Short communication

Evaluation of cottonseed oil-cake meal as a protein source in calf starter meals

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Abstract

The growth performance of 18 Holstein and 20 Jersey heifer calves fed calf starter meals containing either cottonseed oil-cake meal (CSOCM) or soybean oil-cake meal (SBOCM) was compared. The diets were iso-nutritious in terms of crude protein and energy, and were fed from two weeks of age until two or three months of age to Holstein or Jersey calves respectively. Jersey and Holstein calves weighed 21.4±0.5 and 35.9±1.4 kg respectively at the start of the experiment. There were no differences between calf starter meals containing CSOCM or SBOCM ($p > 0.05$) in respect of feed intake, growth rate or efficiency of feed conversion. Average daily gain of Jersey and Holstein heifer calves was 0.435±0.02 and 0.635±0.03 kg/day respectively. No calves died during the experiment. It was concluded that the most important criterion for inclusion of CSOCM in calf starter meals is the cost of CSOCM relative to that of SBOCM, provided that the CSOCM used has a gossypol content of less than 200 ppm.

Key words: heifer calves, cottonseed oil-cake meal, soybean oil-cake meal, growth rate, gossypol, mortality.
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Introduction

Although cottonseed oil-cake meal (CSOCM) has long been recognized as an economical protein source for dairy cow diets, it is potentially toxic when fed to calves (Risco *et al*., 1992). Cottonseed products contain gossypol, a yellow, polyphenolic binapthylaldehyde that is toxic for monogastric animals (Gray *et al., 1993*). In ruminants, gossypol is detoxified in the rumen either by bonds formed with soluble proteins or by a dilution effect, which results in slower absorption of gossypol. Young calves, however, function as monogastric animals until the rumen is fully developed and are therefore more susceptible to gossypol poisoning. Nonetheless, CSOCM is sometimes included in dairy calf diets under practical farming conditions, apparently without ill effects. The objective of this study was to compare CSOCM with soybean oil-cake meal (SBOCM) to determine the suitability of locally-produced CSOCM for inclusion as a protein sources in calf starter meals.

Materials and methods

Eighteen Holstein and 20 Jersey calves were randomly allocated to calf starter meals containing either 8% CSOCM or 8% SBOCM (Table 1). The diets contained similar levels of crude protein, total digestible nutrients and crude fibre. The ratio of calcium to phosphorus was 1:1 as recommended by NRC (1989). The experiment began when calves were 14 days old and was terminated when Jersey calves were three months of age and Holstein calves were two months of age. Calves were fed whole milk (3-4 l/day) twice daily prior to the start of the experiment and were encouraged to eat the calf starter meal by placing meal into the buckets after they had finished drinking milk. Calves were weaned at 35 days of age and thereafter they received only calf starter meal *ad libitum*. Fresh water was freely available from day 10. The quantity of meal offered was increased on an individual basis whenever there were no residues left over from the previous day. Feed intake of calves was monitored twice weekly. Calves were kept in individual stalls and were weighed once weekly. Feed samples were collected once weekly, dried at 55°C for three days to determine dry matter content and analyzed for contents of crude protein, crude fibre (AOAC, 1990) and total digestible nutrients (Engels & Van der Merwe, 1967). Data were analyzed by analysis of variance (Statgraphics, 1993).

Results and discussion

There were no differences between diets in respect of dry matter intake, feed conversion efficiency or average daily gain ($p > 0.05$) between diets for calves of either breed (Table 2). These results are in agreement with those of El-Din *et al.* (1992) and Biondi *et al.* (1993) who also reported no differences between diets containing

CSOCM and SBOCM. The free gossypol content of the experimental calf starter meal used in the current trial was 162±43ppm. No calves died and neither were symptoms of gossypol toxicity observed. Similar findings were reported by Biondi *et al.* (1993). Risco *et al*. (1992) found that a diet containing 200 ppm free gossypol was safe for Holstein bull calves from 1 to 120 days of age, but that 400 ppm was toxic, and that 800 ppm resulted in deaths.

Table 1 Physical and chemical composition of calf starter meals containing cottonseed oil-cake meal (CSOCM) or soybean oil-cake meal (SBOCM)

	Calf starter meal	
Parameters	CSOCM	SBOCM
Ingredients (kg)		
Lucerne hay	86	82
Wheat	610	565
Maize	150	200
CSOCM	80	-
SBOCM	-	80
Fishmeal	63	63
Limestone	6	5
Salt	5	5
Chemical composition (% of DM)		
Crude protein	18.9	19.0
Crude fibre	7.6	7.0
TDN[1]	80.5	81.4
Calcium	0.56	0.57
Phosphorus	0.58	0.57

[1] Total digestible nutrients

Table 2 Body mass, average daily gain (ADG), dry matter intake (DMI) and efficiency of feed conversion (EFC) of Jersey and Holstein calves receiving calf starter meals containing cottonseed oil-cake meal (CSOCM) or soybean oil-cake meal (SBOCM) as protein sources

	Calf starter meal			
	CSOCM	SBOCM	P^*	SEM[+]
Jersey calves				
Initial mass (kg)	21.8	21.1	0.48	0.47
Final mass (kg)	54.6	55.2	0.88	2.00
ADG	0.43	0.44	0.74	0.22
DMI/day	0.93	1.00	0.42	0.04
Total DMI	72.7	76.8	0.51	3.0
EFC (kg/kg DMI)	0.469	0.464	0.91	0.02
Holstein calves				
Initial mass (kg)	32.8	30.5	0.43	1.42
Final mass (kg)	67.6	64.0	0.44	2.2
ADG	0.66	0.65	0.66	0.03
DMI/day	1.18	1.20	0.86	0.06
Total DMI	55.4	56.3	0.87	2.9
EFC (kg/kg DMI)	0.58	0.54	0.57	0.35

[*] significance level; [+] standard error of mean

Conclusions

It was concluded that this particular source of CSOCM could be used as a protein source for calves, and that the most important criterion for inclusion of CSOCM in calf starter meals is the cost of CSOCM relative to that of SBOCM, provided that the gossypol content is less than 200 ppm.

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