

Dried Whey - A Valuable Ingredient for Pig Starters

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Milk and milk products are excellent feed components for young pigs. This should not be surprising because we learned as children that milk is nature's most perfect food. Milk proteins are highly digestible and have excellent proportions of essential amino acids. Milk fat is highly digestible and high in energy. Milk sugar, called lactose, is very well utilized by pigs as well as all young animals. Milk is also high in calcium, phosphorus, and many other essential minerals and vitamins. Iron is the only nutrient that is deficient in milk.

Dried skim milk is an excellent ingredient for inclusion in starter diets for early-weaned pigs, but it is very expensive. Therefore, it is generally used only in limited amounts in Phase I starters that are fed for a week or two to pigs that are weaned at a very young age (12-16 days). However, dried whole whey is considerably less expensive, and it is commonly included at dietary levels of 10 to 30% in all phases of the starter period. Dried whey makes up a large part of the base mix that some producers use when they mix their own starter diets on the farm;

Whey is a by-product of the cheese industry. When cheese is made, most of the protein, fat, and ash (or minerals) go into the cheese. After the cheese curds are removed, the remaining liquid whey consists mostly of water and lactose along with a small amount of high quality whey protein. The liquid whey is then dried (spray-dried or roller-dried) and the final product is mostly lactose (about 68%) with some protein (about 12%) and ash (about 8%). Much of the ash arises from buffering agents that are used to neutralize the whey prior to drying. The typical nutrient content of dried whey is shown in Table 1.

Dried wheys can differ in their quality and nutritional value. Whey that is properly dried will have a light cream to slightly yellow color. Dark particles may indicate that the whey was overheated in the drying process, and this reduces its nutritional value. Whey that has been stored too long will become lumpy and brown in color. Dark particles or an overall brown color results from a chemical process (Maillard or browning reaction) that makes the lysine unavailable. Also, lower quality wheys are often high in ash content.

We have conducted many studies with dried whole whey at the University of Kentucky. Figure 1 gives a summary of several experiments which involved 1,118 weanling pigs. In most of these studies, the pigs were weaned at 28 days of age and fed starter diets for 28 days, from average weights of about 17 lb initially to 37 lb at the end of the tests. Levels of whey that were added to a corn-soy diet varied from 10 to 25% in the studies. On average, dried whey resulted in a 12% improvement in growth rate, a 12% increase in feed intake, and a 1.5% improvement in feed/gain. The improvement in growth rate and feed intake was a consistent finding in every experiment.

We feel that lactose is the constituent in dried whey that is responsible for its benefits. In one study, we added either dried whey at 10% of the diet (which supplied 7.2% lactose) or 7.2% lactose to a corn-soy diet. Compared with control pigs, the dried whey and lactose resulted in the same improvements in growth rate (.74 vs .82 and .83 lb/day) and feed intake (1.34 vs 1.48 and 1.48 lb/day).

Roller dried whey is more granular and has better flow characteristics than spray dried whey. Both are very good sources of whey provided that they are light in color. In research at UK, we found that spray-dried whey and roller-dried whey gave the same boost in growth rate (.97 and .98 lb/day vs .91 lb/day for controls) and feed intake (1.63 and 1.56 vs 1.48 lb/day).

The \$64-question is: Do pigs fed dried whey gain faster because the whey stimulates appetite and the pigs eat more feed? Or do the pigs eat more feed because they are growing faster and their nutrient requirements are higher? There is no simple answer to this question (which may be only of academic interest anyway). It is sort of like: Which came first, the chicken or the egg?

The price of dried whey is quite volatile and is affected by whey production and stocks of whey in the domestic and world markets. Over the past 10 years, dried whey has ranged from 12¢ to 31 C/lb. The average price over the past two years has been about 18¢/lb.

We are convinced that the benefits of including dried whey in the diet outweigh the costs. From a diet formulation standpoint, 10 lb of dried whey will replace 7 lb of corn and 3 lb of soybean meal. So, in 1 ton of starter feed with dried whey at 10% of the diet, 200 lb of dried whey will replace 140 lb of corn and 60 lb of soybean meal. Figuring dried whey at 20¢/lb, corn at \$2.25/bushel (4¢/lb) and soybean meal at \$200/ton (10¢/lb), the additional cost of a ton of feed containing 10% dried whey is \$28.40/ton (\$40.00 for the whey less \$5.60 for the corn and \$6.00 for the soybean meal that the whey replaces).

Now, let's assume a ton of starter feed will feed 40 pigs from 15 to 40 lb. The additional \$28.40 divided by 40 pigs is about 70¢/pig. But pigs fed whey diets will consume more feed. The additional feed consumed (about 10%) and the more expensive diet are equal to an additional cost of about \$1 .00/pig. If the dried whey diet increases growth rate by 10%, this is equivalent to an additional 2.5 lb of body weight at weaning (25 lb of weight gain x 10% = 2.5 lb). What is an additional 2.5 lb/pig worth at this weight? With a \$40/cwt hog market, it is probably worth between \$2.00 and \$2.50/pig, and this does not include the greater survival rate and greater post-weaning gain that is associated with heavier-weight pigs at weaning. A \$2.00 to \$2.50 return for a \$1 .00 investment is pretty good economics.

We recommend the inclusion of high quality, dried whole whey in pig starter diets. For pigs weaned at 3 or 4 weeks, we recommend a dietary level of 15 to 25% for the first 2 weeks after weaning. The level of dried whey can then be reduced to

10% of the diet for the subsequent 2 weeks. For pigs weaned very early (2 weeks), a high level (20-30%) of dried whey along with 6-8% dried porcine plasma, and perhaps some extra lactose (10%) is recommended for the first week or two after weaning.

Table 1. Typical nutrient composition of dried whole. whey

	%
Dry matter	93
Lactose	68
Protein	12
Minerals	
Calcium	.86
Phosphorus	.76
Sodium	1.30
Amino acids	
Lysine	.94
Threonine	.89
T r y p t o p h a n	
Methionine + Cystine	
Metabolizable energy, kcal/lb	1,500

