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# POTENTIAL OF UTILIZING SCRAP PROCESSED CHEESE AS A MAJOR RATION COMPONENT FOR CHANNEL CATFISH*

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**ABSTRACT**

Three cages (0.9 m³) were stocked with 200 channel catfish, *Ictalurus punctatus* Rafinesque, fingerlings (73.7 g avg.) in a 1.5 hectare pond. Two cheese rations were formulated and fed to the catfish; the first consisting of cheese, oil, and vitamin C (C + VC) and the second consisting of cheese, cottonseed meal, oil, trace minerals, and vitamins (CC + VM). A commercial trout ration (TC) was fed as a control.

High mortalities occurred in the C + VC diet, thus resulting in premature removal of that cage from the study (after 86 days). A sample of 50 fish from the two remaining cages, along with harvest data from the C + VC diet, revealed a 45.6% difference in average fish weight between the C + VC and CC + VM diets, a 63.5% difference between the C + VC diet and TC ration, and 32.9% difference between the CC + VM diet and TC ration. Final harvest of CC + VM and TC cages was completed after 134 days. Comparisons revealed that a 38.3% difference in average fish weight existed between these two diets. Statistical analysis of data indicated that fish fed the CC + VM diet had a significantly lower percentage dress-out weight and a significantly higher amount of mesenteric fat. This experiment does suggest that cheese scraps, when properly balanced with other essential ingredients, may be utilized as a major component of catfish rations.

## INTRODUCTION

Cheese generally has been limited in use to the sport fishing bait industry. Recently, several farming operations in Arkansas have expressed interest in this product because of the relatively low cost and local availability. Scrap cheese, a by-product of the cheese industry, is composed of trimmings and off-color and off-flavor cheeses. Several cheese buyers pass through the catfish region as they supply the bait industry. These same individuals could easily supply many catfish farming operations. With the thrust of feed research striving for least-cost formulation of diets (Robinette, 1977) cheese scraps are an attractive option.

There is no published information on the use of cheese as a major component of fish rations. However, research is presently being conducted at the Franklin Institute (Pennsylvania) involving cheese as a ration component for channel catfish. Due to a lack of information about cheese use in fish rations, a pilot study was initiated in 1979 utilizing scraps as a food source for caged channel catfish at the University of Arkansas at Pine Bluff (UAPB).

## METHODS AND MATERIALS

Three 0.9 m³ cages as described by Newton and Merkowsky, 1976, were anchored in a 1.5 hectare pond. A 27.3 by 43.2 cm pan with a 11.4 cm high food retaining ring (Vexar-0.32 cm mesh) attached to the edges was suspended by wires in two of the cages with the top of the retaining ring located 10 cm below the surface of the water.

Three rations were utilized during the study. Two cheese diets were especially formulated for two cages of catfish. One consisted of scrap cheese, commercially available vegetable cooking oil, and vitamin C (ascorbic acid) (C + VC) with the percentage of each ingredient (by weight) being 95.75, 4.20, and 0.05, respectively. Ascorbic acid, which is essential for catfish rations (Lovell, 1973) was added to the C + VC diet because cheese has an inadequate amount of this vitamin. Cheese, cottonseed meal, vegetable oil, trace minerals (U.S.P. XIV salt mixture) and a commercial vitamin premix (Mountaire Vitamins, Inc.) constituted the second formulation (CC + VM) with the percentage of each (by weight) being 74.00, 18.25, 4.00, 3.50, and 0.25, respectively. The diet was minimally adjusted (purposely) so that growth rates could be established on the basis of cheese scraps only. Commercially available vegetable oil was used as a binder for the other ingredients incorporated into the cheese rations. The third cage of catfish was fed a commercially available trout ration (TC) with a caged catfish performance record established in a previous study at UAPB (Newton and Dean, 1978).

Cages were stocked on 21 June, 1979 with 200 channel catfish weighing an average of 73.7 grams. All fish were preconditioned in the cages 11 days (6 feeding days) on the TC ration with the experimental diet tests beginning on 2 July. Average fish weight and water temperature determined the amount of ration fed, and adjustment of quantity was estimated on a weekly basis (based on monthly samples). Cheese diets were mixed one week in advance and refrigerated. Each cheese ration was separated into three portions and placed in the feeding pans. All uneaten portions remaining from the preceding day were weighed and recorded. Mortality and water temperatures were monitored daily.

A 5% (minimum) sample of fish from each diet was weighed monthly to estimate average fish gain. At harvest, samples consisting of the first 16 individuals captured were removed for individual body weights and dress-out weights. Mesenteric fat was also weighed to determine if any diet related differences existed. A Student's t test (Steel and Torrie, 1960) was used to compare differences in means of total fish weight, dress-out weight, dress-out percentage, mesenteric fat, and percent of mesenteric fat of fish fed the C + VC and TC diets. Percent moisture of each ration was determined by placing weighed samples in a Blue M drying oven for 48 hours at 100°C. Samples then were removed and weighed to determine percent moisture.

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## RESULTS AND DISCUSSION

**Fish Harvest:** Fish on the C + VC diet were harvested prematurely due to high mortalities. After 86 days fish from the C + VC diet cage were harvested, and 50 fish were weighed from each of the remaining test cages. Figure 1 reveals the average fish weights as determined from monthly sample data. There was a 45.6% difference in average fish gain between the C + VC and CC + VM diets, a 63.5% difference between the C + VC diet and TC ration, and a 32.9% difference between the CC + VM diet and TC ration. Fish fed the C + VC diet initially gained weight, and then lost, as was evidenced by final harvest. Food conversion efficiency (FCE) after 86 days was estimated, based on recorded data to be 2.5:1, 3.1:1, and 7.6:1 for the TC ration, CC + VM diet, and C + VC diet, respectively (wet weight basis). Temperature data (Fig. 1) correlated well with growth of the fish on the TC ration and the CC + VM diet. The above data indicated that cheese scraps cannot be used alone as a complete source of nutrition for caged catfish production.

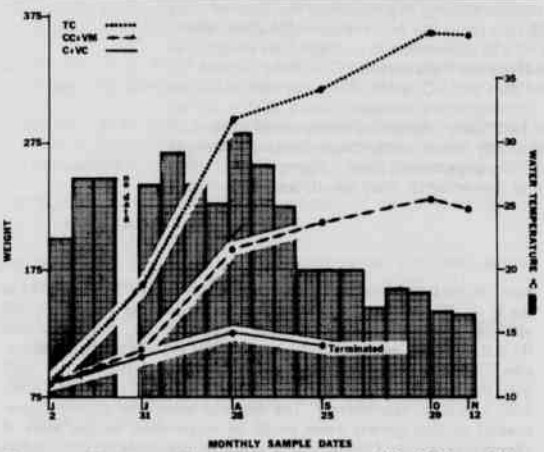


Figure 1. Mean monthly growth of channel catfish fed three different rations. (Average weekly surface temperature data included.)

**Final Harvest:** Harvesting of the remaining two cages of fish was accomplished after 134 days. a 38.3% difference in average fish weight existed between the CC + VM diet and TC ration (Fig. 1). Harvest data was statistically compared, and the results were recorded in Table 1. Since such a large disparity existed between the average mean weight of fish from the two samples, individuals in the same weight class (215-325 g) were selected for statistical comparisons. There was no significant difference in the mean total fish weight of the subsamples from each ration; however, there was a significant difference between means for dress-out percentage, mesenteric fat, and percent of mesenteric fat (Table 1). Page and Andrews (1973) and Lovell (1979) found that diets with high calorie concentrations resulted in decreased consumption. Feeding records and observations indicated that at least some portion of the CC + VM diet remained in the cage for a period of 24 hours 31 of 81 total feeding days. Lovell et al. (1974) found that body protein percentages were inversely related to body fat content. Results indicated that the high fat content (22.9%) of the CC + VM diet satisfied energy requirements but adversely affected the percent of body protein in the catfish fed that diet (Table 1). High fat content of the feed and/or cooling water temperatures may have led to the leveling out of growth of fish on the CC + VM diet (Fig. 1) during the latter part of the study. This study and the results of the above mentioned investigations suggest that scrap cheese may be used as a ration component but in reduced amounts due to the high fat content.

Table 1. Comparison of channel catfish raised on two diets based on a 16-fish sample and 8-fish weighing between 215-325 g.

| DIETS | TOTAL WEIGHT IN GRAMS | DRESSED WEIGHT IN GRAMS | PERCENT DRESS-OUT | MESENTERIC FAT IN GRAMS | PERCENT MESENTERIC FAT |
|---|---|---|---|---|---|
| | | | 16-Fish | | |
| TC | 345.0 a[1/] | 200.5 a | 57.3 a | 10.28 a | 2.89 a |
| CC + VM | 243.4 b | 119.4 b | 49.2 b | 8.89 a | 3.61 b |
| | | | 8-Fish | | |
| TC | 273.1 a | 146.9 a | 53.5 a | 7.10 a | 2.55 a |
| CC + VM | 278.8 a | 133.8 a | 48.1 b | 9.35 b | 3.39 b |

[1]Means followed by different letters are significantly different at the 0.05 level.

**Moisture:** Percent moisture of the three diets was 10, 26, and 32 for the TC, CC + VM, and C + VC diets, respectively. Adjustment for moisture with respect to the amount of ration offered the catfish in the cheese diets was made on 20 August. Amounts fed to fish on the cheese diets were adjusted to equal the wet weight fed to the TC diet fish. Poston (1974) found that brown trout *(Salmo trutta)* fed diets containing 9.6% and 55.0% moisture grew at nearly the same rate when fed on a dry weight basis. Results of the present study were inconclusive with respect to the effect on weight gain made by the levels of moisture in the diets. Future studies with high moisture diets should reflect consideration of moisture as a variable in ration design.

**Mortality and Antibiotics:** Total survival at harvest for the C + VC diet fish was 72%, while survival for the TC ration and CC + VM diet fish was 82 and 96%, respectively. Bacterial problems caused mortality in the TC ration and CC + VM diet cages, therefore, an approved antibiotic (Tetracycline Hydrochloride) was incorporated into the feed mixtures. During two reoccurring incidents of bacterial infection, the fish fed the medicated TC ration consumed only a small amount on the first and second feeding days, while fish fed the CC + VM diet immediately consumed all of their medicated ration. Mortalities ceased to occur among the CC + VM diet fish more rapidly than in the TC ration fish. This observation suggests that a cheese-antibiotic mixture might be more readily accepted than the medicated pellets by diseased fish. Diseased fish that can be brought back on feed quickly will recover faster and thus will resume growth more rapidly. Further research on the appeal of cheese as an attractant and as a binding mixture for antibiotics should be conducted.

**Ration Preparation:** Preparation of cheese diets requires considerable time; however, mixing large batches of ingredients would be more feasible with proper equipment. The size of a commercial catfish operation may be a limiting factor in production of cheese-based rations due to the frequency and necessity of mixing feed batches.

These results indicated that cheese scraps cannot be utilized as a single source of nutrition for caged channel catfish production. Cheese should not be used at the level incorporated in the CC + VM diet because of the high fat content. Fish growth was attained with cheese, so it may be assumed that a relatively high percentage of cheese may be incorporated into a ration designed for channel catfish production. Finally, observations indicated that cheese may be effective as a medium for antibiotics in the treatment of some internal bacterial diseases of catfish.

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