Short Paper

Triacylglycerol and Phospholipid Contents in Developing Japanese Flounder Eggs

Manabu Seoka, Osamu Takaoka, Kenji Takii, and Hidemi Kumai

Fisheries Laboratory, Kinki University, Urugami, Nachikatsuura, Wakayama 649-5145, Japan

(Received June 11, 1997)

Key words: Japanese flounder, triacylglycerol, phospholipid, egg development

It is generally accepted that amino acids, lipids, and carbohydrates have an essential role as energy reservoirs during the early development of fish.¹⁾ The importance of understanding nutrient utilization during the early development has been stressed to advance the method of mass seedling production.²⁾ We have shown that red sea bream *Pagrus major*³⁾ and bluefin tuna *Thunnus thynnus*⁴⁾ utilize triacylglycerol (TAG) as the main energy source for the embryogenesis. These results suggest that lipids may have an important energy role for the early development period of other marine fish species cultured in Japan. In the present study, therefore, changes in egg TAG and phospholipid (PL) contents of Japanese flounder *Paralichthys olivaceus* were successively determined during the development to confirm our suggestion. Japanese flounder as well as red sea bream are representative marine cultured fish in Japan.

Three replicates of naturally fertilized and buoyant eggs were obtained from a spawning tank containing 15 male and female broodstock fish at a water temperature of 17.0–17.5°C. The eggs were transferred to 300 l aquaria at the spawning water temperature and then were sampled at the stages of early cleavage, gastrula, Kupffer's vesicle appearance, and prehatching for assaying chemical constituents. Moisture content was determined by the AOAC⁵⁾ method. TAG and PL contents were determined as described previously⁶⁾ with modification of the method presented by Suzuki *et al.*⁷⁾

As shown in Fig. 1, moisture content of the developing eggs remained almost constant (92.5%). Egg TAG and PL contents also showed almost constant levels until the eggs prehatched. They were approximately 63 mg/g dried eggs for the former, and 88 mg/g dried eggs for the latter.

As compared with the TAG and PL contents of red sea bream³⁾ and bluefin tuna⁴⁾ eggs (Fig. 1), the egg TAG contents of Japanese flounder showed more constant and for lower levels, but the egg PL contents of Japanese flounder showed slightly higher levels. The characteristics of lipid utilization during the embryonic development can be classified into the following two large groups in respect of energy metabolism: one consuming mainly TAG,^{3,4,8,9)} and the other consuming mainly PL.^{2,10)} However, we interpret the present results as showing that Japanese flounder embryo belong neither to the former group nor to the latter group. Japanese flounder probably prefer amino acids and/or carbohydrates to lipids as energy substrate during the early development. On the other hand, Japanese flounder eggs as well as red sea bream and bluefin tuna

Fig. 1. Changes in triacylglycerol (TAG) and phospholipid (PL) contents in developing Japanese flounder (●), red sea bream (■),³⁾ and bluefin tuna (▲)⁴⁾ eggs.

Abbreviations of developmental stages: EC, early cleavage; G, gastrula; K, Kupffer's vesicle appearance; PH, prehatching.

eggs are around 1 mm in diameter, positively buoyant, and contain a single oil globule. Therefore, the results also show that utilization of energy substrates during the embryogenesis are not simply related with the biological features of fish eggs, but with native nutritional and metabolic characteristics among fish species. It has been mentioned that the pattern of nutrient use during the endogenous feeding period alludes to the nutritional needs during the early exogenous feeding period.^{1,2)} We should conduct effective and suitable methods to enrich live feeds, rotifer and *Artemia*, for obtaining better larval quality and seedling production of each fish species.

The authors thank Prof. O. Murata and Mr. S. Yamada, Fisheries Lab. of Kinki Univ., for their kind advice and assistance with this work.

References

- 1) T. A. Hemming and R. K. Buddington: "Fish Physiology" (ed. By W. S. Hoar, D. J. Randall, and J. R. Brett), Vol. XI, Part A,

- Academic Press, New York, 1988, pp. 407–446.
- 2) J. R. Sargent: "Broodstock Management and Egg and Larval Quality" (ed by. N. R. Bromage and R. J. Roberts), Blackwell Science, London, 1995, pp. 353–372.
 - 3) M. Seoka, K. Takii, O. Takaoka, M. Nakamura, and H. Kumai: *Fisheries Sci.*, **63**, 122–127 (1997).
 - 4) K. Takii, M. Miyashita, M. Seoka, Y. Tanaka, Y. Kubo, and H. Kumai: *Fisheries Sci.*, **63**, 1014–1018 (1997).
 - 5) AOAC: Official Methods of Analysis of the Association of Official Analytical Chemists, 14th edition, Arlington, VA, 1984, pp.1–1141.
 - 6) K. Takii, M. Seoka, O. Takaoka, S. Furuta, M. Nakamura, and H. Kumai: *Fisheries Sci.*, **60**, 73–76 (1994).
 - 7) M. Suzuki, M. Yamashita, M. Fujita, H. Kikuchi, H. Nakano, and R. Ordonio: *Bull. Natl. Res. Inst. Fish. Sci.*, **6**, 1–7 (1994) (in Japanese).
 - 8) R. D. Vetter, R. E. Hodson, and C. Arnold: *Can. J. Fish. Aquat. Sci.*, **40**, 627–634 (1983).
 - 9) R. Vazquez, S. Gonzalez, A. Rodriguez, and G. Mourente: *Aquaculture*, **119**, 273–286 (1994).
 - 10) S. Falk-Petersen, I.-B. Falk-Petersen, J. R. Sargent, and T. Haug: *Aquaculture*, **52**, 207–211 (1986).