

Original Research Article

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***In vitro* Crude Fibre Disappearance of Brewery Waste Incorporated Paddy Straw in Rusitec**

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An *in vitro* experiment was conducted to study the *in vitro* crude fibre disappearance of the following seven experimental feeds such as 1) Control feed; 2) Experimental feed (75%) + Fresh brewery waste (25%) (EFFBW); 3) Experimental feed (75%) + Dried brewery waste (25%) (EFDBW); 4) Fresh brewery waste (FBW); 5) Dried brewery waste (DBW); 6) Paddy straw (PS) and 7) Brewery waste incorporated paddy straw (BWIPS) incubated for 2, 6, 12, 24, 48 and 72 hours in Rumen Simulation Technique (RUSITEC). During initial incubation periods (2, 6, 12 and 24 hours), the control feed, EFFBW, EFDBW and FBW showed higher *in vitro* crude fibre disappearance than other experimental feeds, whereas, during later incubation periods (48 and 72 hours), the DBW, paddy straw and BWIPS showed higher *in vitro* crude fibre disappearance than other experimental feeds incubated in RUSITEC.

Introduction

Brewery waste is a by product of ethanol industry which uses cereal grains as feed stock. Distiller's grain has a moderate content of protein and high level of crude fibre which make it an attractive ingredient to be used in ruminant feed (Rasco *et al.*, 1989). Among the various cereal crop residues, paddy straw (*Oryza sativa*) is the main roughage source for majority of cattle and buffaloes reared in Indian small holdings. However, the nutrient digestibility of straw is very poor. Knowledge on disappearance / degradability of brewery waste incorporated with paddy straw would

throw more light on its usefulness and would help to formulate complete feed for dairy cattle. The present study was undertaken to evaluate the *in vitro* crude fibre disappearance of brewery waste incorporated paddy straw based feeds using Rumen Simulation Technique (RUSITEC).

Materials and Methods

Per cent ingredient composition of the control and experimental concentrate mixtures used are presented in Table 1. The Dry matter (DM) composition of Control feed, Experimental feed, Brewery waste, Paddy

straw and Brewery waste incorporated paddy straw were carried out as per standard procedure (AOAC, 1990) and was 95.15 ± 0.56 , 94.76 ± 0.26 , 29.15 ± 0.43 , 90.35 ± 0.81 and 78.11 ± 0.63 respectively. Similarly, the crude fibre (CF) content of Control feed, Experimental feed, Brewery waste, Paddy straw and Brewery waste incorporated paddy straw were carried out as per AOAC (1990) and was 6.34 ± 0.18 , 8.88 ± 0.35 , 19.62 ± 0.31 , 34.19 ± 0.61 and 30.55 ± 0.57 per cent, respectively on dry matter basis.

The *in vitro* crude fibre disappearance of seven experimental feeds such as control feed, experimental feed with fresh brewery waste (EFFBW), experimental feed with dried brewery waste (EFDBW), fresh brewery waste (FBW), dried brewery waste (DBW), paddy straw (PS) and brewery waste incorporated paddy straw for 3 days (BWIPS) was determined using the rumen simulation technique (RUSITEC) described by Czerkawski and Breckenridge (1977).

The *in vitro* crude fibre disappearance of experimental feeds were studied at 0, 2, 6, 12, 24, 48 and 72 hours of incubation in RUSITEC and the experiment was replicated. Each RUSITEC experiment totally consisted

of 7 days adaptation period followed by collection period.

Loss in weight of nylon bag after 0, 2, 6, 12, 24, 48 and 72 hours of incubation in RUSITEC followed by washing and drying was recorded to calculate *in vitro* crude fibre disappearance.

$$\text{In vitro CF disappearance} = \frac{(\text{weight of bag with CF before incubation}) - (\text{weight of bag with CF after incubation})}{\text{weight of sample}} \times 100$$

The data were analysed statistically as per the standard statistical methods given by Snedecor and Cochran (1994).

Results and Discussion

The percentage *in vitro* disappearance of crude fibre of control feed, experimental feed with fresh brewery waste (EFFBW), experimental feed with dried brewery waste (EFDBW), fresh brewery waste (FBW), dried brewery waste (DBW), paddy straw (PS) and brewery waste incorporated paddy straw (BWIPS) incubated for 0, 2, 6, 12, 24, 48 and 72 hours in RUSITEC are given in Table 2 and is illustrated in Fig. 1.

Table.1 Per cent ingredient composition of the control and experimental concentrate mixtures used

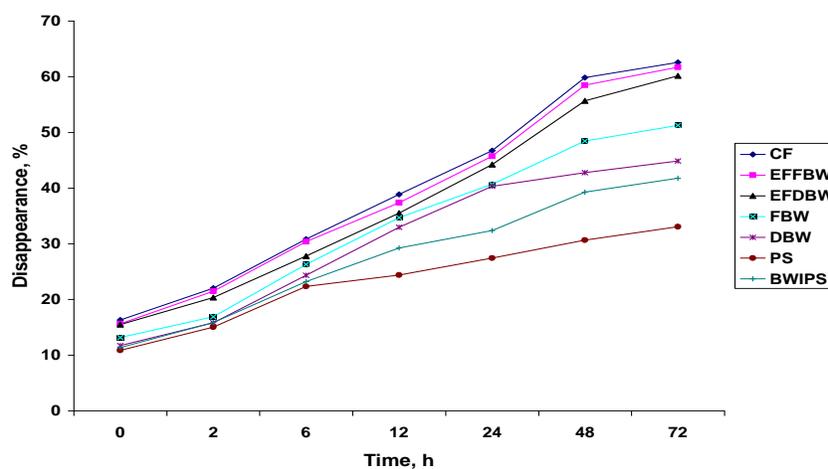
Ingredient	Concentrate mixture (%)	
	Control	Experimental
Yellow Maize	37.00	40.00
Groundnut Cake	29.00	21.50
Wheat bran	30.50	10.00
Brewery waste	0.00	25.00
Mineral Mixture*	1.00	1.00
Salt	1.00	1.00
Shell Grit	1.50	1.50

To every 100 kg of concentrate mixture 20 grams of Nicomix AB₂D₃K (Nicholas Piramal India Ltd, Mumbai) containing Vitamin A-82500 I.U, Vitamin D₃-12000 I.U, Vitamin B₂-50 mg, Vitamin K-10 mg per gram was added.*Mineral mixture supplied by Kerala Feeds Ltd. Kerala, containing Calcium (minimum) 20 per cent, Phosphorus (minimum) 12 per cent, Magnesium (minimum) 5 per cent, Iron (minimum) 0.4 per cent, Copper (minimum) 0.1 per cent, Zinc (minimum) 0.8 per cent, Manganese (minimum) 0.12 per cent, Cobalt (minimum) 0.012 per cent, Iodine (minimum) 0.026 per cent, Sulphur 1.8 - 3 per cent, Arsenic (maximum) 7 ppm, Lead (maximum) 20 ppm and Flourine (maximum) 0.07 per cent.

Table.2 *In vitro* crude fibre disappearance of experimental feeds at different incubation periods (h) in RUSITEC, %

Treatments	CF Disappearance, %						
	0h	2h	6h	12h	24h	48h	72h
Control feed	16.30	22.00	30.83	38.86	46.72	59.81	62.54
Experimental feed with fresh brewery waste (25%)	15.61	21.45	30.38	37.38	45.70	58.47	61.67
Experimental feed with dried brewery waste (25%)	15.46	20.35	27.78	35.48	44.22	55.66	60.17
Brewery waste (fresh)	13.18	16.88	26.30	34.67	40.67	48.42	51.26
Brewery waste (dried)	11.70	15.81	24.31	32.96	40.32	42.76	44.87
Paddy straw	10.83	15.03	22.35	24.40	27.41	30.64	33.03
Brewery waste incorporated paddy straw	11.36	15.83	23.18	29.24	32.36	39.27	41.76

Fig.1 *In vitro* crude fibre disappearance of experimental feeds at different incubation periods (h) in RUSITEC, %



The *in vitro* crude fibre disappearance of experimental feeds such as control feed, EFFBW, EFDBW, FBW, DBW, PS and BWIPS at 2 hours of incubation in RUSITEC was 22.00, 21.45, 20.35, 16.88, 15.81, 15.03 and 15.83 per cent, respectively.

The CF disappearance at 24 hours incubation period was 46.72, 45.70, 44.22, 40.67, 40.32, 27.41 and 32.36 per cent for control feed, EFFBW, EFDBW, FBW, DBW, PS and BWIPS, respectively.

During 72 hours of incubation, 62.54, 61.67, 60.17, 51.26, 44.87, 33.03 and 41.76 per cent crude fibre disappeared from control feed, EFFBW, EFDBW, FBW, DBW, PS and BWIPS, respectively. Similarly, Carro *et al.*, (1995) found significant improvement in the *in vitro* (RUSITEC) NDF disappearance of grass and corn silage when nylon bags with pore size of 100 μm was used, compared to those with 40 μm pore size. Addition of fibrolytic enzymes (30000 nova cellulase and 10000 nova xylanase units per kg DM)

significantly improved the *in vitro* (RUSITEC) cellulose and hemicellulose disappearance of orchard grass hay (Dong *et al.*, 1999). Varga and Hoover (1983) also reported that the *in situ* NDF disappearance of brewer's grain and distiller's grain were 50.8 and 76.6 per cent, respectively, values being higher than that obtained in the present study. They further reported that the *in situ* rate of degradation of brewer's grain and distiller's grain was 0.071 and 0.072 per hour, respectively. Firkins *et al.*, (1985) reported that the *in situ* NDF disappearance rates were 4.4 and 3.7 per cent per hour for wet and dry corn distiller's grain, respectively in rumen cannulated steers. Al-suwaiegh *et al.*, (2002) reported *in situ* NDF disappearance of wet sorghum distiller's grain as 45.2 per cent, which is comparable to the findings of the present study while that of wet corn distiller's grain as 39 per cent which is lower than the present values obtained for fresh and dried brewery waste.

Among the feeds experimented in RUSITEC, disappearance was more in the control feed, EFFBW and EFDBW when compared to other experimental feeds. Similarly, the disappearance was more in BWIPS compared to paddy straw. The *in vitro* crude fibre disappearance at all incubation periods was higher for FBW than the DBW. The FBW had more disappearance compared to DBW. A low *in vitro* crude fibre disappearance of 33.03 per cent was recorded at 72 hours of incubation for paddy straw, whereas the BWIPS had improved *in vitro* crude fibre disappearance of 41.76 per cent at 72 hours of incubation.

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References

- Al-Suwaiegh, S., K.C. Fanning, R.J. Grant, C.T. Milton, and T.J. Klopfenstein. 2002. Utilization of distiller's grains from the fermentation of sorghum or corn in diets for finishing beef and lactating dairy cattle. *J. Anim Sci.*, 80: 1105-1111.
- AOAC. 1990. *Official Methods of Analysis*, Fifteenth edition. Association of Official Analytical Chemists. Washington D.C., p. 587.
- Carro, M.D., P. Lebzien, and K. Rohr. 1995. Effects of pore size of nylon bags and dilution rate on fermentation parameters in a semi-continuous artificial rumen. *Small Ruminant Res.*, 15: 113-119.
- Czerkawski, J.W. and G. Breckenridge. 1977. Design and development of a long term rumen simulation technique (RUSITEC). *Br. J. Nutr.*, 38: 371-384.
- Dong, Y., H.D. Bae, T.A. McAllister, G.W. Mathison, and K.J. Cheng. 1999. Effects of exogenous fibrolytic enzymes, α -bromoethanesulfonate and monensin on digestibility of grass hay and methane production in a rumen simulation (Rusitec) system. *Can. J. Anim. Sci.*, 79: 491-498.
- Firkins, J.L., L.L. Berger, and G.C.Jr. Fahey. 1985. Evaluation of wet and dry distiller's grains and wet and dry corn gluten feeds for ruminants. *J. Anim. Sci.*, 60: 847.
- Rasco, B.A., M. Borhan, and Y. Owusu-Ansah. 1989. Effects of drying techniques and incorporation of soluble solids on the chemical composition and color of distiller's grain products. *Cereal Foods Wld.*, 34: 346-349.

Snedecor, G.W. and W.G. Cochran. 1994.
Statistical Methods. Eighth edition.
The Iowa state University press, Ames,
Iowa, p. 313.

Varga, G.A. and W.H. Hoover. 1983. Rate

and extent of neutral detergent fibre
degradation of feedstuffs *in situ*. *J.*
Dairy Sci., 66: 2109-2115.

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