

VITAMIN C . . .
AND CROOKED BACK DISEASE

By Richard T. Lovell
Associate Professor
Department of Fisheries and Allied Aquacultures
Auburn University

Reprint from: *The Catfish Farmer*, May 1973, Vol. 5(3): 31-32.

Vitamin C . . . And Crooked Back Disease

By RICHARD T. LOVELL
Department of Fisheries
and Allied Aquacultures

Auburn University, Auburn, Alabama

On many occasions in recent years — since commercial catfish culture has become an important endeavor — fish disease personnel at Auburn University and at other research and diagnostic laboratories have examined catfish which showed disease symptoms without signs of disease-causing organisms.

The fish usually showed one or more of the following characteristics: crooked, humped or even broken backs; white (depigmented) vertical band across the back; irregular surface swimming; tetany when handled; poor growth, and mortality. Fish pathologists have referred to this condition as the "crooked or broken back syndrome."

Fish showing this condition usually came from a culture environment where natural aquatic food is limited — such as cages, raceways or ponds which had a higher poundage of fish than is generally found in conventional pond culture.

Examination of the history of the fish revealed that they were intensively fed feeds that did not contain supplemental vitamin C. These symptoms have not been observed in catfish with access to a significant amount of vitamin-rich pond organisms or when feeds containing supplemental vitamin C were fed.

A Need For Vitamin C

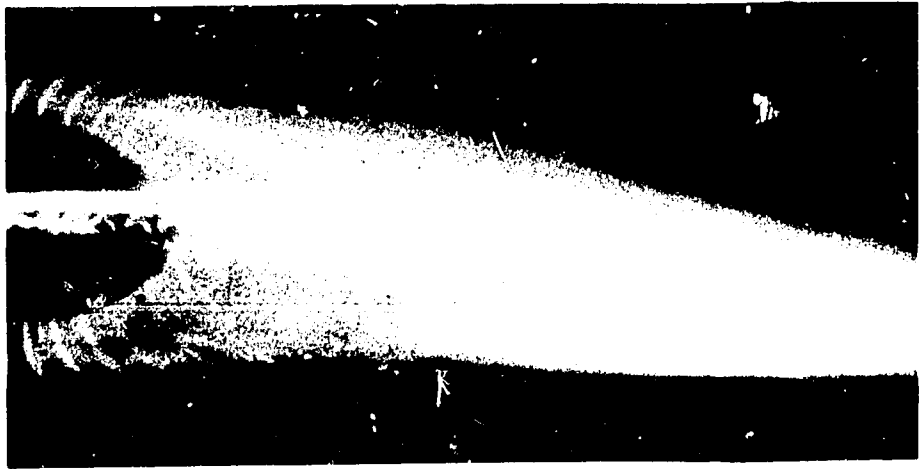
All animals have a metabolic need for ascorbic acid (vitamin C). Most warm-blooded animals can synthesize enough to meet their needs and do not require it in their diet. Exceptions are man, the monkey and the guinea pig.

Salmonids and carps apparently need dietary sources of the vitamin for maximum growth. A primary function of vitamin C or ascorbic acid to the animal's body is in the formation of collagen or cartilage which is the base upon which bone develops. Beside poor bone development, a deficiency of this vitamin also causes capillary fragility which results in internal bleeding. Hence, the symptoms described previously indicate that vitamin C may be a dietary necessity for fast-growing catfish.

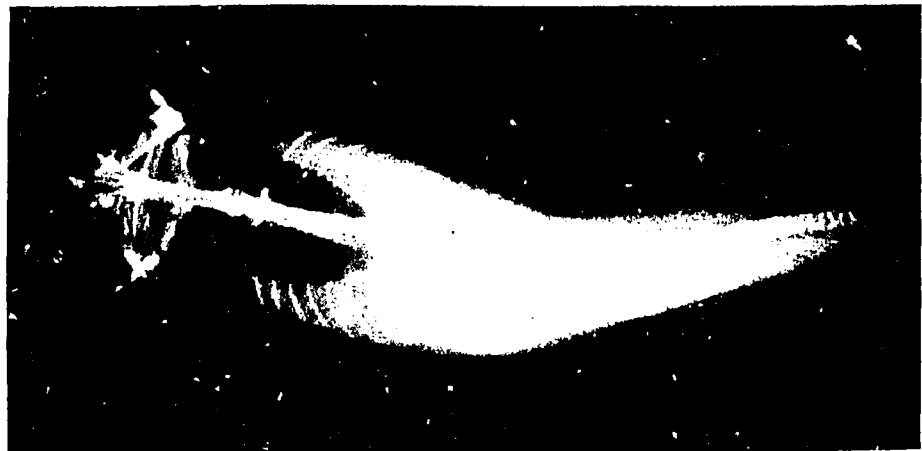
A study was conducted at the Auburn University Fishery Research Unit to obtain information on the response of channel catfish grown from stocking to harvest size in a culture system with limited natural aquatic food and intensively-fed a high-performance diet sufficient in all nutrients except vitamin C.

1,600 Fish In Test

Sixteen hundred channel catfish fingerlings were randomly assigned in 1973



Here are radiographs of two channel catfish, weighing approximately 350 grams each, that were fed a vitamin C-deficient diet for 180 days. They show a half-developed vertebrae with only slight spinal curvature (top) and a severe lateral dislocation of vertebrae or broken back (bottom).



equal numbers to four 1-m (3) cages which were suspended in a 2-hectare pond. The fish were fed one of two experimental diets for 180 days. Feed was allotted once daily, six days per week, at a rate which began at 4 percent of biomass and decreased to 1.5 percent of biomass near the end of the trial. Feed allotments were adjusted bi-weekly, based upon monthly samplings.

One-half of the fish were fed a diet that was formulated to be nutritionally adequate for satisfactory growth of channel catfish in an artificial environment. The remaining fish were fed a diet of similar composition except that it contained no supplemental vitamin C.

Evidently, the diet was nutritionally adequate when supplemented with vitamin C, based upon the favorable gain and feed conversion for cage fed catfish. The effect of the absence of vitamin C from the diets on growth is obvious.

Vitamin C also had a pronounced effect upon resistance to pathogenic organisms. During the last 73 days of the feeding period, eight to 12 dead fish per week were removed from the cages of

vitamin C-deficient fish. Primary cause of the deaths was determined by the Cooperative Fish Parasite and Disease Laboratory to be the bacterium *Aeromonas liquefaciens*.

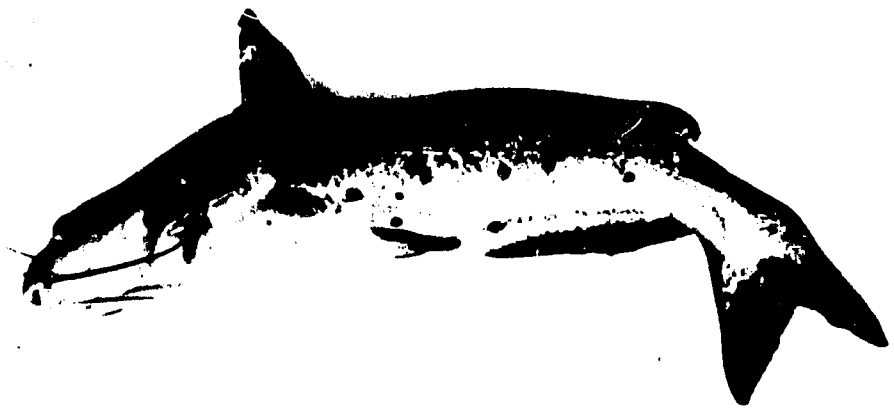
Monthly sampling indicated that differences in weight or appearance between fish fed the two diets were not manifested until after the first 12 weeks of the feeding period, or until the fish weighed 100 to 180 grams. All fish fed actively until approximately the last 30 days of the six-month test when the vitamin C-deficient fish accepted feed more slowly.

Deformities Identified

Deformities were identified visually at the end of the experiment in 45 percent of the fish fed the vitamin C-deficient diet. Most common was a slight to severe lateral curvature of the spinal column, usually at approximately the mid-length of the fish. There was usually external swelling near the damaged area, often with a vertical, white band on the back.

Many fish had a large hump near or immediately behind the dorsal fin. In

(Continued on next page)



This channel catfish, weighing approximately 350 grams, was fed a vitamin C-deficient diet in a suspended cage for 180 days. Note the hump at the base of the dorsal fin, crooked back and drooped tail.

severely deformed fish, there was complete separation of the vertebral column. Enlarged, spongy vertebrae or half-developed vertebrae were common. Hemorrhagic areas along the spinal column, particularly at the point of injury, was common. Many fish which appeared normal externally had massive bleeding near the backbone.

The feeding trial demonstrated that rapidly growing channel catfish need dietary ascorbic acid to prevent extensive deformation of the spinal column, poor growth and increased sensitivity to pathogenic organism infestations.

However, other factors, independently or through interaction with vitamin C

deficiency, may cause the "crooked back syndrome." Tryptophan and vitamin E deficiencies and exposure to high levels of various pesticides have caused similar anomalies in fish.

Most commercial catfish feeds do not contain supplemental vitamin C because deficiency symptoms of vitamin C have not previously been demonstrated. Also, catfish grown in ponds at a low to moderate stocking density, not greatly exceeding 2,000 pounds of fish per acre, probably get enough ascorbic acid from natural pond foods.

At Auburn, we observed nutritional deficiency symptoms in pond-grown channel catfish fed vitamin C-deficient feeds only when the maximum poundage of fish per acre exceeded 4,000 to 5,000. Presently, there is little basis for making recommendations on the feasibility of adding vitamin C to feeds for conventional pond catfish culture. Perhaps added growth and health of fish may justify it.

Add Vitamin C

Certainly, vitamin C should be added to feeds fed to catfish in cultures with limited natural foods. The amount to add to the feeds is not known. The minimum recommended dietary level for normal growth in trout is .01 percent. However, vitamin C is relatively sensitive to loss from oxidation during processing and storage of feed. The method of application of the vitamin to the feed (before or after processing), the temperature it is exposed to during processing, exposure to various prooxidants in the feeds and length and temperature of feed storage all affect the life of the active vitamin.

Hence, vitamin C addition to catfish feeds presents important economic considerations — i.e., its value in pond culture feeds, dietary levels for catfish, and procedures for application of the vitamin to minimize losses in processing, storage and feeding. 