An Approach to Including Protein Quality When Assessing the Net Contribution of Livestock to Human Food Supply

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Abstract
The production of protein from animal sources is often criticized because of the low efficiency of converting plant protein from feeds into protein in the animal products. However, this critique does not consider the fact that large portions of the plant-based proteins fed to animals may be human-inedible and that the quality of animal proteins is usually superior as compared with plant proteins. The aim of the present study was therefore to assess changes in protein quality in the course of the transformation of potentially human-edible plant proteins into animal products via livestock production; data from 30 Austrian dairy farms were used as a case study. A second aim was to develop an approach for combining these changes with quantitative aspects (e.g. with the human-edible feed conversion efficiency (heFCE), defined as kilogram protein in the animal product divided by kilogram potentially human-edible protein in the feeds). Protein quality of potentially human-edible inputs and outputs was assessed using the protein digestibility-corrected amino acid score and the digestible indispensable amino acid score, two methods proposed by the Food and Agriculture Organization of the United Nations to describe the nutritional value of proteins for humans. Depending on the method used, protein scores were between 1.40 and 1.87 times higher for the animal products than for the potentially human-edible plant protein input on a barn-gate level ( = protein quality ratio (PQR)). Combining the PQR of 1.87 with the heFCE for the same farms resulted in heFCE × PQR of 2.15. Thus, considering both quantity and quality, the value of the proteins in the animal products for human consumption (in this case in milk and beef) is 2.15 times higher than that of proteins in the potentially human-edible plant protein inputs. The results of this study emphasize the necessity of including protein quality changes resulting from the transformation of plant proteins to animal proteins when evaluating the net contribution of livestock to the human food supply. Furthermore, these differences in protein quality might also need to be considered when choosing a functional unit for the assessment of environmental impacts of the production of different proteins.

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