Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: https://www.tandfonline.com/loi/tjas20

Fecal nitrogen and dietary quality relationships in Fallow deer

F. Sacconi, M. P. Ponzetta & F. Cervasio

To cite this article: F. Sacconi, M. P. Ponzetta & F. Cervasio (2007) Fecal nitrogen and dietary quality relationships in Fallow deer, Italian Journal of Animal Science, 6:sup1, 862-864, DOI: 10.4081/ijas.2007.1s.862

To link to this article: https://doi.org/10.4081/ijas.2007.1s.862

Fecal nitrogen and dietary quality relationships in Fallow deer

F. Sacconi, M. P. Ponzetta, F. Cervasio

Dipartimento di Scienze Zootecniche. Università degli Studi di Firenze, Italy

Corresponding author: Maria Paola Pinzetta. Dipartimento di Scienze Zootecniche, Viale delle Cascine 5, 50144 Firenze, Italy - Tel. +39-055-3288266 - Fax: +39-055-321216 - Email: mariapaola.ponzetta@unifi.it

ABSTRACT: Fecal nitrogen of free ranging and captive herbivores is correlated with dietary nitrogen, as well as other dietary chemical characteristics. Besides, only few experimental studies examined in depth the precision of these relationships. This study investigates the correlation between fecal and dietary nitrogen in fallow deer (*Dama dama*), using data from 38 feeding trials collected from captive subjects. Significant linear regressions were found for all the dietary and fecal chemical components, but only nitrogen showed a noteworthy result (R^2=0.76), very similar to the results obtained by several authors in other deer species (Robbins, 1993). Use of fecal nitrogen however, has been criticised because plant secondary compounds, such as tannin, may artificially inflate levels of fecal nitrogen; moreover, the binding effect of tannin is strongly reduced in mixed diets. After all, fecal nitrogen confirms its usefulness in studies about feeding strategies of free living ruminants.

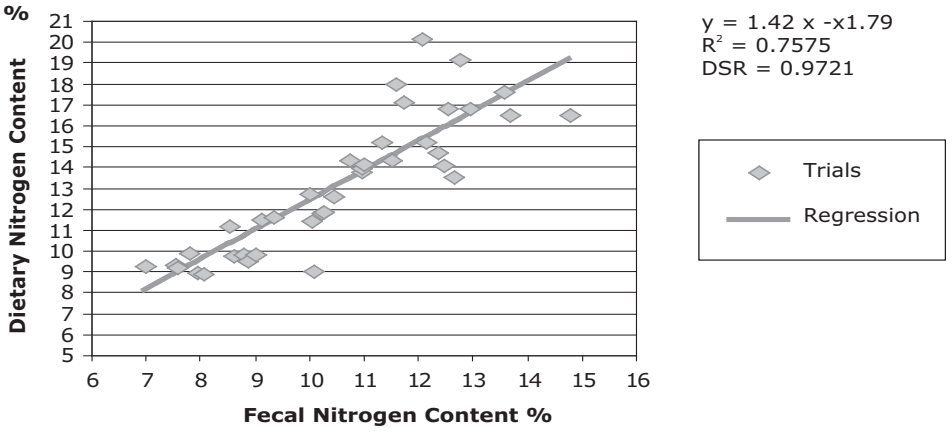
Key words: Fallow deer, Fecal indices, Dietary fecal protein, Diet quality.

INTRODUCTION – The use of fecal indexes to study diet quality may be a feasible non-invasive method, alternative to other techniques requiring disturbance, stress, or death of wild ungulates. Fecal index is beside inexpensive and easy to apply on large part of wild animal populations, all over the year. In spite of its wide spreading distribution (wild and farmed), fallow deer (*Dama dama*), typical Mediterranean species, is still little known about the quality of the diet selected by free ranging animals. Fallow deer can compose a diet with a great variety of plants, so the resulting nutritive value is very difficult to estimate, depending on habitat, season, interspecific competition and on many factors uneasy to identify. Fecal nitrogen is a common index that has shown positive correlations with intake (Stallcup *et al*., 1975), dietary digestibility (Brown *et al*., 1995), dietary protein (Mould and Robbins, 1981) and weight changes (Wehausen, 1995). This index seems to depend on season (Massey *et al*., 1994) and geographic area (Massey *et al*., 1994). In studies on wildlife ruminants, fecal nitrogen has been used to identify differences on diet quality (Massey *et al*. 1994). This method needs a validation for each species, through a specific regression based on experimental feeding trials (Arman *et al.*, 1975).
The aim of this study was to verify the applicability of fecal nitrogen (i.e. crude protein) as index of diet quality on free-ranging fallow deer.

MATERIAL AND METHODS – In about 20 years, thirty-eight *in vivo* digestibility trials were carried out on captive fallow deer, purposely reared at the Department of Animal Science (University of Florence). All the trials were carried out using a standard method: group trials (n. of animals varied from 2 to 6 for group among the different trials, according to animals' availability) using adult (at least 2 year old), female animals, with an average live weight of 42Kg. The diets used were all forages, alfalfa hay or mixed hays of different cuts and quality. Each different diet was supplied to animals for a 10-day pretrial period. During the experimental period (7 days) fallow deer were fed *ad libitum* and daily intakes were calculated through the difference between the weight of food and of its residues. Water was available *ad libitum* and at all times. On all the 7 days trial period fecal samples were collected. Hays, residues and faeces were analysed for all the chemical components according to the official methods (AOAC, 1990). The digestibility coefficients were calculated using acid insoluble ash (AIA) as internal marker (Van Keulen and Young, 1977). Data were analysed to examine the utility of fecal components in predicting the diet quality (PROC REG; SAS Inst. Inc 2003).

RESULTS AND CONCLUSIONS – Each fecal chemical component was significantly correlated to its equivalent in diet. Otherwise, only fecal nitrogen reached an high value of R^2 (Figure 1). Thus, even in fallow deer, fecal nitrogen content seems to allow a good assessment of dietary nitrogen, commonly considered as the main indicator of diet quality.

Figure 1. Regression between fecal and dietary nitrogen (% on DM).

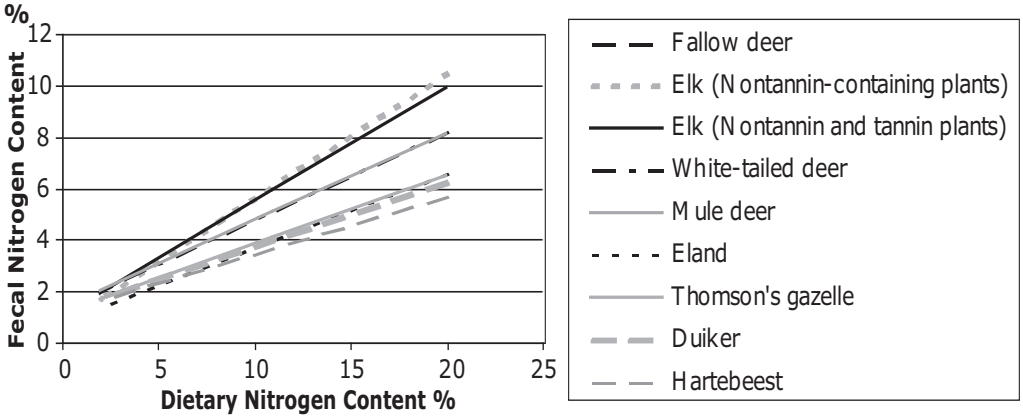


This result is well comparable (Figure 2) with similar value extents found by other authors (Robbins, 1993). Therefore, the employ of this fecal index to assess the diet quality on free ranging fallow deer seems to be useful. Nevertheless, fecal nitrogen as index of diet quality is influenced by a number of factors; first of all, the relationship between dietary nitrogen and its digestibility should be constant, as reported for diet digestibility in free-ranging ruminants (Wehausen, 1995) and also as our results confirmed.

Moreover, nitrogen digestibility may depend on tannin plant content. Such compounds can bind the dietary protein producing tannin-protein complex undigested at rumen pH. In this way, a larger amount of dietary nitrogen passes in the faeces, elevating fecal nitrogen level and artificially inflating estimate of dietary nitrogen. Anyway, tannin effect is reduced in mixed diets, composed by plants rich in tannin (trees and shrubs) and species not containing tannin (Mould and Robbins, 1981). The relationship between fecal nitrogen and dietary nitrogen appears strong for grazers (Wofford *et al.*, 1985) but is less reliable for browsers (Robbins, 1993). For a correct use of fecal nitrogen as index of diet quality, the correlation between population density and fecal nitrogen (Blanchard *et al.*, 2003) implies the need of a sample collection stratified for habitat and population density.

Finally, the applicability of regression between fecal and dietary nitrogen is also influenced by the season effect, in terms of plant chemical composition and in terms of variation in feed availability (Leslie and Starkey, 1987).

Figure 2. Regression between dietary and fecal nitrogen (% on DM) in different ruminant species (Robbins, 1993, modified).



The Authors want to thank C. Triberti and L. Pianaccioli for assistance in data collection and chemical analyses. The research was supported by funds of Ricerca Scientifica d'Ateneo - ex quota 60%.

REFERENCES – **AOAC**, 1990. Official methods of analysis of the association of official analytical chemist. 15th ed. n. 960.39, Ed. Ass. Off. Analyt. Chemists, Washington. **Arman**, P., Hopcraft, D., McDonald, I., 1975. Nutritional studies on East African herbivores. 2. losses of nitrogen in the faeces. British Journal of Nutrition 33:265-276. **Blanchard**, P., Festa-Bianchet, M., Gaillard, J-M., Jorgenson, J.T, 2003. A test of long-term fecal nitrogen monitoring to evaluate nutritional status in bighorn sheep. Journal of Wildlife Management 67:477-484. **Brown**, R.D., Hellgren, E.C., Abbott, M., Ruthven, D.C., and Bingham, R.L., 1995. Effects of dietary energy and protein restriction on nutritional indices of female white-tailed deer. Journal of Wildlife Management 59:595-609. **Leslie**, D.M., Starkey, E.E., 1987. Fecal indices to dietary quality: a reply. Journal of Wildlife Management 51:321–325. **Massey**, B.N., Weckerly, F.W., Vaugn, C.E., Mccullough, D.R., 1994. Correlations between fecal nitrogen and diet composition in free-ranging black-tailed deer. Southwest Nature 39:165-170. **Mould**, E.D., Robbins, C.T., 1981. Nitrogen metabolism in elk. Journal of Wildlife Management 45:322-334. **Robbins**, C.T., 1993. Wildlife feeding and nutrition. 2nd edn. Academic Press, San Diego. **Sas**, 2003. SAS/STAT software, release 9.1 SAS Institute Inc., Cary, NC, USA. **Stallcup**, O.T., Davis, G.V., Shields, L., 1975. Influence of dry matter and nitrogen intakes on fecal nitrogen intakes on fecal nitrogen losses in cattle. Journal of Dairy Science 58:1301-1307. **Van Keulen**, J., Young, B.A., 1977. Evaluation of acid-insoluble ash as a natural marker in ruminant digestibility studies. Journal of Animal Science 44:282-287. **Wehausen**, J.D., 1995. Fecal measures of diet quality in wild and domestic ruminants. Journal of Wildlife Management 59:816-823. **Wofford**, H., Holechek, J.L, Galyena, M.L., Wallace, J.D., Cardenas, M., 1985. Evaluation of fecal indices to predict cattle diet quality. Journal of Range Management 38:450-454.