10.1071/ANv62n10–11abs

ANIMAL SCIENCE IN AUSTRALIA

Proceedings of the Australian Association of Animal Sciences

Volume 34

Anchoring knowledge – exploring the animal science ecosystem

34th Biennial Conference

Australian Association of ANIMAL SCIENCES
34TH BIENNIAL CONFERENCE
Anchoring knowledge – exploring the animal science ecosystem

Pullman Cairns International Hotel, Cairns, Queensland
5–7 July 2022

Non-structural carbohydrate content of the mixed ration affects both pasture and total intake of dairy cows via mechanisms explained by the hepatic oxidation theory

K. A. D. Ison[A,B,C], *D. G. Barber*[A], *D. G. Mayer*[A], *A. Anstis*[A] *and M. A. Benvenutti*[A]

[A]Department of Agriculture and Fisheries, Qld 4343, Australia.
[B]School of Agriculture and Food Sciences, The University of Queensland, Qld 4343, Australia.
[C]Corresponding author. Email: kieran.ison@daf.qld.gov.au

Feed intake is the single most important factor driving milk yield in dairy systems. Partial mixed ration (PMR) feeding systems incorporate conserved forages and concentrates, combined in a mixed ration, into a grazing system. These systems have become the most common within the sub-tropical Queensland dairy industry; however, feed intake in PMR systems is highly variable (2012 Queensland dairy farm survey showed 12.2 to 25.0 kg dry matter (DM)/day, unpubl. data). Part of this variability is likely due to the two distinct feed types (mixed ration and pasture) having varying effects on intake. Ison *et al.* (2020*a*, 2020*b*) illustrated that pasture structure and allocation have significant effects on intake within sub-tropical PMR systems. Auldist *et al.* (2014) found that increasing the crude protein (CP) content of the mixed ration increased pasture intake for dairy cows in the temperate region of Australia. This current study was conducted to determine how the nutrient profile of the mixed ration affects pasture and total intake in the sub-tropical region. Three diets were formulated to be isoenergetic but vary in non-structural carbohydrates (NSC; starch and sugars), CP and fibre content. The differences in nutrient profiles were achieved by altering the proportion of wheat grain, canola meal and soyhulls within the mixed ration. Soyhulls were used as a non-forage fibre source so that the physical properties of the mixed ration were not affected. The experiment was conducted at the Gatton Research Dairy during spring in 2020. Thirty-six lactating Holstein-Friesian dairy cows were randomly allocated to one of the three experimental diets; High NSC; High CP or High Fibre. Targeted feed allocations were 15.5 kg DM/day of the mixed ration on a feed pad during the day and 8.0 kg DM/day of lucerne (*Medicago sativa* L.) pasture grazed overnight.

Pasture and total intake ($P < 0.001$) were significantly lower in the High NSC treatment (Table 1). Energy corrected milk (ECM) yield was significantly lower for cows in the High NSC treatment ($P < 0.001$; Table 1).

Table 1. Effect of non-structural carbohydrate (NSC), crude protein (CP) and fiber content of the diet on feed intake, nutrient content of the consumed diet and milk production of lactating cows in a partial mixed ration (PMR) system (n = 12)[A]

	High NSC	High CP	High fibre	SEM	*P*-value
Mixed ration intake (kg DM/day)	13.6	15.7	15.4	0.556	0.074
Pasture intake (kg DM/day)	6.95[a]	10.4[b]	9.26[b]	0.414	<0.001
Total intake (kg DM/day)	20.6[a]	26.1[b]	24.7[b]	0.574	<0.001
Non-structural carbohydrate (% DM)	29.4[b]	20.3[a]	19.4[a]	0.498	<0.001
Crude protein (% DM)	21.2[a]	26.8[b]	21.7[a]	0.461	<0.001
Neutral detergent fibre (% DM)	24.1[a]	30.1[b]	32.7[c]	0.119	<0.001
Energy corrected milk yield (kg/day)	15.3[a]	20.3[b]	20.0[b]	1.17	0.024

[A]Values are treatment means, standard error of the mean (SEM) and *P* values for differences between treatment means. [a-c]Mean values with a common superscript within rows are not significantly different ($P < 0.05$). DM, dry matter.

Intake and production from cows in the High CP and High Fibre treatments were not significantly different. Therefore, excess CP intake was likely lost to the environment. The NSC content of the total diet in the High NSC treatment (29.4% DM) was similar to the average of sub-tropical PMR farms (28.6% DM) surveyed in 2012. This study has illustrated that diets with an NSC similar to the industry average had a negative effect on both pasture and total intake, and ECM yield. The low ECM yield was driven by low milk fat content (2.48%) likely due to cows suffering from low milk fat syndrome. Average rumen pH was not affected by treatment in this study. Therefore, the reduction in intake was not driven by reduced cellulolysis and low rumen pH but was likely due to mechanisms explained by the hepatic oxidation theory (HOT; Allen 2020). Briefly, HOT describes the regulation of feed intake which is driven by the fuels oxidised in the liver. Propionate, the major product of NSC digestion, is the main fuel that triggers satiety and reduces feed intake. This study demonstrated that mixed rations with a high NSC content reduce feed intake via mechanisms described in HOT, not only immediately while consuming the mixed ration but also affected pasture intake. Formulating mixed rations using non-forage fibre by-products like soyhulls, may be an effective strategy for producers to reduce the negative effects on intake and production observed in high NSC diets, whilst limiting the potential negative impacts on the environment caused by excess CP intake.

References

Allen MS (2020) *Animals* **14**, 55–64.
Auldist MJ *et al.* (2014) *Animal Production Science* **7**, 869.
Ison KAD *et al.* (2020*a*) *Animals* **10**(5), 860.
Ison KAD *et al*. (2020*b*) *Animals* **10**(5), 904.

We gratefully acknowledge Dairy Australia and Queensland Department of Agriculture and Fisheries for funding this work.