



Alliance

(<https://www.aquaculturealliance.org>)



Aquafeeds

Banana meal tested as feed ingredient for Nile tilapia fingerlings

Monday, 1 December 2003

By Ramiro Segura Méndez and Juan B. Ulloa Rojas, Ph.D.

Tannins and other antinutritional factors can produce low feed digestibility at higher levels



The study, which kept tilapia fingerlings in a bank of aquariums, found that banana meal added to the fish diets reduced body fat content in the animals.

Many agricultural residues produced in the world in great amounts may have potential value as ingredients in animal feeds. Rejected green bananas, those that do not meet quality standards for export) are the main residue from the banana-processing industry. They are widely available in many tropical countries. For example, in Costa Rica during 1998 to 99, rejected green banana production was estimated at 480,000 to 650,000 metric tons.

Green banana meal (GBM) prepared from rejected green bananas contains high carbohydrate levels and low levels of ash and fiber, and can be considered a good potential energy source for omnivorous fish species. However, the presence of polyphenols (e.g., tannins) in GBM can restrict its use in fish diets. Polyphenol content varies depending on banana strains, plantation management, and grade of ripeness.

Experimental setup

The authors recently evaluated the utilization of green banana meal in tilapia diets during a feeding trial with fingerlings of Nile tilapia (*Oreochromis niloticus*). Five diets containing 0, 100, 200, 300, and 400 grams of GBM per kilogram feed were formulated to be approximately isoproteinous and isoenergetic (Table 1). Prepared using bananas of the genus *Musa acuminata*, the banana meal replaced wheat meal and cassava starch in diet formulation.

Méndez, Ingredient composition (g/kg, DM) of diets, Table 1

Ingredient (g/kg)	Diet (g banana meal/kg feed) Control (0)	Diet (g banana meal/kg feed) D (100)	Diet (g banana meal/kg feed) D (200)	Diet (g banana meal/kg feed) D (300)	Diet (g banana meal/kg feed) D (400)	Diet for Digestibility
Fishmeal	380	380	380	380	380	266
Soybean meal	180	150	150	150	150	126
Cassava starch	200	100	0	0	0	140
Wheat meal	200	220	220	100	0	140
Blood meal	0	10	10	30	30	0
Green banana meal	0	100	200	300	400	300
Soybean oil	10	10	10	10	10	7
Vitamins	20	20	20	20	20	14
Chromium oxide	10	10	10	10	10	7

Table 1. Ingredient composition (g/kg, DM) of diets used in feeding trial with *O. niloticus* fingerlings.

Méndez, Weight, growth, and feed utilization of *O. niloticus* fingerlings fed graded levels of green banana meal, Table 2

Variable	Diets (g banana meal/kg feed) Control Diet (0)	Diets (g banana meal/kg feed) D (100)	Diets (g banana meal/kg feed) D (200)	Diets (g banana meal/kg feed) D (300)	Diets (g banana meal/kg feed) D (400)
Initial body weight (g)	2.0 ± 0.1 ^a	2.0 ± 0.1 ^a	2.0 ± 0.1 ^a	2.0 ± 0.1 ^a	2.0 ± 0.1 ^a
Final body weight (g)	40.3 ± 1.4 ^a	37.8 ± 1.0 ^{ab}	39.9 ± 1.6 ^a	34.3 ± 1.8 ^{bc}	29.9 ± 1.9 ^c
Relative growth rate of metabolic weight (g/kg 0.8/day)	39.9 ± 1.1 ^a	37.9 ± 0.8 ^a	39.3 ± 1.6 ^a	35.7 ± 2.0 ^{ab}	32.2 ± 2.1 ^b
Feed intake (g/fish/day)	0.96 ± 0.01 ^a	1.0 ± 0.01 ^a	1.0 ± 0.01 ^a	1.0 ± 0.06 ^a	1.0 ± 0.05 ^a
Feed-conversion ratio	1.1 ± 0.1 ^a	1.2 ± 0.05 ^a	1.1 ± 0.1 ^a	1.3 ± 0.1 ^b	1.5 ± 0.1 ^c
Apparent net protein utilization (%)	32.3 ± 0.2 ^a	33.7 ± 0.7 ^a	35.1 ± 0.2 ^a	35.5 ± 0.3 ^a	24.0 ± 0.5 ^b
Dry matter digestibility (%)	60.1 ± 0.3 ^a	60.1 ± 0.1 ^a	59.7 ± 0.2 ^a	54.6 ± 0.7 ^{ab}	51.6 ± 0.6 ^b
Daily fat gain (g/day/fish)	3.5 ± 0.1 ^a	2.6 ± 0.3 ^b	2.7 ± 0.2 ^b	2.1 ± 0.3 ^{bc}	2.0 ± 0.1 ^c
Hepatosomatic index ¹	2.8 ± 0.1 ^a	2.5 ± 0.1 ^{bc}	2.7 ± 0.2 ^{ab}	2.1 ± 0.1 ^d	2.2 ± 0.3 ^{cd}

¹Initial HSI: 2.5 ± 0.6 (n: 6).

Means in a row with different supercripts are significantly different (P < 0.05, one-way ANOVA and Tukey test).

Table 2. Weight, growth, and feed utilization of *O. niloticus* fingerlings fed graded levels of green banana meal during a 42-day period. (Means ± standard error.)

The fish were reared in a recirculating unit consisting of 16 aquariums. Each aquarium was stocked with 10 sex-reversed male fish of 1.8 to 2.4 grams. Fish were fed to apparent satiation three times daily in triplicates for 42 days. The five diets were assigned randomly in three replicates in the system. Apparent digestibility coefficients were determined for dry matter and the green banana meal.

Results

Fish fed a control diet without GBM and diets with 100 and 200 grams of GBM per kilogram feed showed similar growth (final body weight, relative growth rate of metabolic weight) and feed-conversion ratio. Feed intake was not affected by treatments (P > 0.05). The worst growth and feed utilization were found with fish fed the diet containing 400 grams per kilogram of banana meal.

The apparent net protein utilization was significantly lower with the diet containing 400 grams of GBM per kilogram feed than the other diets. However, its trend for higher values at 100 to 300 grams GBM per kilogram of feed and the corresponding higher fish protein contents (157 to 164 grams per kilogram) may indicate GBM can be an efficient energy source for tilapia.

Dry matter digestibility was similar (about 60 percent) for the control diet and diets with 100 and 200 grams per kilogram of GBM, whereas the other diets showed significantly lower digestibility values of 55 and 52 percent. The dry matter digestibility of GBM was 68 percent with the *O. niloticus* fingerlings tested, an acceptable value when compared with other feedstuffs of vegetable origin or carbohydrate-rich ingredients.

In this study, the increasing dietary levels of banana meal had a positive effect on the tilapia because it reduced daily fat gain from 3.5 to 2.0 and cut body fat content 101 to 80 grams per kilogram. The added meal also reduced the hepatosomatic index 2.8 to 2.2 at the same dietary carbohydrate levels.



Green bananas.

Conclusion

Nile tilapia fingerlings can assimilate up to 200 grams green banana meal per kilogram feed in diets without depressing growth and feed-utilization parameters. Test diets containing the meal did not affect fish survival. The reduction in performance for tilapia that received 300 grams or higher banana meal per kilogram feed may be associated with the presence of tannins and other antinutritional factors in the meal that can produce low feed digestibility at higher dietary levels.

(Editor's Note: This article was originally published in the December 2003 print edition of the Global Aquaculture Advocate.)

Authors



RAMIRO SEGURA MÉNDEZ

Escuela de Ciencias Biológicas
Universidad Nacional
Heredia 86-3000

Heredia, Costa Rica



JUAN B. ULLOA ROJAS, PH.D.

Escuela de Ciencias Biológicas
Universidad Nacional
Heredia 86-3000
Heredia, Costa Rica

julloa@una.ac.cr (<mailto:julloa@una.ac.cr>)

Copyright © 2016–2020 Global Aquaculture Alliance

All rights reserved.