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Araştırma/Research Article

Effect of Feeding to Yolk Sac Consumption in Brook Trout (Salvelinus fontinalis, Mitchill, 1814) Alevin

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Abstract: In this study, Brook trout (Salvelinus fontinalis, Mitchill, 1824) alevins with feeding yolk sac consumption and growth rates were determined. The eggs were hatched at 11,62±0,56 °C water temperature and hatched alevins were placed in an aquarium about 500 individual. The alevins 21th day were divided two groups as A and B and A group was fed three times daily. When 90% hatching of the eggs were accepted 0 (zero) and alevins were sampled in 7th, 14th, 21th, 28th, 35th, 42th, 49th days. The dry yolk sac weight of A and B groups for both were calculated as 23.01±0.76 mg hatching and 0.72±0.27 mg and 0.70±0.29 mg swim-up stage ($p<0.05$). Regression analysis of A and B groups with length, wet alevin weight, dry alevin weight, total wet weight (wet alevin weight + wet yolk sac weight), total dry weight (dry larvae weight + dry yolk sac weight) differences were significantly ($P<0.05$), while dry and wet yolk sac weights differences were insignificant ($P>0.05$).
The highest yolk sac conversion efficiency, weight and length growth rates, yolk sac absorption and condition factor values were calculated in A group ($P>0.05$).

Keywords: Dry larvae weight, growth rates, yolk sac consumption, feed

Özet: Bu çalışmada Kaynak alabalığı (Salvelinus fontinalis, Mitchell, 1824) alevinlerinin yemlemeye bağlı besin kesesi tüketimi ve büyüme oranları belirlenmiştir. Yumurtalar 11.62±0.56 °C su sıcaklığında kuluçkalanmış ve yumurtadan çıkan yaklaşık 500 adet alevin bir akvaryuma yerleştirilmiştir. Alevinlerin (21.gün) A ve B olarak 2 gruba ayrılmış ve A grubu günde 3 kez yemlenmiştir. Yumurtaların % 90'ının yumurtadan çıktığı an 0 kabul edilmiştir ve alevinler 7., 14., 21., 28., 35., 42., 49. günlerde örneklenmiştir. A ve B gruplarının kuru kese ağırlıkları yumurtadan çıktığı dönemde her ikisi için 23.01±0.76 mg ve serbest yüzme döneminde 0.72±0.27 mg ve 0.70±0.29 mg hesaplanmıştır ($p<0.05$). A ve B gruplarının regrasyon analizinde boy, yaş alevin ağırlığı, kuru alevin ağırlığı, toplam yaş ağırlık (yaş alevin ağırlığı + yaş besin kesesi ağırlığı), toplam kuru ağırlık (kuru larva ağırlığı + kuru besin kesesi ağırlığı) ile faklılıklar önemli ($p<0.05$) iken kuru ve yaş besin kesesi ağırlıkları ile farklılıklar önemsizdir ($P>0.05$).
Besin kesesi dönüşüm randımanı, boyca ve ağırlıkça büyüme oranları, besin kesesi tüketimi ve kondiston faktörü değerleri en yüksek A grubunda hesaplanmıştır ($p>0.05$).

Anahtar Kelimeler: Kuru larva ağırlığı, büyüme oranları, besin kesesi tüketimi, besleme

Introduction

The faster growth by optimum feed consumption is major problem in aquaculture (Gökçek ve ark., 2008). Carnivorous and other consumer-desired species substantial resource input needed in the form of feeds to sustain of practices (Silva ve ark., 2009). The culture of carnivores species generally more than % 55 must be high protein content feeds. If alevins more than % 30 perform free swimming activity, first external feeding starts (Başçınar ve ark., 2003).
Either light density or day long can effect growth. Usually fish are disturbed by excessive light. Salmons light ambient had better growth than dark ambient (Başçınar, 2001). The period early development the larvae is a critical period that pathogens and diseases, environmental fluctuations and starvation. Therefore, it is possible to increase survival and growth rates through proper hatchery management skills during this critical stage(s). However, well feeding regime increase survival rate of larvae and faster growth in during to yolk sac absorption. The rainbow trout reared in 200-250 g over a 10-12 months period from fingerling to market size while same property for brook trout 18-20 months. Brook trout hatched time and yolk sac absorption 10-12th and 14th later than rainbow trout. The yolk sac absorption and development phases can be shortened with faster growth (Önder, 2013).

Materials and Methods

Eggs from 16 females were collected and fertilized with milt from 10 males at the trout hatchery in the Sürmene Faculty of Marine Sciences, Karadeniz Technical University Trabzon, Turkey. The eggs were hatched in a vertical incubator. After hatching, alevin were randomly divided at 21th day (alevin start feed) into two groups about 220 individuals in freshwater and its placed 10 liter aquarium. A group was fed with starter trout feed three times daily while B group was not feeding. Aerated water in the batches was recirculated and was replaced 20 % daily. The temperature was measured with a digital thermometer twice a day (8.30-9.30, 16:30-17:30). Dead alevins were removed every day.

The alevin sampling was gathered 7 day intervals from hatching and it finished 1030 degree-days. The first larvae were sampled at 455 degree-days (50% eggs hatched) and then at 539, 619, 703, 783, 870, 951 and 1030 degree-days (finished yolk sac), respectively. Ten alevin randomly were sampled at each sampling period (8 times), total 80 larvae were used during the study. Alevin were anesthetized in 20 ppm benzocaine (used acetone SIGMA-ALDRICH, St.Louis, MO, USA and pure water), and then preserved in 10% formalin (SIGMA-ALDRICH, St.Louis, MO, USA) until further analysis. The alevin wait minimum interval 3 weeks, after its separated yolk sac from body. The body and yolk sac were dried separately at 60°C for 48 h and they weighed (Hansen, 1985; Hondson ve Blunt, 1986).

Yolk sac conversion efficiency was calculated as YCE (mg) = (Lt - L0)/(Y0 - Yt) Hodson and Blunt (Ergün ve Aktaş, 2009; Hansen, 1985), where L is dry larvae weight, Y is yolk sac dry weight, and t is day. The dry yolk sac consumption rate (mg/day) was calculated as YCR = (Y0- Yt)/t, daily length growth rate (mm/day) as LGR = (Lt - L0)/t, daily weight growth rate (mg/day) as WGR = (Wt - W0)/t and development index (mg/mm) as KD = (10xW11/3)/length, where Y is yolk sac weight at any time t and time zero, L is length at any time t and time zero, W is weight at any time t and time zero, t is day,W1 is total wet weight (Peterson ve Martin-Robichaud, 1995).

Statistical analysis

The length, dry alevin and yolk sac weights, wet alevin and yolk sac weights, total alevin and yolk sac weights slope values were analyzed by SigmaPlot 11.0 (Systat Software, San Jose, CA, USA) and all data are expressed as mean ±SD. The all slopes (Ho: b=0) and regression analysis performed at 0.05 probability level (Ergün ve Aktaş, 2009; Hondson ve Blunt, 1986).

Experimental diet

The alevins was fed traditional starter trout feed (55% protein level and NutraHp 0.5 micron) (Table 1).

Results

The incubation water temperature varied between 10.5°C and 12.8°C (11.61± 0.77 °C). The eggs eyed at 16th day (194 degree-days), hatched at 39th day (454 degree day) and swim-up stage passed (end of yolk sac) at 88th day (1021.6 degree-day). The contrast relationships between mean dry weights of alevin and yolk, wet weights of alevin and yolk, total dry and wet weights (Figure 1), (Figure 2), (Figure 3), respectively.

Table 1. Feeds content

NutraHp 0.5	
Main Feeds Content (%)	
Protein	55
Oil	18
Ash	10.5
Fiber	0.5
Phospore	1.7
Calsiyum	2
Natrium	0.6
Vitamin (iu/kg)	
Vitamin A	7500
Vitamin D	1125
Mikrofeeds content(mg/kg)	
Iron (Ironsülfatmonohidrat)	62
İodize (Calsiyumiodizeanhyhydrous)	3.1
Copper (Copper sulfatemonohidrat)	9
Manganez (Manganez sulfatemonohidrat)	23
Zinc (Zinc sulfate monohidrat)	160
Selen (Selenometioninyvytwarzanej)	0.05
Antioksidan (mg/kg)	
Ethoxyquin	75

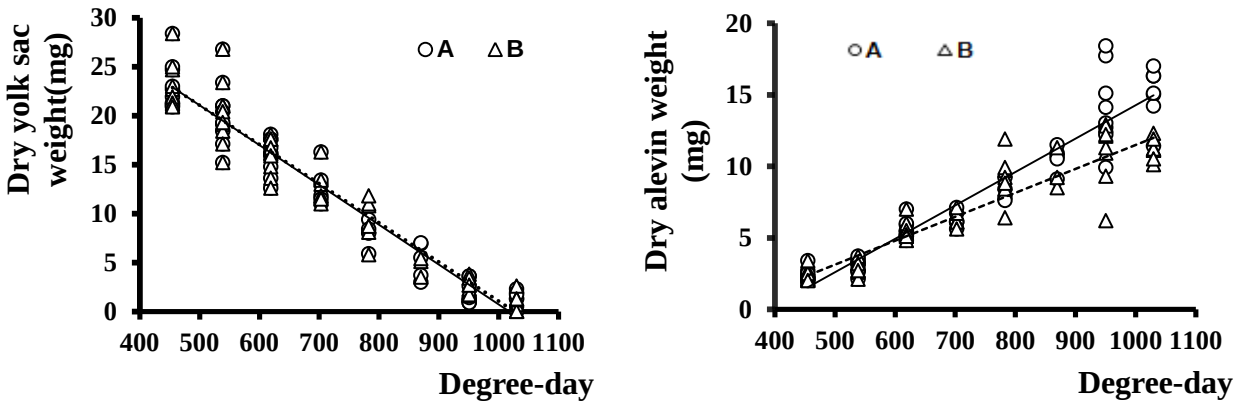

Figure 1. Adverse correlation between dry larvae and yolk sac weight (A:—, B:••)

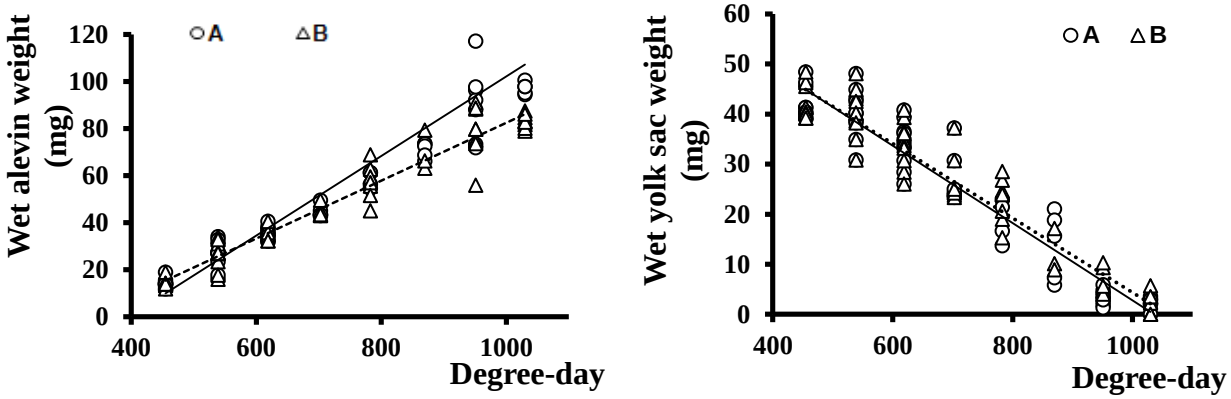

Figure 2. Adverse correlation between wet larvae and yolk sac weight (A:—, B:••)

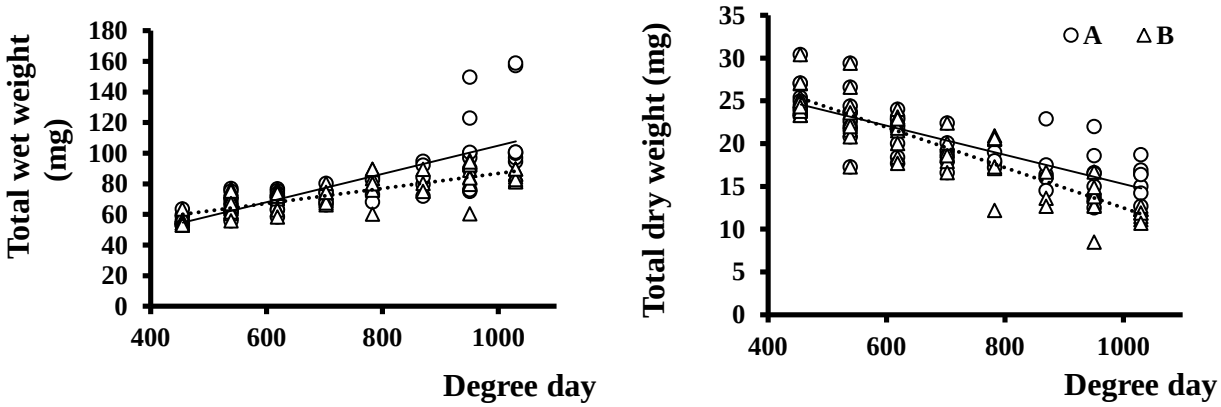

Figure 3. Adverse correlation between total wet and dry weight (A:—, B:••)

The length and wet alevin weights A and B groups for both were calculated as 12.76±0.55 mm and 14.23±0.58 mg hatching and 26.34±1.49 mm and 22.50± 0.79 mm and 113.56±10.65 mg and 83.02±0.90 mg swim-up stage, respectively ($P<0.05$). Depend on degree-day total wet weight, dry and wet alevin weights increase while total dry weight, dry and wet yolk sac weights decreased.

A and B groups YCR, KD, YCE, BBO, ABO values calculated 0.36 mg/day and 0.25 mg/day, 2.02 mg/mm and 1.96 mg/mm, 0.44 mg and 0.31 mg, 0.19 mm/day and 0.13 mm/day, 0.78 mg/day and 0.40 mg/day, respectively. Regression analysis of A and B length, wet larvae weight, dry larvae weight, total wet and dry weight, differences were significantly ($P>0.05$), while dry and wet yolk sac weight differences were insignificant ($P<0.05$) (Table 2).

Table 2. The linear regression parameters describing the changes in weights, length of larvae with degree-day

	Model	a	b	r^2	F	P
Length						
A	y=a+bx	3.587	0.021	0.91	573,219	<0,001
B	y=a+bx	6.350	0.017	0.89	519,330	<0,001
Total wet weight						
A	y=a+bx	12.615	0.092	0.62	94,754	<0,001
B	y=a+bx	37.654	0.049	0.66	120,475	<0,001
Total dry weight						
A	y=a+bx	32.326	-0.017	0.65	109,273	<0,001
B	y=a+bx	36.026	-0.024	0.81	262,746	<0,001
Dry yolk sac weight						
A	y=a+bx	41.419	-0.041	0.93	826,728	<0,001
B	y=a+bx	41.118	-0.040	0.94	950,029	<0,001
Dry larvae weight						
A	y=a+bx	-9.059	0.023	0.91	611,905	<0,001
B	y=a+bx	-5.231	0,017	0.88	448,957	<0,001
Wet larvae weight						
A	y=a+bx	-67.103	0.169	0.85	350,607	<0,001
B	y=a+bx	-40.730	0.123	0.95	1102,629	<0,001
Wet yolk sac weight						
A	y=a+bx	80.103	-0.077	0.92	688,720	<0,001
B	y=a+bx	78.759	-0.074	0.93	774,759	<0,001

y: a: intercept, b: slope, r2: correlation coefficient, F:F test H=0 hipotesis, P: probability (P<0.05)

Discussion

The alevin intake the water for histogenesis, so many researcher used dry weight (Hansen, 1985; Hansen ve Møller, 1985; Dumas ve ark., 1995; Peterson ve Martin-Robichaud, 1995). In our study, dry weight used as yolk sac and alevin weights. The dry yolk sac weight A and B groups for both were calculated as 23.01±0.76 mg hatching and 1.21±0.28 mg and 0.91±0.27 mg swim-up stage ($p<0.05$). Similar results reported at hatching Hodson et al. (Hodson ve Blunt, 1986) rainbow trout 31 mg, Peterson et al. (Peterson ve Martin-Robichaud, 1995) Atlantic salmon 27.8 mg, Kocabaş et al. (Kocabaş ve ark., 2012) brown trout 10.67 mg and Başçınar et al.(Başçınar ve ark., 2013) black sea trout, brook trout, hybrid's 16.43 mg, 20.83 mg, 15.56 mg, respectively. Alevins more requirement energy for tissue formation and higher mortality rate at yolk sac stage. The end of study, mortality rate A and B groups were calculated 11.8 % and 12.2 %, survival rate of alevins higher feeding group, because their higher feed energy conversion.

Alvin dry matter (%) rate decrease while water content (%) increase with degree-days. The alevin dry matter and water content A and B groups were calculated as 14.99 (%) and 85.01 (%). Hodson et al. (Hodson ve Blunt, 1986) reported for trout at hatching dry matter and water content 33.10 % and 66.90 %, total biomass 15.46 % and 84.54 %, respectively. In another study, Başçınar et al. (Başçınar ve ark., 2003) reported for trout at hatching dry matter and water content 36.04 % and 63.96 %, before swim-up stage 19.22 % and 80.78 %.

The highest YCR, KD, YCE, BBO, ABO values were calculated A group. Similar results Başçınar et al. (14) reported for black sea trout, brook trout and hybrid's BBO and ABO values 0.19 mm/day and 0.87 mg/day, 0.21 mm/day and 0.63 mg/day, 0.20 mm/day and 0.45 mg/day, respectively. The YCE reported Başçınar et al. (Başçınar ve ark., 2003) at brook trout 0.50 mg and Başçınar et al. (Başçınar ve ark., 2010) 0.76 mg, 0.61 mg, 0.46 mg for blacksea trout, brook trout and hybrid species, respectively.

The total wet weight A and B groups hatching for both calculated as 56.0±1.13 mg hatching and 115.51±9.21 mg and 85.32±0.98 mg swim-up stage ($p<0.05$). Başçınar et al. (Başçınar, 2010) reported at brook trout alevin total wet weight 58.16±9.98 mg hatching, 96.94±8.71 mg 28^{th} day in fresh water, 120.29±9.26 mg 19^{th} day at 4 ‰ salinity, 102.80±5.80 mg 22^{th} day at 8 ‰ salinity. In another study, Başçınar et al. (Başçınar ve ark., 2003) reported at brook trout alevin initially total wet weight 72.45±5.58 mg (n=10), 98.85±6.22 mg before swim-up stage.

In conclusion, feeding activity a important factor during the yolk sac consumption. Alevins obtain a major part of energy with feeding. With the feeding activity length and weight growth rates were increased during the yolk sac stage. The different feeding regime of Brook trout at yolk sac stage research effect on yolk sac consumption and growth rates.

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