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Relationship between faecal scoring and *in vitro* digestibility of the diet in buffalo cows

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ABSTRACT: Samples of faeces were collected monthly for 3 and 2 times respectively from 12 lactating and 12 dry buffalo cows. The samples, evaluated for faecal scoring (Faecal Consistency, FC and Undigested Fractions, UF), were used as inocula (dilution 1:2 with anaerobic medium) to determine *in vitro* digestibility (IVTD) of organic matter, crude protein and NDF after 48 h of incubation using the apparatus Daisy^{II} ANKOM. The IVTD of organic matter was significantly higher (46.5 *vs* 32.9 and 33.0 %, P<0.01) in lactating (FC = 3) than in dry animals (FC = 3.5 and 4), probably due to the higher fibre content of diet of the latter. The higher crude protein digestibility obtained for dry animals (59.1 *vs* 65.6 and 66.4 %, respectively for FC = 3 – 3.5 and 4, P<0.01) could be due to the higher efficiency of nutrient utilisation of the micro organisms. Faeces with higher UF showed significantly higher organic matter digestibility (35.6 *vs* 38.8 %, respectively for UF=1 and 2, P<0.01). Finally, the equations able to estimate IVTD from faecal scores were always statistically significant (P<0.01) and the highest R^2 value was reached for organic matter (about 0.83). The latter results suggest that the combination of FC and UF scores allows a good estimation of *in vitro* digestibility of organic matter, crude protein and NDF.

Key words: Faecal consistency, Undigested fractions, *In vitro* digestibility, Buffalo.

INTRODUCTION - Ruminant nutritionists have been attempting to relate faecal consistency with changes in rations for many years. Feeding different levels and types of feed fibre, protein, and fat have been suggested as causing changes in manure (Stallings, 1993). Also moisture content of the ration may cause changes in manure of cattle. However, there are few published reports that have compared faeces of lactating cows fed different diets (Ireland-Perry *et al.*, 1993; Kononoff *et al.*, 2002; Samuelson *et al.*, 2005). In addition visual observation is usually the way comparisons which are made in the field.. Faeces scoring can be a helpful tool. Fresh faeces can indicate presence of disease and nutritional status. Skidmore *et al.* (1996) proposed two score systems for faeces evaluation: Faecal Consistency (FC) and Undigested Fraction (UF). Both systems are a 5 points scale with score 1 being very liquid faeces, score 5 being firm faecal balls, and score 3 being ideal for FC; and score 1 being faeces with few particles (1-3mm, ideal score), score 5 being faeces with high particles and long fibre residues for UF. The aim of the paper was to study the physical-chemical characteristics of the faeces produced by buffalo cows. Moreover, *in vitro* digestibility of organic matter, crude protein and NDF of the buffalo diets was studied by Daisy^{II} ANKOM using as inoculum buffalo faeces and related to faecal scores.

MATERIAL AND METHODS - The trial was carried out on a farm in Caserta (Italy). The physical evaluation of the faeces was made monthly for three times on 12 lactating buffaloes (an average 135 ± 148 days in milk), and on 12 dry buffaloes, monthly but for two times. Lactating buffaloes fed a diet consisting (% as fed) in: corn silage (63 %), ryegrass hay (20 %), commercial concentrate (14 %) and corn meal (3 %). Dry buffaloes during the first and the second months fed two different diets whose composition (% as fed) was respectively: corn silage 40 and 52 %; ryegrass hay 27 and 21 %; commercial concentrate 13 and 11 %; wheat straw 20 and 16 %. The faeces were collected, from each buffalo, directly from rectum at 04.00 p.m.. (for lactating buffaloes, immediately after milking). Faecal consistency (FC) was evaluated using the 5 points scale proposed by Skidmore *et al.* (1996), from three different evaluators. About 200 g of faeces were sieved (sieve mesh size 1.6 mm) within washing to remove faecal residues. Successively, Undigested Fraction score (UF) was evaluated (1 – 5 scale, Skidmore *et al.*, 1996) as function of quantity, quality and physical aspect of undigested particles. For each faecal sample, the remained part was placed in a pre-warmed thermos and transported to the laboratories of the Department for chemical composition (AOAC, 2000) and starch analysis (Martillotti *et al.*, 1987). Finally, the faeces were used as inoculum for *in vitro* digestibility trials using a DAISY^{II} Ankom apparatus (Ankom, Tech. Co., Fairport, NY, USA) consisting in a incubator room at 39°C, containing 4 flasks (volume 2.5 l per flask) that turn along the longitudinal axis. In each flask, 1.6 liters of anaerobium medium (Theodorou, 1993) were introduced. About 0.5 g of diet samples were weighed in 24 replications in specific bags and placed in the flasks. Faeces were diluted 1:2 with the anaerobic medium and the inoculum, prepared under CO_2, was introduced in the flasks (400 ml/flask). Faeces from lactating and dry buffaloes were used to study the digestibility of lactating and dry diets, respectively. After 48 h of incubation, the bags were washed, dried at 103°C and weighed. Therefore 8 bags were ashed to obtain degraded organic matter, 8 were used for residual nitrogen determination and 8 to determine the percentage of residual NDF. The results were analysed by ANOVA (SAS, 2000) using a two-ways model in which the levels of the class FC were 3 – 3.5 – 4 and that of UF 1 and 2. The equations for the estimation of in vitro digestibility from faecal scoring were obtained using STEPWISE procedure of SAS (2000).

RESULTS AND CONCLUSIONS - Faeces with higher consistency (FC = 4) and lower UF showed a significantly higher ($P<0.01$) content of dry matter (Table 1). The faeces of lactating buffaloes (FC = 3) showed contents of protein, ether extract and starch significantly ($P<0.01$) higher than that of dry buffaloes (FC = 3.5 and 4) while the opposite happened for NDF and ADF. Faeces with higher UF showed significantly higher ($P<0.01$) contents of crude protein and starch, the latter due to the fact that the score 2 is attributed to faeces contained residues of grains. The digestibility of OM and NDF was significantly ($P<0.01$) lower for dry faeces. Regarding $IVTD_{NDF}$ the inclusion of wheat straw in the diets of dry buffaloes affected the result due to the higher content of lignin. The higher digestibility of crude protein recorded using the faeces of dry animals (59.13 % *vs* 65.62 and 66.36, respectively for FC = 3 – 3.5 and 4, $P<0.01$) could be due to the higher efficiency of nutrient utilisation of the micro-organism from the animals fed a poor-nutrient diet. (Church, 1988). Faeces with higher UF showed significantly higher digestibility of organic matter (35.63 *vs* 38.83 %, respectively for UF = 1 and 2, $P < 0.01$) and NDF (49.11 *vs* 50.75 %, respectively for

UF = 1 and 2, P<0.01). This results does not surprise because score UF = 2 was attributed to lactating buffaloes and UF = 1 to dry buffaloes.

Table 1. Chemical composition of faeces and in vitro digestibility in function of faecal scoring.

	Fecal Consistency			Undigested Fraction		MSE
	3	3.5	4	1	2	
	n = 36	n = 12	n = 12	n = 32	n = 28	
DM, %	13.52^{C}	13.91^{B}	14.41^{A}	14.20^{A}	13.76^{B}	0.08
Ash, % DM	16.57	16.41	16.38	16.36	16.52	0.13
CP, % DM	10.59^{A}	8.48^{B}	8.54^{B}	8.92^{B}	9.41^{A}	0.07
EE, % DM	1.46^{A}	1.29^{B}	1.28^{B}	1.32	1.36	0.01
NDF, % DM	47.78^{B}	58.40^{A}	58.38^{A}	56.19^{A}	53.90^{B}	4.46
ADF, % DM	28.63^{B}	39.03^{A}	39.71^{A}	37.41^{A}	34.63^{B}	0.76
Starch, % DM	15.25^{A}	7.81^{B}	6.91^{B}	8.90^{B}	10.90^{A}	0.28
$IVTD_{OM,}$ %	46.53^{A}	32.93^{B}	33.04^{B}	35.63^{B}	38.83^{A}	2.51
$IVTD_{CP,}$ %	59.13^{B}	65.62^{A}	66.36^{A}	64.47	63.00	5.01
$IVTD_{NDF,}$ %	55.50^{A}	47.10^{B}	47.60^{B}	49.11^{B}	50.75^{A}	2.04

A, B, C: P < 0.01; MSE = mean square error.

The $IVTD_{NDF}$ recorded were slightly lower than those recorded by Spanghero *et al.* (2003) for some roughages. It can be due to the use of faeces instead that rumen liquor as source of inoculum (Mauricio *et al.*, 2001).

The equations for estimation of IVTD from faecal scoring (Table 2) were always significant (P<0.01) with R^2 values that, for organic matter, reached the value of 0.83.

Table 2. Equations for estimation of in vitro digestibility from faecal scoring.

Y	Intercept	UF	FC	R^2
$IVTD_{OM}$	110.28	-6.08	-18.05	0.8313*
	(5.59)	(1.04)	(1.26)	
$IVTD_{CP}$	24.37	+3.34	+9.73	0.6777*
	(4.60)	(0.86)	(1.03)	
$IVTD_{NDF}$	94.35	-3.95	-10.87	0.7633*
	(4.12)	(0.77)	(0.93)	

(…): standard error; *: P < 0.01.

The IVTD of organic matter and NDF were negatively related to faecal scores, while the $IVTD_{CP}$ was positively related. Moreover, FC seems to have a higher effect on IVTD estima-

tion because in each case the coefficients of FC score were about three times that of UF. The results indicate that diet composition is the major factor affecting the consistency and the particle content of the buffalo faeces. The combinations of the two scores, Faecal consistency and Undigested Fraction allows to obtain a reliable estimation of in vitro digestibility of organic matter, crude protein and NDF. Further research have to be made in order to evaluate the effect of water consumption, protein and structural carbohydrates contents can have on faecal scores.

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