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Digestibility and Metabolisable Energy Intake Equations of Tropical Ruminant Forages Using Nutrient Concentration of Cattle Faeces

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Abstract

Smallholder farmers of sub-Saharan Africa feed livestock almost exclusively on natural native pastures and forages whose nutritive value is often unknown or highly variable. This undermines optimisation of nutrition management. Accurate methods of determining the digestibility of feedstuffs is via *in vivo* experiments which are resource intensive. Substitute *in vitro* or *in sacco* methods have limitations like lack of surgically altered animals and instrumentation. Prediction equations based on chemical composition of feeds and faeces regressed against *in vivo* digestibility and metabolisable energy intake (MEI) values represent a viable alternative that is fast, cheap, routine and can be used under resource-constrained circumstances often found in developing countries. This study aimed at developing equations to predict apparent dry matter digestibility (DMD), apparent digestible organic matter in dry matter (DOMD) and MEI of tropical feedstuffs using proximate composition of forages and cattle faeces from three *in vivo* studies (n=42 steers) conducted at the International Livestock Research Institute, Kenya between 2014 and 2018. Faecal chemical composition from two studies were regressed against DMD, DOMD, and MEI. The third study provided a validation dataset.

Digestibility equations using combined dataset showed poor fit (r^2=0.05–0.10) and weak correlations (r=0.3–0.4) between predicted and actual values but had low prediction errors (PE=3–5 %) while equations of MEI showed moderate fit and correlation (r^2=0.4–0.5; r=0.7) but relatively high PE (i.e. 22 $^{MJ}/_{day}$). In contrast, equations developed using individual datasets separately had better fit, higher correlation, and lower PE. Using more datasets with varied diets and more test animals may improve these equations. Best predictors of digestibility and MEI were faecal dry matter, crude protein and fibre fractions in varied combinations. Analysis of these parameters is simple, cheap and routine.

Ideally, prediction equations are developed when feeding a balanced ration at maintenance level. However, prediction equations based on a large database of *in vivo* animal experiments with sub-optimal diets, feeding levels and quality may better reflect the prevailing conditions in smallholder farming. This study is a first step towards development of such a database in order to propose digestibility and MEI prediction equations for smallholder feeding situations.

Keywords: Digestibility, forages, metabolisable energy intake, prediction equations, ruminant, sub-Saharan Africa

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