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VARIATION IN EGG AND LARVAL QUALITY IN VARIOUS FISH AND CRUSTACEAN SPECIES

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Abstract

It is generally accepted, that a major constraint in the further development of marine fish and crustacean aquaculture, is the variable quality of eggs and larvae used for the hatchery-production of fry. Nonetheless, valid criteria to evaluate optimal egg quality have not been identified yet. Instead, particular indicators, are used, *e.g.* the fertilization and hatching rate, overall culture success during the first rearing period, *etc.*, but these are not totally objective because hatchery-specific conditions may interfere.

The biochemical composition of the egg may be one of the possible determinants of egg quality, which can be evaluated on a more objective basis. In this respect, studies have been initiated to analyze in freshly-released eggs, the levels of two nutrients which are believed to play a critical role in the early larval development, *i.e.* (n-3) highly unsaturated fatty-acids (HUFAs) and vitamin C. Analytical data have been gathered for various species of marine fishes (*Scophthalmus maximus*, *Epinephelus tauvina* and *E. fuscoguttatus*, *Dicentrarchus labrax*, *Sparus aurata*, and *Pagrus major*) and for the freshwater prawn (*Macrobrachium rosenbergii*). Egg samples have been collected from wild females and from captive broodstock kept under various conditions at various hatcheries.

Results available so far illustrate that for some of the species tested HUFA levels and total lipid content in the eggs vary considerably among spawnings, even when coming from the same hatchery. The highest variation was noted in turbot broodstock, *i.e.* the HUFA levels and total lipid content ranged from 19 to 47mg.g⁻¹ DW, and 8 to 30%, respectively. Contents of ascorbic acid in turbot eggs varied up to 100%, respectively 500% among different egg batches provided by two hatcheries.

In other studies, the effect of changing the lipid composition of the broodstock diet on the HUFA level in the eggs and the larval quality was assessed for *E. tauvina* and *S. aurata*. Preliminary results revealed significant increases in 20:5n-3, total HUFA and lipid content of respectively 47%, 18% and 21% in *E. tauvina*. In seabream eggs, only 20:5n-3

levels increased (approximately by 90%). Grouper larvae with an increased HUFA content furthermore displayed an increased survival after a 7 day standard culture period.

These results indicate that the quality of the food available to the maturing females may be one of the main causes for the noticed variability in essential nutrient composition in the eggs and, consequently, may affect egg viability. What minimum levels of these nutrients are required for normal embryonic and early larval development, is, however, not yet known and may also be species-specific.

ADVANCES IN THE ENRICHMENT OF ROTIFERS AND ARTEMIA AS FOOD SOURCES IN MARINE LARVICULTURE(1) (2) (1) (2)
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Introduction

The industrial application in fish and shrimp hatcheries of the first commercial live food enrichment product SELCO (ARTEMIA SYSTEMS N.V./S.A., Ghent, Belgium) was launched five years ago. Thanks to its beneficial effects on hatchery outputs SELCO enrichment has become a standard practice in many hatcheries of marine fish and shrimp. Based on this experience ARTEMIA SYSTEMS N.V./S.A. has developed a series of SELCO analogues for particular applications : SUPER SELCO, for obtaining maximal w3-HUFA build-up or for reducing enrichment doses or periods ; PROTEIN SELCO, for the combined w3-HUFA, protein and vitamin enrichment, and DRY SELCO, a powdered SELCO formulation. The SELCO formulation has further proven to be an excellent carrier for therapeutics when treating fish diseases through the food chain. Some results obtained so far with these products are summarized in this poster.

Materials and methods :

The enrichment of rotifers is performed either during or after their culture, in the same or a separate tank (40 to 3000 l). The enrichment diets are fed during six to eight hours at a dose of 100 ppm to 250 ppm, in two rations, depending on the type of product. Rotifer density is about 200 to 500 per ml and temperature is kept between 20°C to 25°C.

Artemia enrichment is performed with thoroughly rinsed nauplii, separated from the empty cyst shells after a 24 h hatching period (28°C). The nauplii are transferred at a density of 100 to 300 n/ml to a separate container (10 to 3000 l) filled with disinfected seawater (28°C). The different enrichment diets are administered in one, two or three rations (300 ppm each) for a period of respectively 12 h, 24 h or 48 h.

Results

Table I : w3-HUFA accumulation in rotifers enriched with algae and different enrichment products

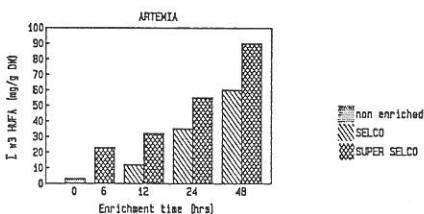
TREATMENT	20:5w3		22:6w3		Ew3-HUFA	
	area %	mg/g	area %	mg/g	area %	mg/g
† 6 d culturing on algae and fresh baker's yeast	3.0	2.0	1.0	0.6	4.8	3.1
† C + 8 h enrichment with <u>Isochrysis galbana</u>	3.8	1.8	2.8	1.3	8.7	4.0
† C + 8 h enrichment with <u>Nannochloropsis sp.</u>	6.2	3.5	1.3	0.7	9.0	5.1
† C + 24 h enrichment with <u>Chlorella japonica</u>	10.9	9.3	0.6	0.5	12.8	10.9
† C + 8 h enrichment with PROTEIN SELCO (2x125ppm)	10.4	8.2	11.1	8.8	25.1	19.9
† C + 6 h enrichment with SELCO (2 x 100 ppm)	11.3	22.8	5.6	11.4	20.1	40.4
† C + 6 h enrichment with DRY SELCO (2 x 100 ppm)	14.3	18.9	11.7	15.5	30.6	40.4
† C + 6 h enrichment with SUPER SELCO (2x50 ppm)	18.0	21.1	17.2	20.3	39.2	46.2

† rotifers cultured on algae + baker's yeast

Artemia enrichment :

Table II : w3-HUFA accumulation in *Artemia* enriched with different products

TREATMENT	20:5w3		22:6w3		Ew3-BUFA	
	area %	mg/g	area %	mg/g	area %	mg/g
+ freshly hatched nauplii	3.5	4.3	-	-	4.0	4.9
+ 24 h enrichment with SELCO (2 x 300 ppm)	9.9	21.3	5.9	12.7	17.8	37.4
+ 24 h enrichment with DRY SELCO (2 x 300 ppm)	13.1	22.3	5.5	9.4	20.1	34.4
+ 24 h enrichment with SUPER SELCO (2x300ppm)	15.4	28.4	12.4	22.9	30.2	55.7
+ 24 h enrichment with PROTEIN SELCO (2x300ppm)	9.4	12.6	3.7	4.9	14.2	19.0

Fig. 1. w3-HUFA accumulation rate in *Artemia* using SELCO and SUPER SELCO as enrichment diets

Discussion and conclusions

The use of rotifer and *Artemia* enrichment diets and techniques ensures a drastical increase of their level of essential fatty acids for marine species (w3-HUFA). The products and techniques are developed in such way as to allow their routine application on a large commercial production scale. The analogue products of the original self-emulsifying enrichment diet SELCO enlarge the potential of the latter in various ways : with SUPER SELCO a maximal enrichment level can be attained which has proven to be required for particular species (e.g. dolphin fish, halibut and turbot) ; the same product also allows for a shorter enrichment period or for a lower dose for reaching the w3-HUFA levels as obtained with SELCO ; with DRY SELCO similar levels are obtained as with SELCO though the use of a dry powder is often preferred to a liquid oily formulation ; and PROTEIN SELCO has proven to be particularly interesting for application in rotifer enrichment, mainly because of its composition and physical property eliminating the problem of rotifer clogging which may appear when using emulsions.

Acknowledgements

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