ISSN: 2347-5129
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2016; 4(5): 571-573

www.fisheriesjournal.com
Received: 15-07-2016
Accepted: 16-08-2016

Tayfun Karataş
Agri Ibrahim Cecen University, Health Services Vocational School, 04100-Agri, Turkey

Esat Mahmut Kocaman
Ataturk University, Aquaculture Faculty, 25240-Erzurum, Turkey

Correspondence
Tayfun Karataş
Agri Ibrahim Cecen University, Health Services Vocational School, 04100-Agri, Turkey

Effect on survival and growth rates of rainbow trout eggs of applied shocks in different temperatures

Tayfun Karataş and Esat Mahmut Kocaman

Abstract
The aim of this study compared to effect on survival and growth rates of rainbow Trout Eggs of applied shocks in different temperatures. Throughout this study, four different temperatures (24, 26, 28 and 30^{0}C) and a control group (9.6^{0}C) were used.Eggs fertilized by milt of male fish were shocked for 7 minutes in four different water batches provided to 24±0.1^{0}C, 26±0.l^{0}C, 28±0.1^{0}C and 30±0.1^{0}C by aquarium heaters. The survival rates of eggs from fertilization to hatching were determined as 87.1% for control group (9.6^{0}C), 86.6% for 24^{0}C, 84.6% for 26^{0}C and 80.1 for 28^{0}C, and 76.3% for 30^{0}C. The difference between groups was important as statistical (P<0.05).No significant differences between groups with regard to weight gain and feed conversion rates (FCR), specific growth rates (SGR) of fry at the end of the 120-days experiment were determined, but, the growth rate, FCR and SGR of fish shocked in 24^{0}C were found to be higher than that of the other groups.Finally, the heat shock applied in 24^{0}C could be important for the optimal development in rainbow trouts.

Keywords: Rainbow trout, temperature shock, eggs, survival, growth

1. Introduction
Rainbow trout, one of the most significant species in terms of the rearing of aquaculture, have high market value in Turkey and the World [1]. However, the increasing demand for aquaculture and decline day by day of natural stocks has made aquaculture farming even more important [2]. Whereas, one of the most important environmental factors affecting the development of trouts rearing in culture conditions is temperature. Increase or decrease in temperature may lead to slowing down in development of the fish. Therefore, the best growth temperature for the fish should be known. Fisheries sectors are generally concentrated on a very fast growing fish under the name of increase efficiency in production. There are two processes that accelerate the growth of fishes. First, the fish are transferred to cages upon their grown up to a certain level. Secondly, fish is applied to biotechnological methods developing further in recent years [3]. Heat shock application from biotechnological methods is often a preferred method for triploid fish production. The heat shock applied to fish eggs is necessary to know whether this is related with optimum growth temperature or not [4].
Gene manipulations (such as heat shocks, radiation) applied to fish can be provided to rapid growth the fish from fry stage [2]. However, there is a limited study on the development of diploid fish obtained with heat shock applied to fish eggs. In this study, we compared in terms of survival and growth rates rainbow trout eggs fertilized in different water temperature. This is first study evaluated effect on survival and growth of eggs of heat shock.

2. Material and methods
2.1 Fertilizing, hot shock and incubation
This study was carried between 29 November 2008 and 11 March 2009 in Aquaculture Faculty Trout Production and Research Center (Ataturk University, Erzurum, Turkey). Eggs taken from a female fish were divided into four groups and were used 60 cc (896 pieces) for every groups, Eggs were poured into water provided to 24±0.1, 26±0.1, 28±0.l, 30±0.1^{0}C by aquarium heaters, and immediately after, were fertilized by milking to milt of a male fish (four fish) for every groups to temperature water. Fertilization process was provided by mixing of eggs for 7 minutes [5]. Fertilized eggs were taken to incubators spawn (with four divisions) placed on the fiberglass tanks of 310 lt. Incubation water used for eggs is an artesian water which has 9.6 mg/L dissolved oxygen, 7.2-7.6 pH, 9.6^{0}C temperature, 1 L/s flow rate [2].

2.2 Determination of survival rates of eggs

The death eggs, having a white color, and not fertilized eggs were removed and counted daily from experimental groups (24, 26, 28 and 30^{0}C) and the control (K) during the 45 days of incubation period. The fertilization, embryo, eyed stage and hatching of eggs were calculated by using values obtained at end of experiment [6].

2.3 Determination of Triploid

Determination of triploid in groups was done according to the method described by Tomas [7] and Schreck and Moyle [8].

2.4 Feed conversation rate and specific growth rate

Following of hatch period, fry freely fed with commercial trout feed (150, and 300 µ) up to 2 g. Then, fish taken randomly from each group (enough number fish) were fed in controlled manner. Fish reached to weigh 2 g weighed with a sensitive scale in every 15 days throughout 120 days and amounts of the daily feed given to fish at the end of weighing were determined. Throughout experiment, fish fed with commercial trout feed (500 µ, 800 µ and 1mm). FCR and SGR of fish were calculated according to values obtained at the end of experiment. SGR was calculated as SGR = [($\ln R_2$ - $\ln R_1$) / (F_2 - F_1)] X 100where R2 and R1were fish weights at times F_2 and F_1, and (F_2-F_1) were the number of days between weighings. FCR for the groups was calculated as FCR =(R) / (Y2 – Y1**)** where R was the amount of food consumed by the groups between weight measurements, Y2was the final groups weight and Y1 was the initial groups weight [4].

2.5 Statistical Analyses

To estimate statistically differences between groups in experiment, ANOVA test was performed to all groups. To that end, the 11.5 version of SPSS program was used (SPSS Inc, Chicago, USA). For all date was accepted statistically significant P<0.05 [4].

3. Results

Results obtained from fertilization (DR), embryo (ER),eyed stage (ES), hatching, initial weight (IW), final weight (FW), specific growth rate (SGR) and food conversion rate (FCR) between the groups (K, 24, 26, 28 and 30^{0}C) fertilized in different water temperature and the results of statistical analysis are given in Table 1. According to the results obtained from this study, the survival rates from fertilization to hatching of rainbow trout eggs were determinate as Control > 24^{0}C > 26^{0}C > 28^{0}C> 30^{0}C. Increased heat shock reduced survival rates of eggs from fertilization to hatching. All groups applied to heat shock were 100% diploid. There were statistically significant differences between the groups (24, 26, 28 and 30^{0}C) (P<0.05). Following of growth 120 days, growth rates, SGR and FCR rates were determined as 24^{0}C >30^{0}C>28^{0}C >26^{0}C > Control. There were statistically insignificant differences between the groups in terms of SGR, FCR and growth rates (P>0.05). But, even if there is not a statistically significant difference, growth of fish shocked at 24^{0}C was higher when compared with other groups. Heat-shock applied at 24^{0}C have an important effect on growth of fish.

Table 1: Comparıson of survival and growth rates of Rainbow trout eggs fertilized in different water temperatures

^{0}C	DR (%)	ER (%)	ES (%)	Hatching	IW(g)	FW(g)	SGR (%)	FCR
Control	95,9±2,4^a	94,7±4,0 ^{a}	93,9±1,0^a	87.1±2.5^a	2±0,1	10,1±2,9 ^{a}	2,16 ^{a}	1,06±0,01^a
24^{0}C	94,8±2,4^a	97,5±1,7 ^{a}	95,7±1,5^{ab}	86.6±3.0^a	2±0,1	16,0±5,3 ^{a}	2,77 ^{a}	1,02±0,02 ^{a}
26^{0}C	93,1±2,6^a	94,6±4,2 ^{a}	91,3±1,5^c	84.6±1.9^{ab}	2±0,1	11,5±3,5 ^{a}	2,33 ^{a}	1,05±0,01 ^{a}
28^{0}C	90,6±5,8^a	92,0±15,2^a	87,1±2,5^{cd}	80.1±2.7^b	2±0,1	13,5±4,4 ^{a}	2,54 ^{a}	1,04±0,02 ^{a}
30^{0}C	88,7±6,3^a	86,9±17,8^a	80,2±1,1^e	76.3±2.8^c	2±0,1	15,6±5,1^a	2,73 ^{a}	1,03±0,01 ^{a}

Results were given as mean±SD and %. Control group was compared with 24, 26, 28 and 30^{0}C in terms of growth and survival rates. DR, fertilization rates; ER, embryo rates; ES; eyed rates; IW, initial weights; FW, final weights; SGR, specific growth rates; FCR, food conversion rates. There is significant difference between parameters given as different superscripts

4. Discussion

Heat shock application from biotechnological methods is often a preferred method for triploid fish production. Heat shock applied to rainbow trout eggs have influenced the survival rates from fertilization to first feeding (range 88,7– 95,7%) [9]. Chourrout [10] has reported that eggs taken from rainbow trout were exposed to heat shock with times 2, 4, 6, 8, 10, 15 and 20 minutes in 26°C, and survival rates of fertilized eggs were more than 90% in all groups. In another study, 10 and 20 mins after the fertilization, eggs taken from Atlantic salmon (*Salmo salar*) were applied to shocks at temperature changing between 26-29°C for 1,5 and 10 mins and eggs showed a fairly good survival rate (range 66-89%) [11]. In present study, the survival rates from fertilization to hatching of rainbow trout eggs exposed to heat shock for 7 minutes in 24, 26, 28, 30°C were determined changing between 76%-87% (respectively). Our results were compatible with results of Quillet and Gaignon [11] and Ingrid [9]. But, were different than that of chourrout [10]. Differences in survival rates may be associated with heat shock period or application. There was a significant difference between the groups (p<0.05).

The heat shock applied to fish eggs is necessary to know whether this is related with optimum growth temperature or not. The optimum temperature for growth of Salmonides is obtained as 12°C, 19°C, 15°C, 17°C and 17.2°C for *Cutthroat trout* [12], *Chinook salmon* [13], *Sockeye salmon* [14], *Brown trout* [15] and *Rainbow trout* [16], respectively. In the present study, the optimum shock temperature for growth of rainbow trouts was obtained at 24°C (Table 1). Obtained results were found to be different from the literature. This difference can be resulted from fertilization for 7 min of rainbow trout eggs.

Specific development rate is important in terms of determining the growth rate of the fish [2]. The specific growth rates (SGR) in our study (range 2.16-2.77%) were higher than reported by Yanik *et al.* [17] (1.67%), Uysal and Alpbaz [18] (1.87 to 2.01%) and Kocaman *et al.* [19] (1.24) but, were lower than the values reported by Kızak *et al.* [20] (3.63) for rainbow trout. Increased or decreased specific development rates (SGR) can be resulted from application of heat shock.

In controlled rainbow trout farming, feed conversion rates (FCR) of rearing process are desired to be between 1,50 and 1,80 [21]. Feed conversion rates (FCR) in our study were in the range of 1.03-1.06%. FCR of rainbow trouts were found to be 0.59 [20] and 1.36 [22] before. In the present study, FCR in all groups were found to be lower than the values reported by Kocaman *et al.* [22], but, were found to be higher than the

values reported by Kızak *et al.* [20]. The lower or higher values of FCR may be due to environmental factors such as oxygen, temperature, pH and hardness. As a result, a positive effect on growth and survival of rainbow trout eggs fertilized in the different water temperatures were determined.

Note: The survival rates (except hatching) of eggs in this study have been summarized from master's degree and this study was presented The first International Fisheries symposium in Northern Cyprus.

5. References

1. Rasmussen RS, Ostenfeld TH. Effect of growth rate on quality traits and feed utilisation of rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). Aquacult. 2000; 184:327-337.
2. Karatas T. Farklı sıcaklıklarda şok uygulamalarının gökkuşağı alabalığı (*Oncorhynchus mykiss,* w. 1792) yumurtalarının yaşama, büyüme, triploidlik, biyokimyasal parametreler ve enzim aktivitesi üzerine etkileri. Atatürk Üniversitesi Fen Bilimleri Enstitüsü Su Ürünleri Anabilimdalı, Yüksek Lisans Tezi, Erzurum. (in Turkish), 2012.
3. Özden O, Güner Y, Kızak V. Tatlısu Balık Kültüründe Uygulanan Bazı Biyoteknolojik Yöntemler. E.U. J of Fish. and Aqua. Sci. (in Turkish). 2003; (3-4):563-574.
4. Karataş T, Kocaman EM. Comparison of survival and growth ratios of diploid brown trout eggs after applied temperature shocks. Inter J of Cur Res. 2014; (07)6:7369-7371.
5. Diaz NF, Iturra P, Veloso A, Estay F, Colihueque N. Physiological factors affecting triploid production in rainbow trout, *Oncorhynchus mykiss* Aquacult. 1993; 114:33-40.
6. Suziki R, Fukude Y. Survival Potential of F1 Hybrids among Salmonid Fisher. Bull. Fresh Fish Res. Zub. 1971; 21(1):69-83.
7. Thomas ED. Fish Cromosome Methodology. Charles C Thomas Publisher Springfield Illinois, 1973, 166.
8. Schreck CB, Moyle PB. Methods for Fish Biology, Maryland, 1990.
9. Ingrid L, Helland S, Hjelde K, Bæverfjord G. Temperature effects on malformations in rainbow trout (*Onchorhynchus. mykiss*). http://www.aquamedia.org/FileLibrary/27/Temperature%20-%20Trout.pdf,2016
10. Chourrout D. Use of grayling sperm (*Thymallus thymallus*) as a marker for the production of gynogenetic rainbow trout (*Salmo gairdneri*). Theor. Appl.Genet.1986; 72:633-636.
11. Quillet E, Gaignon JL. Thermal induction of gynogenesis and triploidy in Atlantic salmon (*Salmo salar*) and their potential interest for aquaculture. Aquaculture, 1990; 89:351-364.
12. Meeuwig MH, Dunham JB, Hayes JP, Vinyard GL. Effects of constant and cyclical thermal regimes on growth and feeding of juvenile cutthroat trout of variable sizes. Eco. of Fresh. Fish, 2004; 13:208-216.
13. Brett JR, Clarke WC, Shelbourn JE. Experiments on thermal requirements for growth and food conversion efficiency of juvenile chinook salmon, *Oncorhynchus tshawytscha*. Canada Fish. and Marin. Servi. Tech. Rep, 1982, 1127.
14. Brett JR, Shelbourn JE, Shoop CT. Growth rate and body composition of fingerling sockeye salmon, *Oncorhynchus nerka*, in relation to temperature and ration size. J. of the Fish. Res. Board of Canada. 1969; 26:2363-2394.
15. Ojangurenet AF, Reyes-Gavilan FG, Braña F. Thermal sensitivity of growth, food intake, and activity of juvenile brown trout (*salmo trutta fario*). J. of Ther. Bio. 2001; 26:165-170.
16. Hokanson KEF, Kleiner CF, Thorslund TW. Effects of constant temperatures and diel temperature fluctuations on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri*. J. of the Fish. Res. Board of Canada. 1977; 34:639-648.
17. Yanik T, Hisar SA, Bölükbasi C. Early development and growth of arctic charr (*Salvelinus alpinus*) and Rainbow Trout (*Oncorhynchus mykiss*) At a Low Water Temperature. The Israeli J. of Aqua-Bamid. 2002; 54(2):73-78.
18. Uysal I, Alpbaz A. Food intake and feed conversion ratios in Abant Trout (*Salmo trutta abanticus* T., 1954) and Rainbow Trout (*Oncorhynchus mykiss* W., 1792) in pond culture. Turk. J. Biol. 2002; 26:83-88.
19. Kocaman EM, Bayır A, Sirkecioglu AN, Bayır MC, Yanık T, Aslan H. Comparison of hatchery performances of Rainbow trout (*Oncorhynchus mykiss*), Brook trout (*Salvelinus fontinalis*) and Brown trout (*Salmo trutta fario*)under same environmental conditions. J. of Anim. and Vet. Adv. 2009; 7:1429-143.
20. Kizak V, Guner Y, Turel M, Can E, Kayim M. A comparison of the survival and growth performance in rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta fario*) fry. African J. of Agricul. Res. 2011; 6(5):1274-1276.
21. Geldiay R, Balık S. Türkiye Tatlısu Balıkları. Ege Ün. Su Ür. Fak. Yayınları, İzmir, (in turkish), 1996, 532.
22. Kocaman EM, Bayır A, Sirkecioğlu AN, Bayır CM, Yanık T. Growth of Juveniles (*Oncorhynchus mykiss, Salvelinus fontinalis and Salmo trutta fario*) Under Uniform Cultural Conditions. J.Appl. Anim. Res. 2006; 30:73-75.