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THE USE OF BAKERY WASTES IN FEEDLOT RATIONS FOR SHEEP

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SUMMARY

Intensively feeding animals can be a costly exercise, and as a result many producers are exploring innovative ways to reduce their input costs. Commercial by-products from the human food industry (eg brewers grain, citrus pulp and apple pulp) have recently become popular in animal production. Bakery waste displays favourable characteristics for animal production, however, limited information is available on its use in feedlot rations.

A feeding trial was undertaken to determine if bakery waste could be successfully incorporated into a production ration for intensively fed sheep. The dietary treatments consisted of three inclusion levels of bread, viz 0, 25 and 50%. All diets were formulated to be isonitrogenous and isoenergetic. Twenty one merino weaners were randomly allocated to one of the three treatment groups and fed these rations for a total of 70 d. The bread used consisted predominantly of sliced bread and bread rolls, products containing fruit were not included. The bread was dried and crushed prior to incorporation into the rations.

There was no significant difference in live weight gain between the treatments. Feed intake was significantly lower ($P<0.05$) for the 50% bread group compared to the control, and feed conversion ratios and wool growth (both length and fibre diameter) tended to be higher in the 50% bread group. No clinical signs associated with digestive upsets were evident and thus bread can be successfully incorporated into feedlot rations for sheep at both 25 and 50% inclusion levels.

Keywords: bakery wastes, sheep

INTRODUCTION

Intensively feeding animals can be an expensive exercise. Traditional grains (e.g. oats, barley and lupins) can vary substantially in price from one season to the next due to commodity prices and seasonal demand. Human food by-products offer an alternative source of feed for animals and large amounts of factory seconds, waste and stale food are discarded from a number of different food industries every day.

There has been very little documented evidence of the feeding of by-products in rations for sheep. This can be attributed to the fact that until relatively recently the feedlot production of sheep has not been a popular practice, however, in the future feedlotting will become more common as export markets grow and carcase specifications become more precise. Feedlot production of cattle has been a widely accepted practice since the late 1960s and the beef feedlot industry has evolved and tried many alternative energy and protein sources in rations (Boda 1990).

Bakery waste is a by-product from the commercial food industry. Unlike many other commercial foodstuffs bakery waste is constantly available due to the perishable nature of bread for consumer use. Bakery waste includes sliced bread, rolls, croissants, cakes and biscuits, which could be mixed together to form the basis of a ration. Champe and Church (1980) conducted a bread digestibility trial with sheep and found that digestibility was higher in the bread-based diet compared to the basal (0% bread) diet. Anecdotal evidence suggests that bakery wastes are used by a number of farmers in small intensive sheep and cattle operations, but there is very little knowledge pertaining to appropriate feeding levels and associated production levels.

MATERIALS AND METHODS

Experimental animals, design and diets

Twenty one Merino wether weaners, aged approximately 12 months and weighing 30 (± 1.5 SD) kg initially, were allocated to individual pens, which had slatted floors, feed trough and nipple water delivery system. The sheep were randomly allocated on a stratified weight basis to one of the three experimental diets. The test diets were formulated by replacing (w/w) 25 and 50% of the basal diet with dried bread. The bread used consisted predominantly of sliced bread and bread rolls; bread products containing fruit were not included. The bread was dried at 75°C for 13 h in a fan-forced oven then placed in chaff bags and crushed. The nutritive value of the ingredients used in the rations and the composition and nutritive value of the experimental diets are shown in Table 1. The diets were designed to be similar in CP and ME content. On analysis, however, variations in CP content were observed. Despite these differences, the CP content of all diets were within the requirements for weaner sheep.

Table 1. Composition and nutritive value of the three experimental diets.

Ingredient	Inclusion level (%)		
	Control	25% bread	50% bread
Lucerne chaff (16.9% CP, 9.1 MJ ME/kg DM)	12.5	0	0
Wheaten chaff (8.6% CP, 7.7 MJ ME/kg DM)	33.3	41.2	29
Lupins (35.9% CP, 13 MJ ME/kg DM)	33.3	33.3	20.5
Oats (10.7% CP, 12 MJ ME/kg DM)	20.4	0	0
Bread (15.8% CP, 12 MJ ME/kg DM)	0	25	50
Rumensin	<0.01	< 0.01	<0.01
Mineral premix	0.5	0.5	0.5
Total ration:			
CP (%)	19.2	19.4	17.8
ME (MJ/kg DM)*	10.5	10.4	10.6

Procedures

Feeding. During the first two weeks of the feeding trial the sheep were gradually introduced to their bread-based diets. This involved initially feeding 20% of the total bread to be fed (the balance outstanding fed as a mixture of oats and lupins), and doubling this amount until the final level was reached. The sheep were fed daily 1100 g DM of the experimental diets for the duration of the feeding trial

Measurements. The animals were weighed at the beginning of the feeding trial, and every week thereafter. Weighing was done prior to feeding to minimise the effects of gut fill. There was a general observation of health and any behavioural changes of the sheep that occurred during the feeding trial. Feed refusals were collected and weighed daily to determine daily feed intake. Feed conversion ratio (FCR) was calculated from feed intake and live weight gain (LWG).

Linear wool growth was determined using the dyebanding technique (Wheeler *et al*. 1977). A dye solution made of Nako-H was applied (at the start of the feeding trial) to wool follicles at skin level on the midside of the fleece. The midside patch was clipped at the end of the trial and linear wool growth was measured using a steel rule. Nine staples along the dyeband were randomly selected for measurement and the average of the nine was recorded. The fibre diameter of the samples was determined using Laserscan (Australia Fibre Testing, York, WA).

On the 70th day from the commencement of the trial, the sheep were weighed to determine their final live weights. That same afternoon two sheep from each treatment were randomly selected and slaughtered, their carcases weighed (hot carcase weight), split longitudinally and, from the left side of the carcase, the ‘C’ and ‘G R’ measurements taken to determine carcase scores. (The ‘C’ measurement is taken in the groove between the 12th and 13th ribs, 50 mm out from the spine over the middle of the eye muscle; the ‘GR’ measurement is taken at the 12th rib, 110 mm out from of middle of the spine). All carcases were inspected for abnormalities in the meat and the major body organs were visually examined.

Statistical analysis

Treatment means LWG, feed intake (DMI), FCR and linear wool growth and fibre diameter were compared using analysis of variance, with differences between treatment means determined using the least significant difference (P<0.05) procedure.

RESULTS

Feed intake, live weight gain and FCR

The average daily DMI, LWG and the FCR for the three treatment groups are shown in Table 2. There was no significant (P>0.05) difference in LWG between the three dietary treatments, with all sheep progressively gaining weight throughout the trial. There was no evidence of any clinical signs associated with digestive upsets in any of the animals.

Table 2. Average daily live weight gain, feed intake and feed conversion ratios for sheep fed feedlot rations containing 0, 25 and 50% bread.

Diet	LWG (g/d)	DMI (g/d)	FCR	Wool growth (mm/d)	Fibre diameter (μm)	Dressing %	Carcase score
Control	184	1052^{a}	5.7	0.33	16.66	46.1	2
	(29.4)	(56.1)	(0.63)		(1.51)		
25% bread	188	1004^{ab}	5.3	0.36	17.10	44.5	3
	(37.7)	(75.1)	(0.84)		(0.85)		
50% bread	196	963^{b}	4.9	0.41	17.54	47.2	3
	(66.3)	(105)	(1.33)		(1.14)		

Values within columns with varying superscripts are significantly (P<0.05) different. Values within brackets are the SD.

The sheep fed the diet containing 50% bread consumed 8% less (P<0.05) feed than the control group. Fine bread crumbs made up the majority of the refusals in both the bread treatments whilst refusals were consistently lucerne chaff for the control group.

Wool growth

The daily linear wool growth and average fibre diameter are shown in Table 2. Replacing either 25% or 50% of the diet with bread had no effect (P>0.05) on linear wool growth or fibre diameter, although both of these parameters tended to be higher in sheep fed the 50% bread diet.

Carcase evaluations

The carcase evaluation data is also shown in Table 2. There was no difference in the final live weights and carcase weights, although the dressing percentage tended to be higher for the sheep fed the 50% bread diet. For both the bread-based diets the average carcase score was 3 whilst for the control group the carcase score was 2.

DISCUSSION

There was no significant difference in LWG between the diets, indicating that bread can be successfully incorporated into feedlot rations at 25 and 50% inclusion levels. Finn (1994) reports that for a 35 kg merino wether to gain 150 g/d it must have access to at least 13.4 MJ ME/kg DM and 13.9% CP. The ME contents of the diets used in the current study were10.5 MJ (control), 10.4 MJ (25% bread) and 10.6 MJ/kg DM (50% bread). This is less than the recommended level, however, the sheep performed better than 150 g/d, gaining an average of 184 g/d, 188 g/d and 196 g/d for 0%, 25% and 50% bread diets, respectively. The additional gain may be due to the CP contents of the diets being higher (19.2%, 19.4% and 17.8%) than the recommended level (13.9% CP). It is likely that the animals converted this excess protein into energy.

At the start of the trial the DMI of the control, 25 and 50% bread group feed, as a percentage of their live weights, were 3.35%, 3.38% and 3.31%, respectively. At the conclusion of the trial feed DMI had dropped to 2.46%, 2.34% and 2.25% of their live weight. The NRC (1985) recommend that an animal weighing 40 kg should have a DMI (% body weight) of 4.0%. If feed intake was increased to 4.0% of bodyweight it is expected that weight gains would have been greater than 150 g/d.

As the amount of bread in the diet increased, so too did the level of feed refusal. This is consistent with the findings of Champe and Church (1980) who found that sheep fed a ration containing 40% dried bakery products (DBP) had a higher refusal rate than those on the basal diet (0% DBP). Sheep are reported to have a low tolerance and little preference for sweet compounds (Goatcher and Church 1970), and this may account for the lower acceptance in the bread-based diets. An alternative reason for the lower intakes may be that these diets met the nutritional requirements of the sheep without the need to consume the entire ration.

Easton (1994) states that a FCR of 5:1 is achievable in feedlot situations and should be aimed for, however, for budgeting purposes a ratio of 6:1 should be used. The FCR in the current study were 5.7, 5.3 and 4.9 for the 0, 25 and 50% bread groups, respectively. The improved FCR for the bread-based diets may be because processing of the bread (baking) has changed either the physical or chemical nature of the nutrients (contained in the bread), effectively increasing the level of bypass nutrients. Baking is a recognised means of increasing the bypass nutrient components of feeds (Thomas *et al*. 1979). The main effects of bypass nutrients on ruminant production include; (1) stimulating feed intake; (2) increasing the efficiency of utilisation of absorbed nutrients; and (3) providing amino acids and energy post-ruminally (Leng *et al*. 1981). Throckmorton *et al*. (1981) reported that decreases in feed conversion efficiency may be as much as 38% for sheep when a predominantly rumen degradable diet is supplemented with bypass casein. The control diet used in the current study can be characterised as being predominantly ruminally degradable. Because the bread had been baked initially and reheated for subsequent drying prior to feeding, it is probable that the amount of either bypass protein, bypass starch or both in the diet has been increased. Given that increased bypass protein generally results in an improvement in wool growth (Leng *et al*. 1981), whilst bypass starch does not stimulate feed intake but improves FCR (Preston and Leng 1987), it seems likely that the heat 'treatment' of the bread effectively created both bypass protein and starch. Further research is needed to determine the rumen degradability of the nutrients contained in dried bread.

In the current study the average (linear) wool growth ranged from 0.33-0.41 mm/d. Replacing 25 and 50% of the diet with bread had no effect on (linear) wool growth, although both wool growth and fibre diameter tended to be higher in the 50% bread group, again suggesting that the level of bypass nutrients in the diet had been increased.

The current study has shown that bread can be successfully incorporated into feedlot rations at 25 and 50% inclusion levels, without adversely affecting production. Whilst bread is a suitable ingredient from a production point of view, its inclusion in feedlot rations ultimately depends on cost.

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