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ENERGY RESOURCES IN "ATIPA", *HOPLOSTERNUM LITTORALE*. A NEOTROPICAL AIR BREATHING CATFISH.

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ABSTRACT

Metabolic utilization of energy substrates by a tropical catfish species, *Hoplosternum littorale*, was investigated. Both endogenous and exogenous substrates were considered, either through analysis of whole body losses during long term starvation, or through indirect calorimetric measurements.

Results show that utilization of fats, during long term starvation, was not related to their body concentration. Even if most of the energy is provided by protein, as for temperate species, carbohydrates could be used as far as they remain available. Therefore, carbohydrates metabolism seems to be active in "Atipa".

INTRODUCTION

How fish can use other energy substrates than proteins to meet their energy needs is a key-point for the improvement of fish feeding. One of the destiny of food is to provide fuels required for fish energy metabolism. Three energy substrates are available : proteins, lipids and carbohydrates. If fish are able to burn lipids quite easily, they are reported to mainly use protein for energy purpose. However, tropical fish seems to make a greater utilization of non-protein energy substrates as retention of these nutrients is apparently low (Luquet and Moreau, 1989).

The aim of this work was to determine how a tropical species, the "Atipa", meets their energy needs and to quantify the amount of different energy substrates used, whether they are taken from body stores (endogenous) or from food (exogenous).

METHODS

Two global methods allow determination and quantification of energy substrates :

- Analysis of whole body losses during long term starvation to study utilization of endogenous substrates,

- Indirect calorimetry for either endogenous or exogenous substrates (Van Waversveld *et al.*, 1989).

Regarding the last one, the amounts of oxidized nutrients are calculated from values of respiratory exchanges (oxygen uptake and carbon dioxide excretion) and nitrogen excretion (mainly ammonia in Atipa).

Atipa, *Hoplosternum littorale* (Callichthyidae), is an armoured catfish living in the marshy areas of the northern South America. Its potential for aquaculture is more limited than for fish of the genus *Collossoma*, but it has a very high commercial value in the three Guiana's regions. Bimodal breather, Atipa catches air bubbles in its gut during rush to the surface.

A close respirometer was designed to allow evaluation of respiratory exchanges in both media (Moreau *et al.*, 1991). Only 1% of total carbon dioxide were excreted in the aerial medium. Values of oxygen uptake from the air were obtained following the variations of pressure with a water manometer.

RESULTS

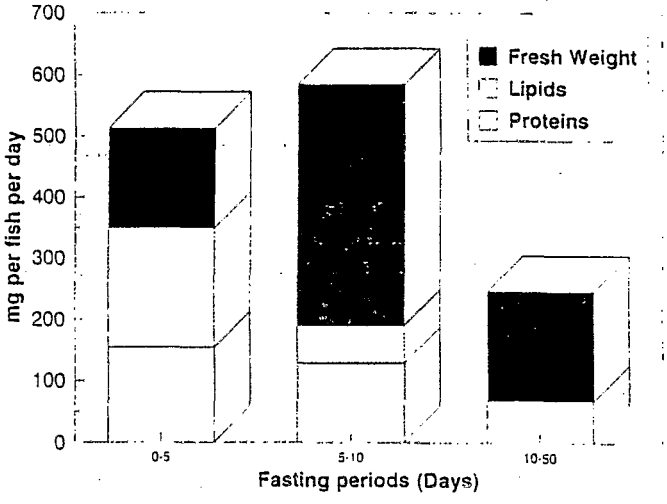

Figure 1. Whole body losses during starvation.

Rather constant over the first ten days of fast, body losses dropped for the following 40 days (figure 1). Utilization of protein decreased steadily. Body lipids contents remained constant after the tenth day; they still represented near 20% of body dry matter. Indirect calorimetry method on fish fasted for 10 days gave reliable results even if ammonia nitrogen excretion did not strictly reflect total protein losses.

As shown in figure 2, proteins were actively catabolized following the food intake. Carbohydrates being available, they were efficiently used as fuel. Afterwards, energy furniture was completed by lipids. For the first 24 hours after meal, contribution of proteins to total energy production was 70% and 30% for carbohydrates while a small amount of fat was produced.

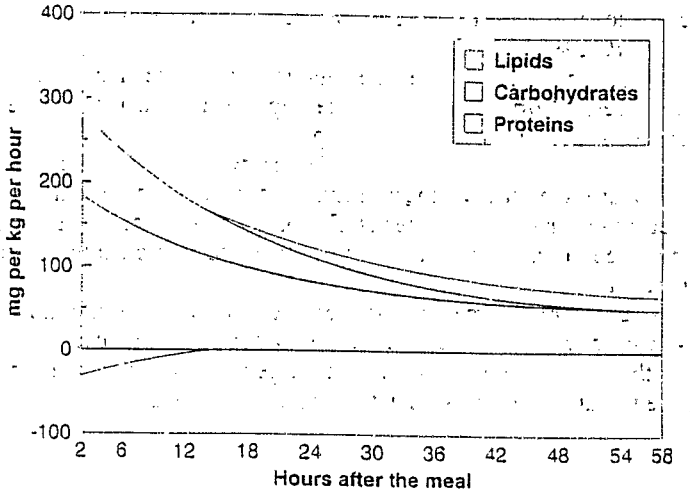

Figure 2. Postprandial utilization of energy substrates.

CONCLUSIONS

Proteins are the main energy-yielding substrates, either they are provided by endogenous stores or by food.

Utilization of lipids is not related to fat body concentration.

Regarding carbohydrates, they could be used as fuel in preference to lipids, as far as they remain available. Therefore, the carbohydrates metabolism seems to be active in the "Atipa".

REFERENCES

Luquet, P. and Moreau, Y., 1989. Energy-protein management by some warmwater finfishes. *In* : Advances in tropical aquaculture. Tahiti, Feb. 20 - March 4, 1989, Aquacop, IFREMER. *Actes de Colloques*, 9 : 751-755.

Moreau, Y., Médale, F., Boujard, T. and Luquet, P., 1991. Indirect calorimetry method to study energy metabolism of an air-breathing fish, *Hoplosternum littorale* (Siluriform, Callichthydae). *J. Aquac. Trop.*, in press.

Van Waversveld, J., Addink, A.D.F., van den Thillart, G. and Smit, H., 1989. Heat production of fish : a literature review. *Comp. Biochem. Physiol.*, 92 : 159-162.