Journal of Animal and Veterinary Advances 9 (6): 1030-1033, 2010
ISSN: 1680-5593

The Effects of Different Feeds under the Same Salinity Conditions on the Growth and Survival Rate of Artemia

[1]Murathan Kayim, [1]Mehmet Ates and [2]Hasan Alper Elekon
[1]Department of Inland Water Biology, Faculty of Aquaculture, Tunceli University, 62000 Tunceli, Turkey
[2]Ministry of Agriculture and Rural Affairs, Directorate General of Protection and Control, Ankara, Turkey

Abstract: This study reports effects of 4 different feeds under same salinity conditions on feeding of artemia in terms of growth and survival rate. The feeds comprised of four groups (Group A: -16% Selco + 80% Headstart + 4% Molasses mixture feed; Group B: -85% Chlorella + 15% Molasses mixture feed; Group C: 50% Chlorella + 50% Headstart mixture feed and Group D: -100% Chlorella feed). Through stabilizing temperature, oxygen, pH and salinity values as general water parameters and replacing 10% sea water from the tank on daily basis, the survival rate and the growth in length of the artemia were analysed as well as the changes in nitrite content in the water. The results showed that the highest increase of 1400 μ in artemia with average pre-test length of 450 μ was observed on feed C. The highest rate of 58.33% survival was recorded on feed D. Similarly, the highest nitrite of 1.50 mg L^{-1} was measured in trial tank containing artemia fed on feed A and least nitrite generation of 0.45 mg L^{-1} was noted in trial tank containing artemia fed on feed C.

Key words: Aquaculture, artemia, headstart, Chlorella, molasses, rearing, growth

INTRODUCTION

The most important problem under artificial conditions especially in production of sea fish appears in feeding during first phases of the larval development. Insufficiency of the food vesicle and small width of mouth opening create problems. The best option to face this problem is to make use of live feed with appropriate methods of feeding. The challenges in feeding the crustaceans during larval stage are less problematic due to their filter feeding herbivorous and carnivorous characteristics (Lavens and Sorgeloos, 1996).

Artemia is the most common live food in aquaculture activities. Artemia is commonly used especially for larval growth in >85% of the marine species reared in aquaculture. Adult artemia individuals have higher biomass and nutritive value compared to the naupli and 23% of dry weight of nauplius is composed of fats, while this rate reduces to 16% in juvenile period and to 7% during adult period replacing protein fat the protein rate is 4-50% in naupli. This rate increases up to 63-65% in adult individuals (Hontoria and Amat, 1992; Atay and Bekcan, 2000). The sizes of the fish differentiate according to the feeding regime. For example, juvenile larva needs fat for feeding, while juvenile and adult individuals require protein for surviving and growing. Therefore, it has become common to use adult artemias live, dried or frozen either at embryonic stage or late larval period to feed sea fish, shrimp and aquarium fish (Sorgeloos and Leger, 1992; Sorgeloos *et al*., 2001; Lavens and Sorgeloos, 1996; Merchie, 1996).

During 2007, >250 million sea fish larvas were produced only in sea fish production segment. Current production conditions require using 150-200 kg artemia eggs for production of average 1 million sea fish larvas.

In addition, artemia is also used for rearing shrimp and aquarium fish as well as in research and implementation activities. Considering all aquaculture activities in Turkey, >10 tons of artemia eggs are produced annually.

MATERIALS AND METHODS

Experimental condition: Artemia eggs used for the study were collected from Great Salt Lake and were supplied by a commercial seafood firm (INVE). Details on research and implementation plans of the experiment are given in Table 1. The sea water used for the experiment was prepared under laboratory conditions using synthetic sea salt (Tropic Marin Tmc Ltd.).

Corresponding Author: Mehmet Ates, Department of Inland Water Biology, Faculty of Aquaculture, Tunceli University, 62000 Tunceli, Turkey

Table 1: Research and implementation plan for artemia

	Experimental groups			
Artemia	A	B	C	D
Volume of water in tank (liter)	60	60	60	60
Experiment period (days)	7	7	7	7
Water temperature (°C)	~24	~24	~24	~24
Salinity (ppt)	35	35	35	35
Oxygen (ppm)	~8-9	~8-9	~8-9	~8-9
pH value of water	~8.3-8.5	~8.3-8.5	~8.3-8.5	~8.3-8.5
Feed used	Selco + Headstart + Molasses	Chlorella + Molasses	*Chlorella* sp. + Headstart	*Chloralla* sp.

Diets: Four different feed groups made up of different mixtures were used for the experiment. The contents and ratio of the feed groups used for the experiment were prepared in following quantities:

- Group A experimental feed 16% Selco + 80% Headstart + 4% Molasses
- Group B experimental feed 85% *Chlorella* sp. + 15% Molasses
- Group C experimental feed 50% *Chlorella* sp. + 50% Headstart
- Group D experimental feed 100% *Chlorella* sp.

Culture selco® 3000: Exhibits the following characteristics; double rotifer output relative to traditional cultures up to 3000 per mL. Bacteria levels comparable to those of traditional systems. Reduction in culture time to only 3 days. Specific Growth Rate up to 40% higher than in traditional culture systems. High egg production during the entire culture period. Food consumption comparable to that of Culture. No deleterious effects on larvae in terms of growth, survival, deformities and hygiene. Facilitates the intensification of larvae production. Facilitates the partial replacement of artemia using rotifer biomass. Sum (n-3) HUFA: min 17 mg g^{-1} dwt.

Headstart: Headstart is a specially blended larval feed designed for the earliest stages of larval development in cultured shrimp and fish larval and artemia nauplii. It is pre-sized at 25 microns and is a nutritionally complete diet containing high levels of protein. HUFA. vitamins, minerals, carotenoids and enzymes; all necessary for growth, digestion and utilization of dietary nutrients strength and survival.

***Chlorella* sp.:** Chlorella is a green single-celled algae cultivated in fresh water ponds. It has a grass-like smell because of very high amount of chlorophyll in it which is the highest concentration recorded in any plant in the world. Chlorella is one of the healthiest, most potent foods in existence 60% of Chlorella is protein, which is in the form of amino acids. Chlorella contains 18 of 22 known amino acids and is considered a complete protein because it contains essential amino acids.

Molasses: Molasses that comes from the sugar beet is different from cane molasses. Only the syrup left from the final crystallization stage is called molasses, intermediate syrups are referred to as high green and low green and these are recycled within the crystallization plant to maximize extraction. Beet molasses is about 50% sugar by dry weight predominantly sucrose but also contains significant amounts of glucose and fructose. Beet molasses is limited in biotin (Vitamin H or B_7) for cell growth; hence, it may need to be supplemented with a biotin source. The nonsugar content includes many salts, such as calcium. potassium. oxalate and chloride. These are produced either as a result of concentration from the original plant material or as a result of chemicals used in the processing. As such, it is unpalatable and is mainly used as an additive to animal feed (called molassed sugar beet feed) or as a fermentation feedstock.

Artemia sampling and length measurements: The length of 5 artemias randomly sampled from each experimental tank was measured under the microscope and the average length was calculated at start of the experiment and in following days. The length increase and survival rates of the artemia were calculated at the end of the experiment in line with the collected data.

Nitrite analysis: The nitrite determination was done in mg L^{-1} NO_2-N using spectrophotometer method. Hach brand DR/2000 model spectrophotometer was used for this analysis. About 25 mL water samples were taken from each experiment tank was separately injected to glass analysis basin of the equipment and the final mixture was manually shaken upon adding Nitrite Reagent. Later, the spectrophotometer equipment was set to make measurement at 510 nm wavelength and the nitrite value in water was read from the equipment.

RESULTS AND DISCUSSION

Artemia lengths: As shown in Table 2, the best length was achieved in Group C fed with Chlorell and Headstart

Table 2: Length wise increase in artemia during experiment (micron)

Time (day)	Group A (μ)	Group B (μ)	Group C (μ)	Group D (μ)
1	450	450	450	450
2	750	650	750	750
3	900	800	900	950
4	1050	1010	1050	1000
5	1150	1015	1150	1050
6	1200	1020	1300	1080
7	1250	1025	1400	1100

Table 3: Changes in artemia stocks during experiment

	Groups (naupli/10 mL)			
Time (day)	A	B	C	D
1	130	110	25	120
2	120	100	25	120
3	80	80	25	80
4	80	75	24	80
5	70	68	23	80
6	60	52	17	78
7	50	40	13	70
Survival rate (%)	38.46	36.36	52.00	58.33

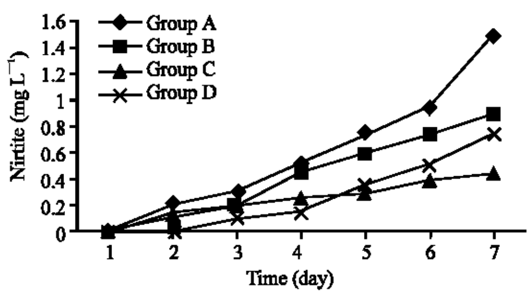

Fig. 1: Nitrite values in water during experiment (mg L^{-1})

experimental feed (1400 μ). This group was followed by Group A (1250 μ), Group D (1100 μ) and Group B (1025 μ), respectively.

Nitrite rates in water: The Fig. 1 shows the changes in nitrite content in sea water used for production during experiment period. Analysis of the nitrite rates shows that the highest increase in nitrite rate appeared in experiment tank fed with Group A feed (16% Selco + 80% Headstart + 4% Molasses), while least nitrite rate was recorded in experimental tank fed with Group C feed (50% *Chlorella* sp. + 50% Headstart).

Changes in artemia stocks: Artemia stock rates in tanks during the experiment are given in Table 3. At the end of the experiment the highest survival rate was achieved in Group D fed with *Chlorella* sp. experimental feed (58.33%). This group was followed by Group C (52%), Group A (38.46%) and Group B (36.36%), respectively.

As it is the same in rest of the globe, increasing seafood consumption in Turkey has led to increases in production and trade activities in this sector as well as increased competition in external markets. The difficulty in aquaculture industry feeding especially during larval period constitutes the most important phase for the production. The loss during this period can be minimized provided that the fish receives sufficient amount of protein, fat, carbohydrate and minerals during larval phase (Leger *et al*., 1986). The live food used to meet these requirements is the live rotifer and artemia. The artemia is unique in that it constitutes ideal live food sources for safe, proper and perfect fish larval. In addition as the artemia has an appropriate size and its eggs can be stored dry. The artemia eggs are commonly used in majority of the aquaculture environments in the country and in rest of the world. However, the artemia is supplied through import as it is not reared in the country. The objective in this study is to highlight information for future research and development activities in the country, which need to focus on rearing and processing artemia eggs through artificial artemia rearing to relieve the industry as we currently depend on import for supply of the artemia eggs.

Production and rearing methods of sea and fresh water fish and various crustacean sea foods have recently gained economic value due to developments in culture methods of various zooplanktons such as rotifer, cladocera and artemia. The larva of the sea fish is primarily fed with unicellular algae, rotifer and artemia (Atay and Bekcan, 2000). The shrimp larva are fed with planktonic diatoms such as *Skelotonema costatum* during zoea stage, while they are fed with newly opened artemia during mysis period. Therefore, live food unit is an indispensable part of incubation facility in enterprises dealing with sea fish and crustacean breeding and in enterprises dealing with rearing some fresh water fish (Lavens and Sorgeloos, 2000; Leger *et al*., 1986). The length of a fully adult individual is 20 times higher than nauplius while its weight is 500 times higher than the nauplius. An adult Artemia may stay alive for 3-4 months under ideal living conditions. A female adult artemia may produce >300 nauplii or egg after every 3-4 days (Lavens and Sorgeloos, 1996; Hontoria and Amat, 1992).

CONCLUSION

This study has determined the nitrite contents generated depending on the feed of the artemia during its production cycle for rearing adult individual artemia that are indispensable for the Aquaculture as well as determining best fitting feed for the artemia and positive criteria to increase the survival rate of the artemia. In this sense, the diet to be used as nutrient in artemia rearing should definitely include phytoplankton such as *chlorella* sp. That is because *chlorella* sp. has significant contributions in both length and survival rates in diets of the artemia. However, the positive result in artemia growth is ensured through using highly protein containing mixture feeds that are rich in terms of HUFA, vitamin, mineral and carotenoids. The residues composed of the artemia fed with rich mixture diets causes accumulation of the hazardous gases such as nitrite and this problem can be solved through fresh water replacement.

ACKNOWLEDGEMENTS

The researchers are also thankful to Associate Prof. Dr. Khalid mahmood Khawar, Department of Field Crops, Faculty of Agriculture, Ankara University, Ankara for his help in preparing the manuscript.

REFERENCES

Atay, D. and S. Bekcan, 2000. Marine Fish and Production Technique. Ankara University, Ankara, Turkey, ISBN: 975-482-517-3.

Hontoria, F. and F. Amat, 1992. Morfological characterization of adult Artemia (Crustacea: Branchiopoda) from different geographical origin: Mediterranean populations. J. Plankton Res., 14: 949-959.

Lavens, P. and P. Sorgeloos, 1996. Manual on the Production and Use of Live Food or Aquaculture. FAO, Rome, Italy.

Lavens, P. and P. Sorgeloos, 2000. The history present status and prospect of the availability of *Artemia cysts* for aquaculture. J. World Aquac. Soc., 181: 397-403.

Leger, P., D.A. Bengtson, K.L. Simpson and P. Sorgeloos, 1986. The use nutritional value of Artemia as a food source. Oceanogr. Mar. Biol. Annu. Rev., 24: 521-623.

Merchie, G., 1996. Use of Nauplii and Meta-nauplii. In: Manuel on the Production and Use of Live Food for Aquaculture, Lavens, P. and P. Sorgeloos (Eds.). FAO, Rome, Italy.

Sorgeloos, P. and P. Leger, 1992. Improved larviculture outputs of marine fish. shrimp and prawn. J. World Aquac. Soc., 23: 251-264.

Sorgeloos, P., P. Ghert and P. Candreva, 2001. Use of the brine shrimp *Artemia* sp. in marine fish larviculture. Aquaculture, 200: 147-159.