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Editorial

Animal Nutrition in the Era of One Health: Advancing Sustainable Livestock Production through Science, Innovation, and Precision Feeding

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Animal nutrition remains the cornerstone of profitable, sustainable, and resilient livestock production. In recent years, the discipline has evolved beyond its traditional focus on meeting nutrient requirements to encompass broader objectives, including environmental sustainability, animal welfare, food safety, antimicrobial stewardship, climate resilience, and the One Health framework [1,2]. As global demand for animal-source foods continues to rise alongside increasing concerns over climate change, resource scarcity, and emerging diseases, animal nutrition has become one of the most strategic scientific disciplines for transforming livestock production systems [3].

Feed accounts for approximately 60–80% of the total cost of livestock production, making nutritional efficiency a primary determinant of farm profitability and productivity [1]. Consequently, advances in feed formulation, nutrient utilisation, precision feeding, and alternative feed resources have become indispensable for improving production efficiency while reducing production costs and environmental footprints [1]. Recent scientific evidence emphasises that sustainable animal nutrition should optimise nutrient use efficiency, reduce nitrogen and phosphorus excretion, minimise greenhouse gas emissions, and promote circular agricultural systems that integrate crop and livestock production [5].

The emergence of the One Health concept has further strengthened the role of animal nutrition in safeguarding the interconnected health of animals, humans, and ecosystems [2]. Appropriate nutritional management enhances immune competence, improves gut integrity, reduces disease susceptibility, and supports responsible antimicrobial use. Healthy animals require fewer therapeutic interventions, thereby contributing to efforts to combat antimicrobial resistance and to ensure safer animal-derived food products for human consumption [5]. Consequently, nutrition should be viewed not merely as a production input but as a preventive healthcare strategy that enhances resilience throughout livestock production systems.

One of the most exciting developments in contemporary animal nutrition is the growing adoption of precision nutrition. Advances in nutritional modelling, artificial intelligence, machine learning, sensor technologies, and real-time farm monitoring now enable nutritionists to formulate diets that closely match the physiological requirements of animals at different stages of growth and production [4,6]. Precision feeding reduces nutrient wastage, improves feed conversion efficiency, minimises metabolic disorders, and enhances economic returns [5]. Such innovations are particularly valuable in developing countries, where feed costs remain a major constraint to livestock productivity.

Equally important is the growing exploration of alternative feed ingredients that can reduce dependence on conventional feedstuffs such as maize and soybean meal. Agricultural by-products, insect meals, algae, fermented feed ingredients, probiotics, phytogenic feed additives, enzymes, organic acids, and locally available tropical feed resources are receiving considerable scientific attention [7]. These alternatives offer opportunities to improve nutrient digestibility, enhance gut health, reduce methane emissions in ruminants, and strengthen resilience against fluctuations in feed ingredient prices [3]. Moreover, phytogenic feed additives derived from medicinal plants continue to demonstrate promising antimicrobial, antioxidant, anti-inflammatory, and growth-promoting properties, offering viable alternatives to antibiotic growth promoters in livestock production [7].

Climate-smart animal nutrition is another rapidly expanding frontier. Livestock systems face increasing pressure to reduce greenhouse gas emissions while maintaining productivity to meet the nutritional demands of a growing global population [3].

Nutritional interventions including optimised protein nutrition, improved rumen fermentation, methane-reducing feed additives, precision amino acid supplementation, and strategic feed processing have demonstrated significant potential for improving nutrient utilisation while lowering environmental impacts [5]. Integrating nutritional innovations with improved genetics, health management, and husbandry practices will be critical for achieving sustainable livestock development in both developed and developing economies [1].

Africa, in particular, possesses enormous opportunities to advance animal nutrition research using its rich biodiversity of indigenous feed resources and medicinal plants. Many underutilised tropical forages, browse plants, agro-industrial by-products, and phytogenic additives remain insufficiently investigated despite their considerable potential for improving livestock productivity under local production conditions [1]. Strengthening interdisciplinary collaboration among nutritionists, veterinarians, microbiologists, agronomists, molecular biologists, economists, and data scientists will accelerate the development of evidence-based nutritional strategies tailored to African production systems [2].

As researchers, educators, policymakers, and industry stakeholders, we have a collective responsibility to generate high-quality scientific evidence capable of addressing contemporary challenges facing animal agriculture. Future research should emphasise precision feeding systems, functional feed additives, gut microbiome modulation, circular feed systems, digital nutrition technologies, feed safety, life-cycle assessment, and climate-resilient nutritional interventions [3,6]. Such multidisciplinary approaches will contribute not only to enhanced livestock productivity but also to improved environmental stewardship, food security, public health, and sustainable rural livelihoods.

The NL Journal of Veterinary and Animal Nutrition remains committed to disseminating innovative, high-impact research that advances scientific understanding and practical applications in animal nutrition. We encourage authors to submit rigorous original research, systematic reviews, short communications, and perspectives that address emerging nutritional challenges through innovative methodologies and interdisciplinary collaboration. Through collective scientific endeavour, animal nutrition will continue to serve as a fundamental driver of sustainable livestock production, resilient food systems, and global One Health objectives [2,6].

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