# Partial replacement of fish meal with either soybean meal, brewers yeast or tomato meal in the diets of African sharptooth catfish *Clarias gariepinus*


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## Abstract

As intensively cultured fish usually require high protein feeds, and since feeds are normally the largest variable cost item in commercial production, the profitability of intensive aquaculture is closely related to the world supply and cost of feed protein. Traditionally, fish meal has been the major component of all fish feeds. However, its high cost has necessitated a search for alternative protein sources, especially those that are not suitable for human consumption. This study investigated the partial replacing of fish meal with alternative protein sources (tomato waste, soybean meal, brewers yeast) in iso-nitrogenous diets of *C. gariepinus*. The tomato used consisted of sun-dried pips and skins from ripe tomatoes used in the production of tomato pastes. The soybean consisted of either dehulled, solvent-(hexane) extracted soybean meal (Soy-2) or the same soy meal that had undergone a further extrusion process (Soy-1). The yeast used was a waste product from a local brewery. A final diet consisting of a mixture of the various ingredients was also prepared. Twenty-five catfish (30 to 45 g live mass (LM)) were randomly allocated to 24 500l tanks and four tanks were allocated to each diet. The tanks were then connected to a recirculating system (13 000l total volume) and each had a flow rate of 7 ± 1 l.min'. The water temperature was maintained at 25 ± 1 °C. The total biomass in each tank was measured weekly and the feed adjusted accordingly. The catfish were fed at 5% of total biomass for the first 4 d and 6% for the last 3 d of the week. The experiment was terminated after a 60 d feeding period. A statistical comparison of the final mean mass showed that all the diets differed significantly from each other (p=0.05), with the exception of the yeast and mixture diet and the yeast and Soy-1 diet. The descending ranking order of the mean final body mass (LM ± standard error, g) of the various diets was as follows: fish meal (284.6 ± 5.2), tomato (261.9 ± 5.3), yeast (222.2 ± 5.7), Soy-1 (220.5 ± 5.2), mix (201.4 ± 5.5), and Soy-2 (115.3 ± 5.5). The relatively strong growth experienced by fish receiving the tomato diet could possibly be caused by the high fish meal content of this diet. The poor growth of the Soy-2 diet is attributed to a high urease activity index (1.73). Soy-1 had an index of 0.07. The growth experienced by catfish fed the various protein sources indicates that *C. gariepinus* are able to utilise alternative protein sources successfully.


## Introduction

The rising costs of fish meal (R2.02 in January 1995 to R3.30 in August 1996) and subsequently fish diets, and lack of a proper marketing strategy are the two major factors contributing to the near collapse of the South African sharptooth catfish *(Clarias gariepinus)* industry. The protein requirements of *C. gariepinus* 30 to 40 g fingerlings (Machiels and Henken, 1985; Degani, et al., 1989) are similar to those of *C. isheriensis* (Fagbenro, 1992), namely between 37% and 40% of the feed. In South Africa the major protein source used in fish diets is fish meal. Fish farming therefore competes with other well-established farming practices for fish meal. This competition, coupled with the global decline in marine fish landings (Ratafia, 1995), makes fish meal expensive (August 1996 - R3.30/kg; US$1.00 = SAR4.55).

As commercial feeds for grow-out contain 25 to 45% crude protein, only high-protein content plant foodstuffs such as oilseed residues are used in fish feed. The extent of plant protein usage is also influenced by its availability, cost, acceptability by fish, ease of processing, and nutritive value (Lim and Dominy, 1989). The latter can be enhanced by adding synthetic amino acids. Soybean meal (defatted or fullfat) has been extensively investigated as a partial or full replacement for fish meal in the diets of various fish species. Shiau et al. (1990) found that either defatted or fullfat soybean meal can be used to replace 30% of fish meal protein in a diet for *Oreochromis niloticus X O. aureus* fingerling hybrids when the dietary protein level is low (24%). Gallagher (1994) showed that, in diets for larger hybrid striped bass *(Morone saxatilis X M. chrysops)*, up to 75% of the fish meal protein can be replaced with soybean meal protein. The replacement of fish meal with soybean meal in the diets of channel catfish has attracted great interest, e.g. blue catfish *Ictalurusfurcatus* (Webster et al., 1992), and the use of alternative protein types in the diets of channel catfish /. *punctatus* has been well reviewed by Lovell (1989) and Wilson (1991). Robinson (1991) studied the influence of cottonseed meal on the growth of *I. punctatus* and found that this proved satisfactory when supplemented with lysine. Other alternative protein sources used with various degrees of success include distillers' grain with solubles in the diets of juvenile I. *punctatus* (Webster et al., 1991), rapeseed meal (Davies et al., 1990), and alfalfa leaf protein concentrates (Olvera-Novoa et al., 1990) in the diets of *O. mossambicus.* Hossain and Jauncey (1989) studied the digestibility of mustard oilcake, linseed and sesame meal for common carp *(Cyprinus carpio)* and found that sesame meal showed the lowest digestibility. Sanz et al. (1994) compared sunflower meal with soybean meal as partial substitutes for fish meal in the diets of rainbow trout *(Oncorhynchus mykiss)* and found that, as with soymeal, sunflower meal could replace up to 40% of fish meal protein.

In the diets of juvenile (3.5 g) African sharptooth catfish


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