The effect of grain sources on *in vitro* rumen acid load of close-up dry cow diets

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Introduction

Over the last two decades, it has become common practice to feed rations of higher grain density during the close-up period (Penner *et al.*, 2007). It has been proposed that the feeding of a high non-fibre carbohydrate diet virtually always results in higher *pre partum* dry matter intake and frequently results in more positive effects on energy metabolism. However, there is a need to manage the inclusion of these feeds to avoid reduced performance due to subacute ruminal acidosis (Garrett *et al.*, 1999) and an increased incidence of clinical acidosis and related disorders. An *in vitro* work has assessed and evaluated a new technique (acidogenicity value; AV) for studying the production of acids during rumen fermentation (Wadhwa *et al.*, 2001). It was proposed that the high concentration of starch in wheat grain is a critical point in AV of a dairy cow diet. Moreover, the impact of different close-up dry cow diets on rumen acid load has not been evaluated. The objective of this experiment was to evaluate the effect of grain sources and combination on the AV of a series of close-up dry cow diets.

Material and methods

Various diets were provided using different concentrations of grain sources including barley, maize and wheat. A basal diet (BD) was provided including barley and maize grains, then wheat grain (WG) was replaced in the basal diet as a part of wheat straw (BDWG1 and BDWG2), or substituted for maize or both barley and maize grains (BDWG3 and BDWG4), or added to the basal diets (BDWG5 and BDGW6). The diets are shown in Table 1. The acidogenicity values of the diets were determined using the procedure as described by Wadhwa *et al.* (2001). Samples were oven-dried (48 h, 68 °C) and ground through a 1 mm screen on a laboratory mill. One-gram (DM) samples were weighed and incubated, in triplicate, with 30 ml of buffered rumen liquor comprising 60% buffer and 40% rumen liquor. The buffer was made up at 20% of the strength of the Tilley-Terry (1963) buffer. Cysteine hydrochloride monohydrate (0.025% wt/vol) was added just prior to incubations. Rumen fluid was collected, 3 h after morning feeding, from four fistulated sheep that were maintained on lucerne hay and concentrates (70 to 30% in the DM). The incubations were carried out in 100-ml bottles held in a water bath at 38.7 °C. Samples (2 ml) were withdrawn from bottles after 24 h and transferred to 2-ml micro tubes containing 50 mg (excess) of $CaCO_3$ powder. The mixture was shaken manually for 5 s and then centrifuged at 4,000 rpm for 10 min before analysis of Ca content in the supernatant using Atomic Absorption. The AV was calculated as the product of Ca concentration (from the analysis) and fluid volume (30 ml) divided by the sample weight. Data were analysed using the completely randomised design of the GLM procedure of SAS® (1999).

Results

The results indicate that the AV of BDWG1, BDWG2 and BDGW6 (11.1, 11.2 and 11.9, respectively) were significantly ($P<0.05$) higher than those of BD, BDWG3, BDWG4 and BDWG5 (10.1, 10.1, 10.1 and 10.7, respectively).

Table 1. The close- up dry cow experimental diets (%DM) and the acidogenicity values.

Items	Diets						
	BD	BDWG1	BDWG2	BDWG3	BDWG4	BDWG5	BDWG6
Maize silage	27.5	27.5	27.5	27.5	27.5	26.5	25.5
Lucerne hay	19.9	19.9	19.9	19.9	19.9	19.1	18.4
Wheat straw	14.6	10.7	6.7	14.6	14.6	14.0	13.5
Wheat bran	4.6	4.6	4.6	4.6	4.6	4.4	4.3
Barley grain	8.6	8.6	8.6	8.6	0.0	8.3	8.0
Maize grain	8.6	8.6	8.6	0.0	0.0	8.3	8.0
Wheat grain	0.0	3.9	7.9	8.6	17.2	3.8	7.4
Soybean meal	4.6	4.6	4.6	4.6	4.6	4.4	4.3
Cottonseed meal	5.3	5.3	5.3	5.3	5.3	5.1	4.7
Rape seed meal	2.1	2.1	2.1	2.1	2.1	2.1	2.0
Anionic salts	2.5	2.5	2.5	2.5	2.5	2.4	2.3
Vitamin & mineral premix	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Protected fat	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Acidogenicity values	10.1	11.1	11.2	10.1	10.1	10.7	11.9

Discussion and conclusion

The present results indicate that the AV of the diets evaluated was influenced by the source and concentration of the grains. In addition, the decrease in wheat straw, as observed in diets BDWG1 and BDWG2, resulted in an increasing AV. This result was in accordance with the finding of a previous study (Wadhwa *et al.,* 2001) in which the forages generally had AV that were lower than that of starchy feeds. In addition, wheat grain had the highest AV of the grains, while wheat straw had the lowest value of the forages. It was concluded that the low values for wheat straw may reflect its resistance to fermentation. Overall, the result of the present study provides additional information for addressing issues of rumen acid load when different sources and concentrations of NFC are included in a dry cow diet formulation.

References

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