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Predicting Diet Quality of White-Tailed Deer via NIRS Fecal Profiling

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Abstract

Near infrared reflectance spectroscopy (NIRS) of feces for the prediction of diet quality in several species of livestock and wildlife has been reported. The technique has not been reported in deer. This study was conducted to determine the ability of fecal NIRS to determine dietary crude protein (CP), digestible organic matter (DOM), and phosphorus (P) in white-tailed deer (*Odocoileus virginianus*). Seventy-six diet reference chemistry:fecal spectrum (D:F) pairs were created ranging from 6.00 to 18.95% CP, 26.64 to 76.08% DOM, and 0.08 to 0.48% P. Calibration results (R^2 and SE cross validation) were: 0.95 and 1.17, 0.88 and 3.62, 0.83 and 0.04 for CP, DOM, and P, respectively. These equations were used to predict a validation D:F set ($n = 11$). Results (R^2 and SE prediction) were: 0.79 and 1.53, 0.49 and 5.46, 0.67 and 0.03 for CP, DOM, and P, respectively. These two D:F sets were combined and calibrations reformulated. Results (R^2 and SE cross validation) were: 0.84 and 1.40, 0.89 and 3.55, 0.83 and 0.04 for CP, DOM, and P, respectively. These combined calibrations were used to predict diet quality characteristics using 11 fecal samples from wild deer. The diet quality characteristics were compared to NDVI greenness values for the study area in winter, spring and summer. High correlation ($R^2 > 0.7$) between fecal NIRS predicted diet quality and NDVI greenness was observed with the exception of P in summer ($R^2 = 0.25$). Fecal NIRS can be used to determine diet quality in white-tailed deer and thus become another tool to evaluate habitat suitability.

Resumen

La near infrared reflectance spectroscopy (NIRS) de excrementos para la predicción de la calidad de la dieta en varias especies de ganado y fauna es reportada en este estudio, la cual no ha sido reportada anteriormente en referencia al venado. Este estudio se realizó para determinar la habilidad de la NIRS fecal a determinar la proteína cruda dietética (CP), la materia orgánica digerible (DOM), y el fósforo (P) en el venado de cola blanca (*Odocoileus virginianus*). Setenta y seis dietas de referencia química: en el espectro fecal (D:F) los pares se crearon recorriendo de 6.00 a 18.95% CP, 26.64 a 76.08% DOM, y de 0.08 a 0.48% P. Los resultados de la calibración (R^2 y SE cruzan la validación) fueron: 0.95 y 1.17, 0.88 y 3.62, 0.83 y 0.04 para CP, para DOM, y para P, respectivamente. Estas ecuaciones se utilizaron para predecir una validación D:F fijo ($n = 11$). Los resultados (R^2 y la predicción SE) fueron: 0.79 y 1.53, 0.49 y 5.46, 0.67 y 0.03 para CP, para DOM, y para P respectivamente. Estos dos conjuntos D:F se combinaron y las calibraciones reinterpretadas. Los resultados (R^2 y SE cruzan la validación) fueron: 0.84 y 1.40, 0.89 y 3.55, 0.83 y 0.04 para CP, para DOM, y para P respectivamente. Estas calibraciones combinadas se utilizaron para predecir las características de la dieta de calidad, utilizando 11 muestras fecales del venado silvestre. Las características de la calidad de la dieta fueron comparadas con valores de NDVI verdes para el área del estudio durante el invierno, la primavera y el verano. La correlación alta ($R^2 > 0.7$) entre NIRS fecal predijo la calidad de la dieta y NDVI verdes se observaron a excepción de P en el verano ($R^2 = 0.25$). El NIRS fecal se puede utilizar para determinar la calidad de la dieta en el venado de cola blanca y así llegar a ser otro instrumento para evaluar la efectividad del hábitat.

Key Words: crude protein, digestible organic matter, feces, near infrared reflectance spectroscopy, *Odocoileus virginianus*, phosphorus

INTRODUCTION

Near infrared reflectance spectroscopy (NIRS) is a well established technique in the analysis of forage and feeds for livestock (see review by Roberts et al. 2004). The NIRS technique provides rapid information on feedstuffs to be used in ration formulation, or about forage on offer in a pasture. If however, information on the diet quality actually selected by free-ranging animals is the desired outcome, forage NIRS offers logistical, but no real analytical advantage over the reference method; it is just another means to determine the chemistry of samples

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