Assessing Whey to Reduce Feed Costs

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SUMMARY

Deproteinized whey permeate is a by-product of the cheese-making industry. Depending on the type of cheese being produced it can be categorized as "sweet whey" or "acid whey", the latter contains about 4.7% organic acids. The objective of this experiment was to determine the response of weanling pigs to 0, 8, 12 or 16% whey in their drinking water and determine if the organic acids supplied in the acid whey provided additional benefit. Diets were formulated to account for the nutrients in the whey based on intakes from a previous experiment. Supplying up to 16% whey in the drinking water increased caloric intake and improved growth rate. Depending primarily on the cost of transporting the whey to the farm, it may be an economical supplement for weanling pigs.

INTRODUCTION

Whey, a by-product of the cheese industry has several uses, specifically due to its high content of protein. Deproteinized whey (whey permeate) however, presents the cheese industry with disposal problems. This project developed from previous work at the Prairie Swine Centre which demonstrated that growing pigs receiving liquid whey permeate in their drinking water decreased intake of dry feed. Depending on the cost of the whey permeate (primarily transportation costs), cost savings could therefore accrue.

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"Acid" whey is a by-product resulting from the production of soft cheeses such as cottage cheese. It contains approximately 4.7% organic acids. Several researchers have shown that weanling pigs respond to the inclusion of organic acids in their diets with improved growth, and organic acids could be a substitution for in-feed antibiotics.

The overall objective of this experiment was to determine the nutrient or "extra-nutrient" value of two types of liquid whey permeate for pigs. Specifically we wanted to determine: 1) if the weanling pig maintains overall caloric intake when the water supply is supplemented with whey permeate and if the compensation occurs regardless of the whey:water ratio, 2) if whey permeate, especially the high organic acid whey, has a positive effect on piglet health, 3) and if there are feed cost savings when the water supply contains whey permeate.

MATERIAL AND METHODS

Animals. The experiment was designed as a randomized complete block with five blocks of 16 pens of pigs, each pen housing two animals of the same sex. Pigs were assigned to treatment at weaning (26 days of age). .Each block consisted of six days of adaptation (day one to six) and 22 days used for data collection (day 7 to 28). A total of 160 animals were used, 80 barrows and 80 gilts. The smaller piglets (initial BW 7.43 ± 0.85 kg) within the litters were utilized with the assumption that weaning would present a greater challenge to them.

Housing in pairs was used to improve welfare and minimize boredom that could lead to water wastage. Additional, enrichment was provided with toys and chains in the crates which were washed and changed as needed. The crates were inoculated with manure from the existing nurseries to increase the immune challenge to the piglets.

Dietary treatments. A diet was formulated to account for nutrients expected to be consumed by pigs receiving the whey at the highest concentration. This was mixed with a control diet for treatments receiving a lower whey/water ratio. Diets contained no antibiotics. Diets were fed in two phases. The water/whey treatments, available ad libitum, were administered using a suspended bucket system over each crate that connected to the nipple drinker in each crate. Filters were removed from the nipple drinkers to prevent clogging. There was no additional source of water provided. During acclimation (day one to six) the whey concentration was gradually increased. Wasted water was caught using a bucket placed under each of the crates and this was weighed and accounted for as intake on a weekly basis. Feed was also provided ad libitum with the amount recorded as it was added. Feed weigh backs were done weekly to calculate weekly intake and waste was collected under the pen, dried, weighed and accounted for weekly.

Data collection. Piglets were weighed weekly following weaning (day one). Faecal scores were recorded daily for the trial duration (day 1 to 28) on a per pen basis, using a scoring system from zero to five with 0 being dry, hard and well-formed feces to 5 which is watery diarrhea.

RESULTS AND DISCUSSION

Although some diarrhea was observed, it was not excessive, nor associated with treatment (data not shown). There were no differences seen between the normal and the acid whey (P > 0.10), therefore table 1 presents average effects of increasing concentration of the whey in the water. The "control vs whey" comparison refers to the overall effect of whey compared to the 0 or control treatment while the linear and quadratic effects of whey refers to the effect of increasing the concentration of whey, regardless of whey type, in the drinking water.

Water and nutrient (including energy), intake, and growth rate increased with increasing whey concentration. The significant quadratic effect is due to a decrease or plateauing of nutrient intake at the highest whey concentration.

Average daily gain, followed a similar trend with the control group having the lowest gains at 0.34 kg per day followed by the sweet and acid whey treatments gaining 0.40 kg and 0.41 kg per day, respectively (P< 0.01 effect of whey, Table 1). There was no effect of the whey treatment on feed efficiency (P > 0.10).

Economic analysis

The economic analysis was conducted to determine a suitable cost of the whey. The whey is considered a waste product by the cheese industry however, a producer must consider the costs associated with transportation, storage and distribution within the barn. In this study, diets were formulated to account for the nutrients in the whey. We hypothesized that nutrient intake and thus growth would be comparable among treatments, regardless of whether the nutrients originated from the whey or the feed. In fact, caloric intake was increased with the whey treatments. Based on our results and assuming a cost of $400 and $392 per tonne for the "no-whey" and the "whey" treatment diets respectively, a producer could afford to pay approximately $400 per tonne for the liquid whey to be used in the nursery. Because of differences in diet cost, and expected differences in production responses, the economic analysis can't be extrapolated to other phases in a swine production system.

CONCLUSION

Including up to 16% whey permeate in the drinking water of nursery pigs improved gains, with no effect on feed intake, when the diets were formulated to account for the nutrients in the whey. Because of the decreased cost of the diets formulated to account for the nutrients in the whey, cost savings could accrue. There was no additional benefit seen with whey permeate which was higher in organic acids.

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Table 1. The effect of including whey in the drinking water of weanling pigs on feed and liquid intake and growth performance over a 22 day experimental period following a 6 day acclimation

	Whey (% in water)					Whey (% in water)		
							Whey conc.	
	0	8	12	16	SEM	Whey vs control	Linear	Quad
ADI feed (kg)	0.49	0.54	0.51	0.48	0.02	0.53	0.74	<0.01
ADI water (kg)	1.43	1.56	2.13	2.06	0.15	<0.01	<0.01	0.72
DM intake of whey	0.00	0.51	1.01	1.36	0.09	<0.01	<0.01	0.10
ADG (kg)	0.34	0.42	0.41	0.39	0.02	<0.01	<0.01	<0.01
Total nutrient intake (over 22 days, whey plus diet)								
CP (kg)	2.55	2.84	2.79	2.74	0.18	<0.01	<0.02	0.01
Sodium (kg)	0.04	0.05	0.07	0.07	0.00	<0.01	<0.01	<0.01
Calcium (kg)	0.09	0.11	0.11	0.10	0.01	<0.01	<0.01	0.02
DE (kg)	40.77	44.91	44.86	43.97	2.96	<0.01	<0.01	0.02
DM Gain:Feed	0.65	0.71	0.70	0.66	0.06	0.23	0.47	0.09