Tech Topics

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Bioavailability of Lysine in Various Blood Meals

Lysine is frequently the first limiting amino acid in animal feeds, notably those formulated with high levels of plant proteins. Significant amounts of synthetic lysine (lysine HCl) or lysine-rich feed ingredients (blood meal, fish meal) need to be incorporated in fish feeds formulated with high levels of plant proteins to meet the requirements of the animal.

Blood meal is a lysine-rich ingredient (five to eight percent lysine by weight) that has been widely used in carnivorous fish feeds. The digestibility of protein in blood meals manufactured using different equipment has been shown to differ significantly. For example, in studies conducted at the University of Guelph, the digestibility of protein in spray-dried blood products (whole blood meal, blood cell meal, spray-dried plasma) was significantly higher (protein digestibility = 97 to 99 percent) than that of rotoplate-dried, steam tube-dried, and ring-dried blood meals (protein digestibility = 82 to 88 percent). These differences in digestibility of protein are probably also reflected in the digestibility and availability of amino acids, such as lysine. There is a need to compare the availability of lysine in different types of blood meals with that of synthetic lysine sources.

A study was carried out to determine the availability of lysine in three commercially produced blood meals using a slope ratio growth assay with rainbow trout. Availability of lysine in the blood meals was determined in comparison with that of lysine HCl, a form of lysine frequently used by feed manufacturers and considered to be 100 percent bioavailable.

A corn gluten meal-based diet deficient in lysine (1.5 percent diet) was used as the basal diet. Two levels of spray-dried poultry blood meal (SDBM), flash-dried bovine blood meal (FDBM), disc-dried poultry blood meal (DDBM), and lysine HC1 (combined with a small amount of dicalcium phosphate) substituted corn gluten meal in the control diet to produce experimental diets containing 1.8 or 2.2 percent lysine. All the diets were fed in equal amounts to rainbow trout (initial body weight = 25 grams/fish) for 12 weeks at 15 degrees Celsius.

Figures 1 and 2 illustrate the response of the live weight gain and

Figure 1. Weight Gain of Rainbow Trout Fed Increasing Levels of Lysine Provided by Various Blood Meals Compared with L-lysine (Lys+DiCal)

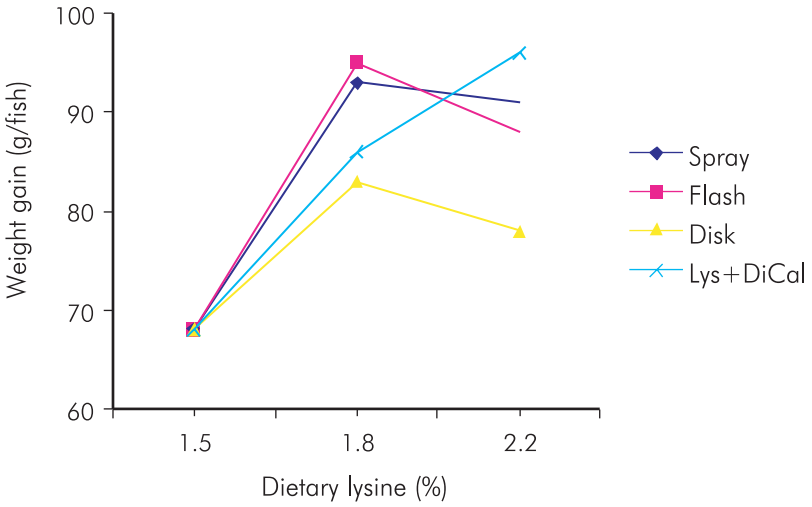
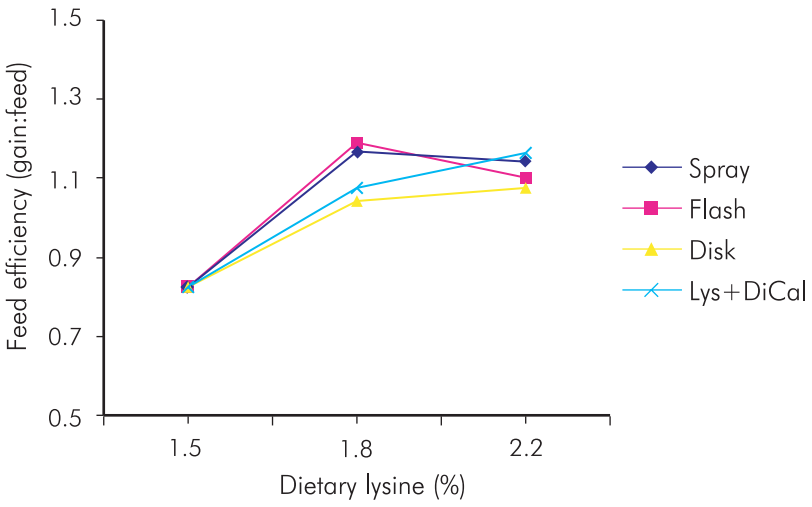


Figure 2. Feed Efficiency of Rainbow Trout Fed Increasing Levels of Lysine Provided by Various Blood Meals Compared with L-lysine (Lys+DiCal)



feed efficiency of fish fed diets with increasing levels of lysine from different sources. Slope ratio analysis at the 1.8 percent lysine level showed that FDBM and SDBM had greater lysine bioavailability relative to lysine HCl. DDBM had lower lysine availability compared to free lysine (Table 1). The results from this study suggest that digestible lysine from blood meal is more efficiently used by rainbow trout than lysine HCl.

Differences in the bioavailability of lysine in blood meals from different origins were apparent in this study. Many studies indicated that the time of exposure to heating and the actual temperature of processing are critical factors determining the digestibility of protein and amino acids of blood meals. The spray-drying process is considered a gentle drying process. Because of evaporative cooling, the temperature of the raw material does not exceed that of the final product, whereas that of the air in the drying chamber may reach several hundred degrees centigrade. This drying process differs from that of the flash drying, in which the blood meal is introduced into a stream of hot air and dried. Particle size during flash drying can vary considerably, which results in variations in exposure time. However, the results from this study clearly indicate that lysine bioavailability in flash-dried blood meal can be as good as that of spray-dried blood meal. The availability of lysine in blood meals processed in a drum dryer appeared lower than spray- or flash-dried blood meals. Drying coagulated blood slurry by contact with steam-heated plates or discs may result in high temperatures at the interface metal/slurry and this may damage a significant proportion of the amino acids. More work should be done on optimization of the drying process of blood using disc driers.

Table 1. Bioavailability of Lysine in Various Blood Meals Relative to Lysine-HCl (assumed to be 100% bioavailable), Based on Different Parameters

Parameters	Lysine HCL	Spray-dried Blood Meal	Flash-dried Blood Meal	Disc-dried Blood Meal
Weight Gain	100	139	150	83
Feed Efficiency	100	135	144	87
Protein Gain	100	129	143	86

The results of this study highlight the importance of the processing/drying technique on availability of lysine in blood meals. The results indicate that, at moderate levels of inclusion (< 10 to 15 percent), spray-dried or flash-dried blood meals are excellent sources of available lysine for fish. Lysine availability in these blood meals is greater than that of lysine HCl. The use of blood meal as a lysine source in fish feeds could be cost effective for feed manufacturers. ❖