brightly colored fruits and vegetables like carrots, tomatoes, papayas, and pumpkins are also notable sources of carotenoids, including β -carotene and lycopene. Additionally, certain algae species, such as *Spirulina* and *Dunaliella*, contain high concentrations of carotenoids, such as β -carotene and astaxanthin. These natural sources offer a diverse range of carotenoids that can be incorporated into farm animal diets to provide various health benefits and enhance product quality. Feedstuffs contain a variety of carotenoid types that contribute to the nutritional composition of animal diets. β -carotene, lutein, zeaxanthin, lycopene, and astaxanthin are among the major carotenoids found in feed ingredients. β -carotene is commonly present in green forages, such as grasses and leafy vegetables. Lutein and zeaxanthin are prevalent in yellow and orange fruits and vegetables, while lycopene is abundant in tomatoes and other red-colored fruits. Astaxanthin, a highly potent carotenoid, is found in certain algae species and marine organisms. Understanding the distribution of these carotenoids in feedstuffs enables feed formulators to select appropriate ingredients to meet the specific carotenoid requirements of farm animals [3,4].

Carotenoids have been recognized for their potential to enhance animal performance in various aspects. Their inclusion in farm animal diets can have positive effects on growth, reproductive performance, and product quality, thereby improving overall animal productivity. Carotenoids, particularly certain types like β -carotene, have been associated with improved growth performance in farm animals. They play a role in enhancing nutrient utilization, supporting efficient metabolism, and promoting optimal growth rates. Carotenoids may positively influence factors such as feed conversion efficiency, body weight gain, and skeletal development, leading to improved growth performance. Carotenoids are known to play a crucial role in reproductive health and fertility in animals. They contribute to proper hormonal regulation, follicular development, and sperm quality, which can lead to enhanced reproductive performance. Carotenoids like lutein and zeaxanthin have been associated with improved ovulation, embryo quality, and successful pregnancy outcomes in various species. The health benefits of carotenoids in farm animals are attributed to several underlying mechanisms. Carotenoids act as antioxidants, neutralizing harmful free radicals and reducing oxidative stress. They also modulate immune responses, enhancing immune cell function and promoting disease resistance. Carotenoids support reproductive health by influencing hormone regulation and improving reproductive outcomes. Additionally, they contribute to gut health by promoting beneficial gut bacteria and maintaining intestinal integrity [5].

Conclusion

The inclusion of carotenoids in farm animal diets holds significant potential for enhancing animal health, performance, and product quality. Carotenoids offer various health benefits, including antioxidant activity, immunomodulation, reproductive support, and promotion of gut health. These benefits are attributed to their antioxidant properties, immune-enhancing effects, and modulation of physiological processes. By

understanding the mechanisms underlying the health benefits of carotenoids and considering factors such as absorption, metabolism, and bioavailability, farmers and feed formulators can optimize carotenoid utilization in animal diets. Incorporating carotenoids into farm animal feeding strategies has the potential to improve growth rates, reproductive outcomes, disease resistance, and the quality of animal-derived products. Overall, carotenoids play a valuable role in promoting the well-being and productivity of farm animals.

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Conflict of Interest

There is no conflict of interest by author.

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