

Factors influencing feed digestibility



In this regular contribution to Feed Tech, Dr Joachim Hertrampf comments on issues that affect shrimp farming and feeding.

Dr Hertrampf regularly writes 'hands-on' articles as a consultant for the monthly newsletter Shrimp Matters, of The Waterbase in Chennai, India. This column focuses on factors that influence the digestibility of shrimp feed.

By Dr Joachim Hertrampf

Throughout the passage of the digestive tract not all the feed is digested and absorbed. The non-digested part is excreted as faeces and therefore is waste. Digestion of feed depends on a number of factors, of which the activity of enzymes produced by the animals and the duration of time the chyme is exposed to enzymes are most important. In addition, the digestion is affected by secondary factors, such as aquaculture species, age of animals, physiological conditions, water temperature and feed consumption.

These individual factors may have overlapping effects. The digestibility of feed varies between fish species. The longer the digestive tract of the fish the better the utilisation of the nutrients because the chyme is much longer attacked by the enzymes. They prepare the feed nutrients for the absorption by the gut wall. There are also differences between fish with a stomach and stomachless fish. The stay of the chyme in the latter is shorter. This situation is found in shrimp – short digestive tract and no stomach. The digestibility of carbohydrates (starch) is better in omnivorous and herbivorous fish than in carnivorous fish and shrimp.

Age and condition

In certain species, the enzymatic activities vary with the age of the animals. The secretion of enzymes in the first development stage is lower than in older animals. The digestibility therefore is lower in younger than in older animals as was found in rainbow trout.

Aquatic animals under stress such as excessive handling or diseases may have disturbed digestibility. It was observed that tilapia transferred from one location to another showed increased defecation until acclimatised. This means the chyme passed the digestive tract rapidly.

Water temperature

The temperature of the water may have a remarkable effect on digestibility. Increasing the temperature may also increase the enzyme secretion as well as the enzymes' activity. On the other hand, the higher the temperature, the more rapid is the transport of the chyme and the shorter is the exposure time to the digestive enzymes and the lower digestibility. For example, in moderate climates in winter, when the water is cold, and in summer, when the water temperature is high, fish are fed less food because of reduced digestibility. Spring and autumn are here the major growing periods.

Feed composition

The composition of the formulated feed has an immense effect on the digestibility. In general, feed components of plant origin are digested to a lesser degree than those of animal origin. Very influential on digestibility is the mode of processing of feed components. For example, soybean meal, which is overheated during the oil extraction process, has a lower degree of digestibility. Also as a rule it can be said that the finer the grinding of the feed components the better the digestibility. Digestibility may also be reduced if feed components contain digestive enzyme inhibitors.

Of most importance for aquaculture feed's digestibility is its crude fibre level. The crude fibre utilisation by aquatic animals is uncertain. In brook trout the carbohydrate digestibility (of which crude fibre is a part) was as follows: glucose 99%, lactose 60%, starch (cooked) 57%, starch (raw) 38% and cellulose 10%.

The digestibility of cellulose in rainbow trout has been determined to be 14%. A cellulose (crude fibre) level of 50% has reduced the protein digestibility to only 60%. As a guideline therefore the higher the crude fibre content of a compound feed, the lower the digestibility. Due to the low digestibility of crude fibre, completed feed for semi-intensive shrimp culture should not contain more than 3% crude fibre. ●