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Estimation of CNCPS Protein Fractions from Proximate Nutrient and Fiber Concentrations in Tropical Ruminant Forages

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Abstract

The fractionation of feed crude protein (CP) according to the Cornell Net Carbohydrate and Protein System (CNCPS) has proven to be a reliable method for estimating rumen CP degradability and thus duodenal flow of undegraded feed CP. However, concentrations of CP fractions are highly variable amongst and within forage species. Moreover, analysis of CP fractions is cost-, labor-, and knowledge-intensive. Thus, the aim was to evaluate whether contents of CP fractions in tropical forages can be accurately predicted from their proximate nutrient and fiber concentrations. A dataset on concentrations (g kg^{-1} dry matter (DM)) of CP, neutral detergent fiber (NDF), acid detergent fiber (ADF), and CP fractions (i.e., A, B1, B2, B3, and C) of 23 tropical forage grasses and 24 tropical forage legumes were used. Multiple linear regression analysis with backward elimination was performed to estimate concentrations of CP fractions from CP, NDF, and ADF. Mean (\pm standard deviation) concentrations of CP, NDF, and ADF of forage grasses were 95.4 ± 37.4 , 617 ± 79 and $384 \pm 73 \text{ g kg}^{-1}$ DM and 178 ± 30 , 476 ± 80 and $368 \pm 80 \text{ g kg}^{-1}$ DM for forage legumes, respectively. The CP and NDF concentrations were good predictors of the concentration of CP fraction A for forage grasses ($R^2=0.82$), whereas for forage legumes, a more accurate prediction was obtained when ADF was additionally included ($R^2=0.67$). Concentration of CP fraction B1 could not be predicted from CP, NDF, and ADF concentrations ($R^2=0.08$). Variation in concentration of CP fraction B2 was well explained using CP, NDF, and ADF ($R^2=0.83$). Similarly, for forage grasses, concentration of CP fraction B3 could be predicted from CP and NDF concentrations with acceptable accuracy ($R^2=0.78$), whereas for forage legumes, NDF, ADF, and fraction B1 were better predictors ($R^2=0.66$). For the CP fraction C in forage grasses and legumes, CP and ADF had a low explanation ($R^2=0.40$). In conclusion, concentrations of CP fractions A, B2, and B3 can be predicted from CP and fiber concentrations in tropical forages; however, analysis of fractions B1 and/or C appears necessary.

Keywords: CNCPS, fibre concentrations, protein fractions