Defatted Rice Bran as a Protein Source in Catfish Feeds[1]

H. Randall Robinette, *Department of Wildlife and Fisheries, Mississippi State, MS 39762*

Constance H. Young, *Department of Wildlife and Fisheries, Mississippi State, MS 39762*

James H. Tidwell,[2] *Department of Wildlife and Fisheries, Mississippi State, MS 39762*

Abstract: A defatted rice bran (DRB) product was evaluated as a potential ingredient in practical channel catfish (*Ictalurus punctatus*) feeds by partial substitution of control feed ingredients. Fingerlings in aquaria were fed 1 of 4 feeds: 0 (control) – a standard commercial feed, 1 – DRB replaced regular rice bran, 2 – DRB replaced some corn, soybean meal, and rice bran, 3 – DRB replaced some corn, fish meal, and rice bran. There were no significant ($P > 0.05$) differences in survival or feed conversion among fish fed the 4 feeds, but fish fed feed 2 had a greater weight gain than fish fed feed 0 or feed 3. Feeds 0 and 2 were then each fed in 3 0.04-ha ponds stocked with fingerling catfish from June 1987 to November 1987. There were no significant differences ($P > 0.05$) in growth, survival, or feed conversion between fish fed either feed. Defatted rice bran appears to be an acceptable feedstuff for use in catfish feeds.

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One of the primary reasons for the success of the channel catfish (*Ictalurus punctatus*) industry has been the development of efficient, nutritious feeds since feed costs represent approximately 50% of the production costs (Keenum 1988). Even though essential amino acid requirements and availability of amino acids in common feedstuffs for channel catfish have been established (Wilson and Robinson 1982), the major catfish feed producing mills in the Mississippi delta commonly utilize only 6 or 7 ingredients in their feeds. While this fixed-formula feed has been quite satisfactory, it does not afford the flexibility of taking advantage of major shifts in the commodity market by either altering percentages of the feedstuffs or by incor-

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[2]Present address: Kentucky State University, Aquaculture Research Center, Frankfort, KY 40601.

porating new feedstuffs into the formulation. Thus, feed costs soar when the price of fixed-formula ingredients increase, reflecting short supplies. It is important to future stability of the feed and catfish industries that alternate feedstuffs are evaluated for incorporation into catfish feeds.

Fish meal and soybean meal are usually the most expensive feed ingredients as they are the major sources of protein in the feed. Alternate feedstuffs which could supply part of the protein requirement might reduce price fluctuations. Rice bran typically contains about 12% protein, 12% fat, and 12% fiber and is often used in catfish feeds at 4% to 10% of the formula. Recently an experimental defatted, parboiled rice bran became available and typical analysis is as follows (%): protein, 25.0–26.0; fat, 0.5–1.5; fiber, 11.0–13.0; ash, 8.0–10.0; moisture, 6.0–8.0. Therefore, the defatted rice bran contains approximately twice the protein level as regular rice bran and could possibly be an important source of protein in catfish feeds. The defatted rice bran should be priced competitively with other major protein sources.

The objective of this study was to evaluate the potential of defatted rice bran as a feed ingredient in channel catfish feeds.

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Methods

Experiment 1

The control feed (0) was a standard commercial feed (32% crude protein) produced by Producer's Feed Company, Isola, MS (Table 1). The first experimental feed was the same as the control except that defatted rice bran (25% protein) was substituted for standard rice bran. In the second experimental feed, defatted rice bran was used as a substitute for rice bran and as a partial replacement for soybean meal and corn. The third experimental feed used defatted rice bran in place of rice bran and as a partial replacement for fish meal and corn. An estimate of lysine and methionine plus cystine availability (4.4% and 2.6% of the protein, respectively) in the defatted rice bran was used in an attempt to maintain equivalent lysine and methionine + cystine levels across the control and feeds 2 and 3. Ingredients for all feeds were obtained from the same source and finely ground with a wiley mill, blended together, and extruded through a small meat grinder die. Diets were air dried, then stored frozen until needed.

Eight fingerling channel catfish averaging 13 g each were stocked into 16 75-liter aquaria (4 treatments × 4 replications). Fish were fed daily 3% of their body weight. Feedings were divided equally into morning and afternoon feedings over 10 weeks. Fish in each aquarium were weighed as a group every 2 weeks to adjust feeding amounts. Each aquarium was equipped with an Aqua-Tech power filter as well as an underwater gravel filter bed. Dissolved oxygen was maintained near sat-

Table 1. Percent composition of experimental feeds in the defatted rice bran (DRB) study. Feeds: Control (0)—a standard commercial feed, 1—DRB replaced regular rice bran, 2—DRB replaced some corn, soybean meal, and rice bran, 3—DRB replaced some corn, fish meal, and rice bran.

Ingredient	Feeds			
	Control (0)	1	2	3
Soybean meal (48%)	45.87	45.87	42.5	45.87
Corn	37.55	37.55	35.1	33.7
Fish meal	8.1	8.1	8.1	6.0
Dicalcium phosphate	1.05	1.05	0.95	1.1
Wheat	3.1	3.1	3.1	3.1
Rice bran	4.15			
Defatted rice bran		4.15	10.0	10.0
Vitamin premix[a]	0.1	0.1	0.1	0.0
Mineral premix[b]	0.1	0.1	0.1	0.1
Choline chloride	0.05	0.05	0.05	0.05
Protein, crude (%)	31.0	33.0	31.3	31.4
Lysine (% of protein)[c]	5.5	5.5	5.5	5.5
Methionine + Cystine (% of protein)[c]	2.5	2.6	2.6	2.6
Energy (kcal/kg)[d]	2,337	2,361	2,337	2,337

[a]Each 0.45 kg contained a minimum of 2 million I.U. vitamin A, 1 million I.U. vitamin D_3, 30,000 I.U. vitamin E, 5.0 mg vitamin B_{12}, 6,000 mg riboflavin, 40,000 mg niacin, 16,000 mg d-pantothenic acid, 908 mg menadione, 1,000 mg folic acid, 4,115 mg pyridoxine, 4,594 mg thiamine, 45.4 mg selenium, and 150,000 mg ascorbic acid.
[b]Contained a minimum of 20.0% zinc, 10.0% manganese, 7.0% iron, 0.7% copper, 0.2% iodine, 0.1% cobalt, and a calcium carrier.
[c]Estimates derived from values provided by Wilson and Robinson (1982).
[d]Estimates derived from values provided by Robinson and Lovell (1984).

uration via an airstone. Water temperature was maintained near 28° C with Visi-Therm aquarium heaters. Ammonia, nitrite, pH, and dissolved oxygen were routinely monitored with a DREL/5 HACH (Hach Chemical Company, Ames, Iowa) spectrophotometer, a Fisher Model 805 pH meter, and a Model 57 Yellow Springs oxygen meter, respectively.

Experiment 2

Based upon results from the aquarium feeding trial, feed 2 was chosen to evaluate against the control in a pond feeding study. Soybean meal (43.0%) and corn (34.6%) were adjusted in the feed 2 formulation listed in Table 1 because the defatted rice bran used in this trial was 21% protein. Otherwise, the composition of the control feed and feed 2 was the same as given in Table 1. Feeds were milled at Millum Feeds, Pine Bluff, Arkansas, through an extruder which yielded a floating feed.

Fingerling channel catfish (avg wt = 22 g) were stocked into 0.04-ha ponds on 27 May 1987 at 9,884/ha. Each feed treatment was replicated 3 times. Fish were fed daily at 3% of body weight. Feed amounts were adjusted biweekly based upon an assumed 1.5 feed conversion, except sample weights were used to adjust feeding

amounts following monthly fish samples. Temperature and dissolved oxygen concentration were monitored daily, and electric aerators were used as needed to maintain dissolved oxygen above 3 mg/liter. Fish were harvested on 10 November 1987.

Statistical Analysis

Data were analyzed by standard analysis of variance techniques and multiple comparisons were conducted using the least significant difference test (LSD). The probability level was set at $P \leq 0.05$ for all statistical analyses unless otherwise noted.

Results

Experiment 1

Fish fed feed 1 gained significantly more weight than fish fed the control (0), but no more than fish fed feeds 2 and 3 (Fig. 1). There was no difference in weight gain for fish fed feeds 1 and 2, but fish fed feed 2 grew significantly better than fish fed the control (0) and feed 3. Weight gain of fish fed feeds 0 and 3 was not significantly different. There were no significant differences in survival or feed conversions among fish fed the 4 feeds. Feed conversions ranged from 2.89 (Feed 2) to 3.54 (Feed 0) and survival ranged from 96% (Feed 2) to 75% (Feed 1). Dissolved oxygen, ammonia, nitrites, and pH were maintained at acceptable levels and varied little throughout the study.

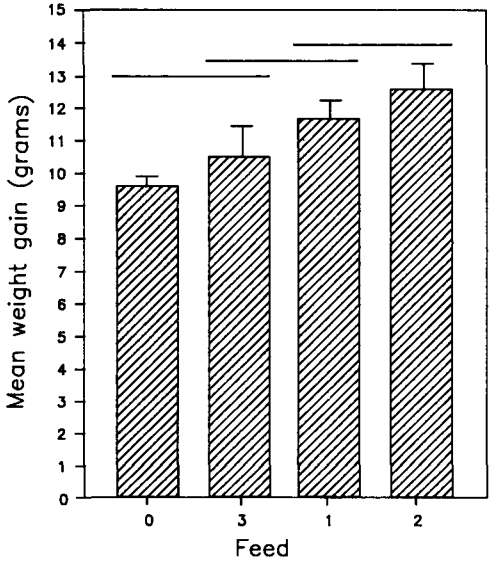

Figure 1. Mean weight gain of channel catfish fingerlings during 10-week aquarium feeding trials. Feed 0 (Control) - a standard commercial feed, Feed 1 - defatted rice bran (DRB) replaced regular rice bran, Feed 2 - DRB replaced some corn, soybean meal, and rice bran, Feed 3 - DRB replaced some corn, fish meal, and rice bran. Vertical bars indicate standard error. Mean weights associated with feeds not covered by the same horizontal bar are significantly ($P < 0.05$) different.

Table 2. Mean weight gain, feed conversion, and survival of pond-raised catfish fingerlings fed a control feed and a feed containing defatted rice bran (DRB) as a partial ingredient replacement. There were no significant differences ($P > 0.05$).

	Mean weight gain (g)		Feed conversion (kg feed/ kg gain)		Survival (%)	
Replicate	DRB	Control	DRB	Control	DRB	Control
1	310.1	286.7	1.80	1.70	82.3	84.2
2	290.5	330.6	1.84	1.73	79.4	79.8
3	323.6	242.8	1.68	1.95	82.5	79.6
Mean	308.0	286.7	1.77	1.79	81.4	81.2
SE	9.6	25.3	0.05	0.08	1.0	1.5

Experiment 2

Although the fish fed the defatted rice bran feed were harvested at a higher mean weight gain than fish fed the control (Table 2), the weights were not significantly different at $P = 0.10$. There were no significant differences in feed conversion or survival between fish fed the 2 feeds. Although similar for fish fed both feeds, survival was lower than normally encountered in our pond studies. We have no apparent explanation as emergency aeration was only occasionally required and no dead fish were observed during the study.

Discussion

Fish in aquaria and ponds fed feeds containing defatted rice bran performed equally as well as fish fed a standard commercial feed. Milling and pellet quality (stability) were not affected by the addition of defatted rice bran. These data show that approximately 7% of the soybean meal can be replaced by defatted rice bran in conjunction with about a 6% reduction of corn. Defatted rice bran appears to be an acceptable feedstuff for inclusion into catfish feeds.

Literature Cited

Keenum, M. E. 1988. An economic analysis of farm-raised catfish production in Mississippi with emphasis on costs and cash flows. Ph.D. Diss., Miss. State Univ., Mississippi State. 134pp.

Robinson, E. H. and R. T. Lovell. 1984. Nutrition and feeding of channel catfish. Southern Coop. Series Bul. No. 296, Texas Agric. Exp. Sta., College Station. 57pp.

Wilson, R. P. and E. H. Robinson. 1982. Protein and amino acid nutrition for channel catfish. Inf. Bul. 25. Miss. Agric. and For. Exp. Sta., Mississippi State. 15pp.