

# Feeding animals to feed humans: Rethinking animal nutrition for future food systems

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The role of animals in future foods systems is under discussion, due to the competition between resources for human consumption and animal feed, and the impact of animal production on the environment. Animals can, however, have a vital role in a circular, sustainable, food production system as they can valorise food waste, agricultural by-products, and nonarable grassland; and provide high-quality food products for humans.<sup>(1,2)</sup> In a true circular food system, in which animals are only fed with those human inedible products, about one-third of the human protein demands could be delivered by animal-source proteins.<sup>(2,3)</sup> In such a scenario, environmental impact of human food production, e.g. expressed as land use, can be lower compared with the consumption of plant-sourced foods only.<sup>(3)</sup> To balance environmental impact of food production with the supply of nutrients to humans, quantitative assessments of production- (i.e. resource use and emission) and consumption practices (i.e. adequacy to meet dietary requirements) are needed. Product footprints approaches that are often used to address this do not account for feed-food competition and interlinkages within the food system.<sup>(4)</sup> Hence, there is a need for new metrics, to understand the true ecological impact of changes in our food system.<sup>(4)</sup> However, also the impact of changes in consumption patterns are currently poorly addressed. A sole focus on protein supply, does not encompass the full complexity of dietary changes and may lead to inadequacies to fulfill requirements for certain essential amino acids (AA) or micronutrients. In addition, interactions among dietary ingredients in the gastrointestinal tract may affect multifarious digestive process, implying that the nutritional value of individual food products depends on the complete diet. A shift from animal-source to plant-source foods may thus have consequences for the nutritional value of diets, beyond those accounted for by current diet formulation practices based relying on product footprint metrics, particularly for specific subpopulations.<sup>(2,5)</sup> To fully understand the consequences of dietary changes, one should look beyond total proteins and include proxies for bioavailability, as well as quantitative estimates on the full range of nutrients (e.g. essential AA, vitamins, minerals) required to fulfill nutritional needs. To assess differences in bioavailability of nutrients among products, digestibility values of for instance individual AA are suitable.<sup>(6)</sup> Furthermore, to account for interactions among food products in the complete diet, modelling approaches that simulate digestion of nutrients inside the gastrointestinal tract in order to predict the extent and rate of nutrient hydrolysis of a diet based on chemical and physical properties of food, can be useful.<sup>(7)</sup> Such tools for the quantitative assessment of foods are crucial to evaluate their contribution to a healthy and nutritional diet for humans, and ultimately balance ecological impact with nutrient supply for humans in future food systems.

## References

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