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Usage of Slaughtered Animal Rumen Fluid for Dry Matter Digestibility of Ruminant Feeds

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Abstract: This study was carried out to investigate the precision of rumen fluid of slaughtered sheep and cows as the inoculums in the *in vitro* digestibility technique and its comparison with *in vivo* apparent digestibility techniques for ten feeds. The following two *in vitro* and one *in vivo* technique were used. These were the *in vitro* slaughtered Sheep Rumen fluid Technique (SRT), the *in vitro* slaughtered Cattle Rumen fluid Technique (CRT) and the *in vivo* Apparent Digestion Technique (ADT). Results from this study indicate that SRT and CRT have potential to be used for predicting *in vivo* DM digestibility. However, more research is required to modify both SRT and CRT to get better regression equation with low RSD and high correlation coefficient.

Key words: Sheep, cow, rumen fluid, *in vitro* digestibility

INTRODUCTION

There are several research techniques that are used to determine the digestibility and degradation of ruminant feeds. The techniques include the *in vivo* and *in vitro* methods, which necessitate the use of live intact or surgically modified animals[1]. Although *In vivo* determinations of digestibility in ruminants are the most useful measures of the nutritional value of feedstuffs, it is expensive, labors intensive, time consuming and needs large amounts of feedstuffs. Two-stage procedure for the *in vitro* digestion of feedstuffs described by[2] has been widely accepted as a standard procedure for the estimation of digestibility. A rumen fluid inoculum is required in this technique utilizing a microbial fermentation approach to feedstuff evaluation[2-4]. The necessity for fistulated animals to provide this inoculum creates a number of problems such as surgical facilities, constant care to avoid infections, long-term maintenance and ethical issues of using these animals[5].

Although one method of overcoming the need for rumen-fistulated animals is to use rumen fluid from slaughtered animals[6], it is not discussed well in literature. The objective of this study was to investigate the precision of rumen fluid of slaughtered sheep and bovine as the inoculums in the *in vitro* digestibility technique and its comparison with *in vivo* apparent digestibility techniques for ten feeds.

MATERIALS AND METHODS

Feed samples: Ten feeds of previously known *in vivo* apparent digestibility, obtained from the digestion trial with sheep from the Animal Science Department of Harran University were used for substrates *in vitro* trials. The feeds were used Commercial Concentrate Feed (CCF) with low CP: Wheat Straw (WS) (30:70; F1), CCF with high CP: WS (70:30;F2), CCF with low CP: Alfalfa Hay (AF) (70:30;F3), CCF with low CP: WS (70:30;F4), CCF with low CP: AH (30:70;F5), tomato pomace silage containing 10% WS (F6), Corn Grain (CG):AH (40:60;F7), CG:AH (85:15;F8), AH (F9) and WS (F10). Nutrient composition of feeds is presented in Table 1. All the feeds were ground in laboratory mill fitted with 1 mm sieve size before *in vitro* digestibility trials. These feed samples were analyzed for DM, OM, ash and CP by procedure of[7]. NDF and ADF contents were measured according to the procedure of[3].

Ruminal inoculum: Rumen contents were removed from 5 healthy sheep and 5 healty cows immediately after slaughtered and stored in thermos flasks. After straining through four layers of cheese cloth, rumen liquor was mixed with McDugall's buffer and saturated with CO_2.

Digestibility determination: The following two *in vitro* and one *in vivo* techniques were used:

- The *in vitro* slaughtered Sheep Rumen fluid Technique (SRT)
- The *in vitro* slaughtered Cow Rumen fluid Technique (CRT)
- The *in vivo* Apparent Digestion Technique (ADT)[8].

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Table 1: Nutrient composition of feeds

Feeds*	DM, %	OM, % of DM	CP, % of DM	ADF, % of DM	NDF, % of DM
F1	90.63	90.03	7.57	44.99	69.76
F2	92.84	91.35	12.55	29.64	44.60
F3	89.52	90.86	14.13	23.47	39.09
F4	89.98	90.52	10.52	29.41	49.50
F5	89.91	90.93	16.01	36.66	48.11
F6	27.01	93.72	13.91	47.31	59.49
F7	89.97	84.26	13.97	21.30	34.02
F8	88.64	86.66	9.87	9.56	15.76
F9	91.18	89.99	15.19	40.93	54.08
F10	92.80	90.21	4.61	53.71	82.21

*F1=Commercial concentrate feed (CCF) with low CP: wheat straw (WS) (30:70), F2= CCF with high CP: WS (70:30), F3= CCF with low CP: alfalfa hay (AF) (70:30), F4= CCF with low CP: WS (70:30), F5= CCF with low CP: AH (30:70), F6= tomato pomace silage containing 10% WS, F7= corn grain (CG):AH (40:60), F8= CG:AH (85:15), F9= AH, and F10=WS

The *in vitro* digestibility of the 10 feeds was determined in quadruple using the two-stage technique of[2] as modified by[9] for each feed and each technique. Four blanks consisting of buffer and inoculum without the feedstuff were included.

In vitro digestibility estimates derived from the use of SRT and CRT were regressed on the values derived from the ADT using SAS program, respectively[10].

RESULTS AND DISCUSSION

The results of applying SRT and CRT *in vitro* procedures to 10 feed samples of known *in vivo* digestibility are illustrated in Fig. 1 and 2, respectively. The relationship between *in vivo* digestibility (y) and *in vitro* digestibility techniques were calculated for 10 feed samples. The data for these feeds were pooled and the relationships between the digestibility estimates were found to be represented by the equations:

For SRT;
y=1.072 (±0.0909)x -14.655 (±6.3180)
With residual standard deviation (RSD) 4.58
For CRT;
y=0.9280 (±0.0755)x +6.2776 (±4.5861)
With residual standard deviation (RSD) 5.4591

Both SRT and CRT for predicting *in vivo* DM digestibility had the similar RSD (4.58 vs. 545), correlation (r^2) (0.90 vs. 0.89) and R^2 (0.80 vs. 0.80), respectively. In an agreement with[6], slaughtered sheep and cow rumen fluids are suitable source of microbial inoculum for in vitro DM digestibility. However, more research is required to modify SRT and CRT to get better regression equation with low RSD and high correlation coefficient. The successful introduction of slaughtered animal rumen fluid as a ruminal inoculum in the in vitro DM digestibility due to lower cost and no need to have available surgically modified animals thus responding to issues of animal welfare has promise in replacing rumen fluid.

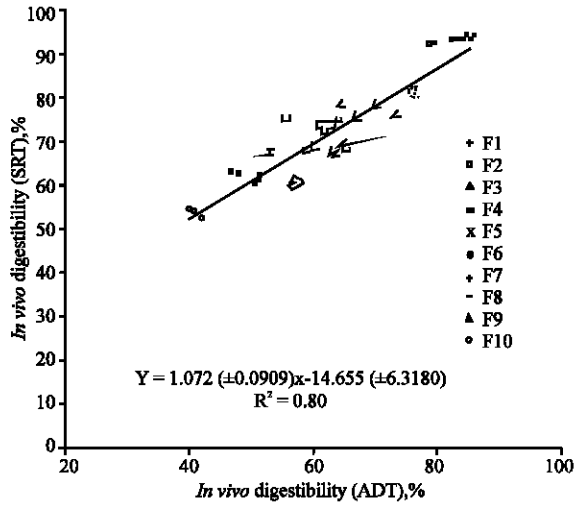

Fig. 1: Relationship between *in vivo* Apparent Digestibility (ADT) of feeds with *in vitro* slaughtered Sheep Rumen fluid Technique (SRT)

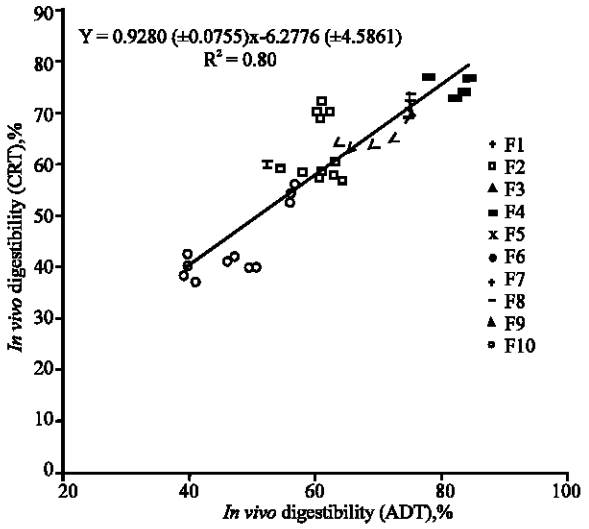

Fig. 2: Relationship between *in vivo* Apparent Digestibility (ADT) of feeds with *in vitro* slaughtered Cow Rumen fluid Technique (CRT)

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