

**PHYSIOLOGICAL CONDITION OF  
ORNAMENTAL FISH *Xiphophorus helleri*  
FED AND STARVED**

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**Abstract**

Ornamental aquarium fish, swordtail (*Xiphophorus helleri*), were fed twice a day with commercial tropical fish food, “Kantal”, *ad libitum* and starved at 23°C for 15 days. To determine physiological condition, nucleic acids concentrations of the white and red muscles of the fish were analyzed by fluorometry. The DNA concentrations ( $\mu\text{g mg}^{-1}$  wet weight) of white and red muscles of starved fish were higher than those of the fed fish. The values of RNA concentrations of fed fish were always higher than those of starved fish in both muscles tested. However, the difference between the RNA values for starved and fed were lower in the red muscle. Red muscle values of RNA showed greater variations among individuals fasted. The RNA concentrations in red muscles of fed fish are superior to those in white muscle. This suggests that red muscle has a storage function similar to liver. The RNA/DNA ratio of the fed fish was always higher than the starved fish for both muscles. This indicates that RNA/DNA ratio of the white muscle can be used as an index of physiological condition of this species.

**Key words:** Physiological condition, Nucleic acids, Ornamental fish

**Introduction**

Fish of the family Poeciliidae, an ornamental fish, were used because of their ease of handling and their resistance in conditions of culture and high economic

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return of aquaculture (Fernando *et al.*, 1991), compared to other species of ornamentals fishes (Olivier & Kaiser, 1997).

The swordtail fish, *Xiphophorus helleri*, a red variety, is one of the commercial ornamental fishes and is more frequently seen in aquarium store; the fish were obtained from the original green form, among other varieties. They are a prolific species among 270 breeding fish (Mills, 1984; Mills & Vevers, 1986), are resistant and energetic, and are aggressive with smaller animals, particularly males. They are distributed geographically in the South of Mexico (meridian zone) and Guatemala, where they live in rivers that outlet at the Atlantic Ocean. Their presence has also been noticed in the rivulet at the southwest of Queensland, Australia (Arthinton, 1989).

Studies of physiological aspects are limited specifically to what is referred to as growth, whether by weight or instantaneous growth (RNA/DNA). The juveniles of the red fish, *Sciarnops ocellatus*, had demonstrated that the levels of RNA/DNA were sensitive to environmental factors such as temperature, salinity and feeding regimes (Chung *et al.*, 1988, 1991, 1993).

The objective of this work is to determine nucleic acid levels in white and red musculatures and to use RNA/DNA ratio as physiological condition of sword-tail fish *Xiphophorus helleri* in laboratory conditions, with the same feeding and suppression.

### **Materials and Methods**

Fish ( $2.82 \pm 0.28$  g wet weight) were obtained from a commercial store, in Maracay city (Aragua State, Venezuela), acclimated to a laboratory, then placed in an experimental aquarium of 60 liters. They were fed *ad libitum*, or starved during a period of 15 days. After the experimental time had passed, 6 samples of each treatment were sacrificed to extract samples from the epaxial white muscle, dorsal musculature and the red muscle under the lateral line.

Tissues were frozen at  $-20^{\circ}\text{C}$  until the moment of analysis. Determinations of RNA and DNA were made taking 15 mg of both tissues and were processed by the fluorometric method (Canino & Calderone, 1995). Two-way analysis of variance was used to determine the effects of feeding and the kind of tissue on the RNA and DNA levels.

### **Results and Discussion**

The set of organisms submitted to fasting survived 15 days of the treatment. Analysis of variance revealed that there were significant differences between RNA and DNA levels and RNA/DNA ratios in both muscles types and feeding conditions, as well as an interactive effect between the variables (Table 1).

DNA levels were different with respect to the tissue, being major on red and white muscle of the no feeding fish ( $138.66 \pm 6.66 \mu\text{g g}^{-1}$  wet mass and  $136.01 \pm 8.66$ , respectively), compared to red and white muscles of the feeding fish ( $130.66 \pm 21.33$  and  $110.66 \pm 0.66 \mu\text{g g}^{-1}$  wet mass, respectively) (Table 2). Thus, the feeding condition appeared to have a major effect on the DNA values.

Table 1. The results of two ways analysis of variance for comparison of RNA, DNA and RNA/DNA ratio in muscles of *Xiphophorus helleri* fed and fasted during 15 days (\*p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001, Ns: p > 0.05).

Variations	Value		
	DNA	RNA	RNA/ DNA
Among tissues	11.88 **	8.41 **	6.34 **
Feeding conditions	4.41 **	18.21 ***	18.57 ***
Interaction	1.30 Ns	19.34 ***	19.40 ***

The basic levels of RNA/ DNA in the white and red tissues of *Xiphophorus helleri* under conditions of feeding show that the white muscle tissue has a higher rate of growth than the red tissue. It is probably related to the white tissue's capacity to grow and to provide metabolic substrates to other tissues, while red musculature seems to be more related to the energetic contributions to fast movement of the fish. It is marked by a great variation over the energetic

substrates of both tissues, and their mobilization is related to physiological processes such as instantaneous growth (Lemus *et al.*, 1993).

Table 2. Average values ( $\pm$  SD) of RNA and DNA in white and red muscles of *Xiphophorus helleri* fed and fasted for 15 days.

Experiment conditions		DNA $\mu\text{g g}^{-1}$ wet tissue	RNA $\mu\text{g g}^{-1}$ wet tissue
Fasting	White muscle	$136.01 \pm 8.66$	$126.6 \pm 4.01$
	Red muscle	$138.66 \pm 6.66$	$120.02 \pm 10.93$
Feed-ing	White muscle	$110.66 \pm 0.66$	$157.32 \pm 10.66$
	Red muscle	$130.66 \pm 21.33$	$125.33 \pm 6.66$

The levels of RNA/DNA ratio on the white musculature of the feeding organisms was  $1.41 \pm 0.10$ , higher than that observed in the same tissue in conditions of initiation ( $0.48 \pm 0.17$ ), demonstrating that there exists a significant increase on the rate of instantaneous growth. However, the red musculature showed less difference with high variation on the levels of RNA/DNA under feeding conditions (Fig. 1).

### Acknowledgments

Thanks to Angel Antón who helped in performing the experiments and Wona Chung for her critical review of the manuscript. This work was funded by el Consejo de Investigación de la Universidad de Oriente (CI: 05-1803-0790/97-98).

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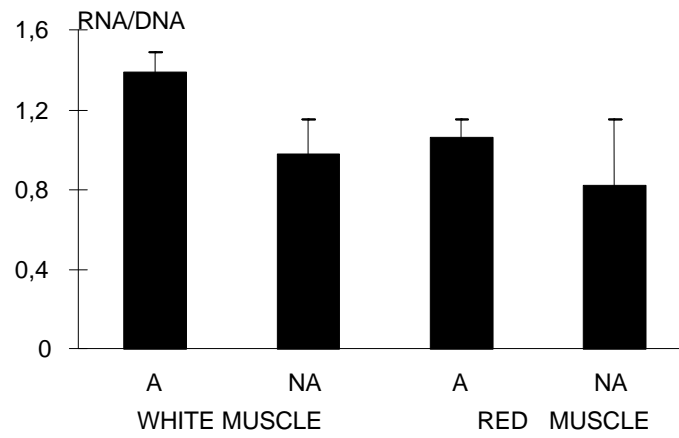


Fig 1. Average value of RNA/DNA ratios in white and red muscles of *Xiphophorus helleri* in fed (A) and fasted (NA) conditions.

