Cow Faeces in *In vitro* Digestibility Assays of Forages

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ABSTRACT : The present study investigated the use of cow faeces as a source of micro-organisms instead of sheep rumen liquor in *in vitro* digestibility assays of forages. Initially 40 forage samples comprising ryegrass, wheat, maize and barley were screened to select a wide range of digestibility (327-794 g/kg) of forages. Finally 8 forage samples were assessed using rumen liquor as well as faecal liquor. The absolute organic matter digestibility (OMD) values using faecal liquor were lower than those with rumen liquor. However, the relationship between OMD using rumen liquor and faecal liquor was highly significant ($p < 0.001$). The R^2 value exceed 0.90. The results suggest that micro-organisms from faecal liquor are capable of digesting forage samples.
(**Key words**: Cow Faeces, *In vitro* Digestibility, Forage)

INTRODUCTION

Most of the experiments on *in vitro* forage digestibility have been made using rumen liquor as a source of inoculum (McLeod and Minson, 1969). There is a need for alternative inocula to rumen liquor. Although limited information on the use of sheep faeces in digestibility assays is available (El Shaer et al., 1987), no literature is available on the use of cow faeces to use as the inoculum.

Akhter (1995) investigated the possibility of using cow faeces with only one forage. For a *in vitro* digestibility technique to be useful, it must be capable of assessing forages covering a wide range of digestibility. Many workers (Tilley et al., 1960; Tilley and Terry, 1963 and Nelson et al., 1976) established the relationship between two methods (e.g. *in vivo*/*in vitro*) considering a wide range of digestibility of forages.

Therefore, this experiment was conducted to produce forages representing a wide range of *in vitro* digestibility which were then used in investigating regression relationship between rumen liquor and faecal liquor.

MATERIALS AND METHODS

Types and quality of forages produced

Forty forage samples comprising of ryegrass (*Lolium perenne*), wheat (*Triticum æstivum*), barley (*Hordeum vulgare*) and maize (*Zea mays*) cut at different dates were produced (table 1). The sample was then assessed for *in vitro* digestibility using the two-stage Tilley and Terry (1963) method. The forages were grown at Centre for Dairy Research (CEDAR), University of Reading, U.K. All the forages were cut at ten days intervals during May-July, 1992. The samples were dried at 60-65℃ to avoid damage to forage quality (Minson and McLeod, 1972). Some of the samples were separated into leaf (with sheath) and stem fractions (table 1) separated into leaf (with sheath) and stem fractions (table 1) to ensure the production of forages with a wide range of digestibility. All the samples were ground through a 1 mm dry mesh screen to perform *in vitro* digestion.

Source of rumen liquor and faeces

Rumen liquor was collected from 3 fistulated Suffolk wethers maintained on *ad libitum* hay (N_2, ADF, NDF were 23, 414 and 715 g/kg DM respectively) and concentrate (200 g/d). Concentrate mixture had *in vitro* DMD of 878 g/kg and N of 32 g/kg DM. Faeces was obtained from 3 Jersey cows. Each animal was offered *ad libitum* ryegrass hay (N_2, ADF, NDF were 25, 421 and 713 g/kg DM respectively) as their daily feed. Individual housing facilities were provided to all animals.

Inocula preparation

Rumen liquor was collected from the fistulated sheep and preserved in a prewarmed (39℃) vacuum flask until required. Rumen liquor was strained through two layers of muslin and 50 ml of the inoculum was added to the

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substrate.

Freshly voided faeces were collected from the rectum of the cows and preserved in a prewarmed (39°C) vacuum flask until used which was not longer than 1.5 h. Faecal liquor was made using 333 g faeces per litre artificial saliva (McDougall, 1948). The faeces inoculum was prepared by mixing faeces with CO_2 saturated artificial saliva, straining through two layers of muslin. 50 ml of inoculum was added to 0.55 g forage for the *in vitro* fermentation.

In vitro digestibility procedure

Firstly forty forages were assessed in triplicate for *in vitro* digestibility using the two-stage technique of Tilley and Terry (1963). Finally 8 forage samples (representing a wide range of digestibilities) were assessed using rumen liquor and faecal liquor as inocula.

Statistical analyses

The data obtained from the experiment were analyzed in a 2 × 8 factorial form. The relationship between OMD of rumen liquor source and faecal liquor source was also investigated using the programme Statistical Analysis System (SAS, 1985).

RESULTS

The cutting dates and *in vitro* OMD of different forages are presented in table 1. The range of digestibilities (g/kg) obtained from the experiment was 327-794. It is readily apparent from the results (figure 1) that the digestibilities of the forages declined with time (May-July). The leaf fractions (irrespective of forages) exhibited higher digestibilities compared to other fractions. However, this pattern was not consistent in all samples. The absolute *in vitro* digestibility using rumen liquor was higher to those with faecal liquor (table 2).

The regression line (figure 2) relating the OMD values from faecal liquor and rumen liquor sources indicate that there was a concordance between rumen liquor and faecal liquor. The linear relationship showed a significant ($p < 0.001$) correlation between OMD determined in rumen liquor and those obtained in faeces. The R^2 value exceeded 0.90.

DISCUSSION

The present study was confined to assessing whether rumen liquor in the Tilley and Terry (1963) technique could be replaced by micro-organisms from cow faeces. The regression relationship suggest that cow faeces can be

Table 1. *In vitro* organic matter digestibility (g/kg), determined by the conventional two stage technique (Tilley & Terry, 1963) of different forages and their fractions harvested at different cutting dates

Cutting date	Forage	Fractions of forage		
		Whole	Leaf	Stem*
15 May	Barley	667	–	–
	Ryegrass	729	–	–
	Wheat	724	–	–
25 May	Barley	574	–	–
	Ryegrass	711	–	–
	Wheat	710	–	–
5 June	Barley	460	522	412
	Ryegrass	654	652	611
	Wheat	673	634	621
15 June	Barley	446	499	327
	Ryegrass	647	618	561
	Wheat	642	611	523
	Maize	719	794	703
25 June	Maize	693	–	–
	Ryegrass	563	–	–
	Wheat	545	–	–
5 July	Maize	631	641	502
	Wheat	448	–	–
15 July	Maize	641	636	619
25 July	Maize	614	629	603

* The fact that seed head was exhibited (early stage) in some forages.

Table 2. *In vitro* organic matter digestibility (g/kg) of different forages using faeces (F) and rumen liquor (R)

Forages*	Sources of inoculum		s.e.d.
	F	R	
BS4	184	328	6.75
B4	263	452	10.59
B3	293	457	10.24
WS4	389	592	14.67
RS4	412	597	21.05
ML5	460	625	22.07
RG3	531	678	15.60
RG2	610	749	22.50
s.e.d.	11.90	14.64	

* BS4 = Barley stem cut on 15 June; B4 = barley whole cut on 15 June; B3 = barley whole cut on 5 June; WS4 = wheat stem cut on 15 June; RS4 = ryegrass stem cut on 15 June; ML5 = maize leaf cut on 25 July; RG3 = ryegrass whole cut on 5 June; RG2 = ryegrass whole cut on 25 May.

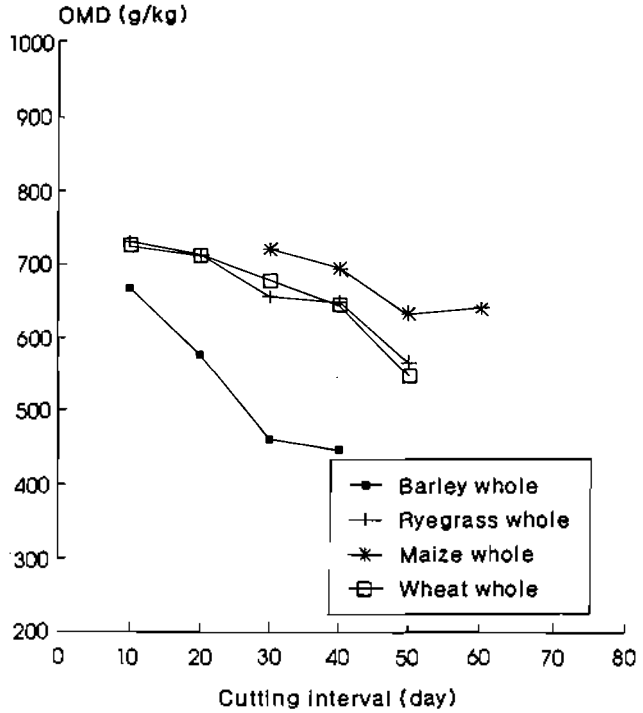

Figure 1. *In vitro* digestibility of different forages at different cutting interval.

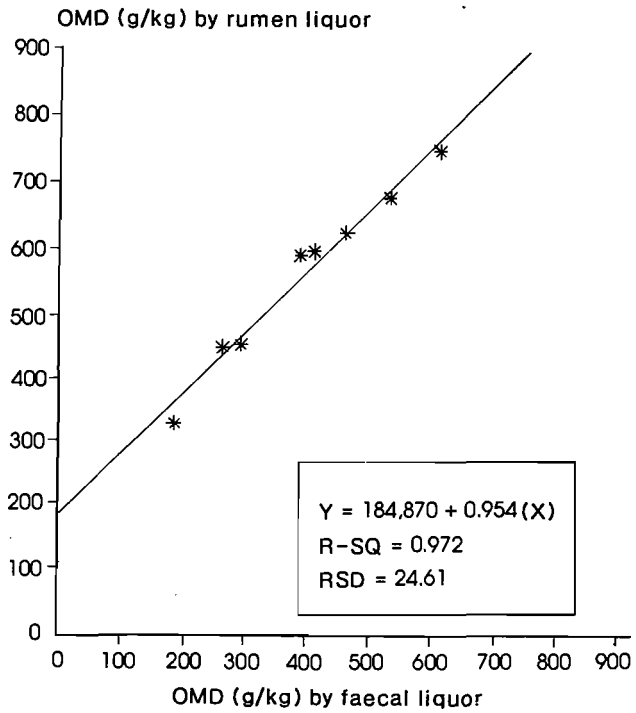

Figure 2. Relationship between OMD using rumen liquor and faecal liquor.

used as a source of micro-organisms. The results highlighted the need for more research in this field. 50 ml of faecal inoculum per *in vitro* digestibility tube was used used in the experiment. It would be interesting to see if high digestibilities would occur if more liquor per tube be used.

One could argue about the necessity of carrying out the initial investigation. Final investigation could be carried out with forages acquired from other sources. The fact is that laboratory facilities vary from place to place. All the processes such as collecting, drying and milling the forages was under taken with special care. Variability due to drying and milling conditions could affect *in vitro* digestibility (Tilley and Terry, 1963). Emphasis was given on maintaining identical sample preparation and procedures used in *in vitro* methods.

The fact that the *in vitro* digestibilities measured by the Tilley and Terry (1963) method give results for forages which are in line with the literature (Kamstra et al., 1958; Melling et al., 1962 and Neathery, 1972) suggests that the relationship we have obtained (figure 2) will be a support to allow use of this technique in the countries where maintenance of fistulated animals is difficult and other techniques e.g. cellulase are too expensive.

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