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Compensatory growth of juvenile flounder (*Paralichthys olivaceus*) during the summer season

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Introduction

Compensatory growth of fish, rapid growth or faster than normal growth rate achieved from followed refeeding of fish after starvation or undernutrition has been observed in coldwater fish (Dobson and Holmes, 1984; Miglavs and Jobling, 1989; Jobling and Koskela, 1996; Damsgaard and Dill, 1998) as well as warmwater fish (Gaylord and Gatlin, 2000; Qian et al., 2000; Wang et al., 2000; Gaylord and Gatlin, 2001; Xie et al., 2001). Besides, Cho and Lee (2002) recently reported that growth of flounder refed for 6 weeks after 2-week feed deprivation was comparable with that of fish fed twice daily for 8 weeks during the spring season. Flounder, which is the commercially most important fish in Korea, grow well between late spring and early fall. However, red tide or cold-mass commonly occurs during this season as well. Fish farmers are suffering from economical loss due to high mortality of fish in the occurrence of this phenomenon every year. To reduce mortality by depressing metabolism of fish, fish farmers starve fish until red tide or cold-mass disappears and it may result in growth reduction or growth depression of fish. Economical loss resulted from poor growth of fish during starvation is additionally burdening fish farmers. Therefore, this study was performed to investigate compensatory growth of juvenile flounder during the summer season.

Materials and method

Juveniles flounder were purchased from private farm and transferred into the lab in Korea Maritime University (Busan, Korea). Twenty juveniles fish (an initial weight of 38.1 g) were stocked into the fifteen of 500 L circular flow-through tanks (water volume: 250 L) and acclimated for 3 days before the initiation of the feeding trial. During the acclimation period, fish were hand-fed to satiation twice daily by the commercial flounder feed (Ewha Oil & Fat Co., Ltd.). Fish were fed for 6 days a week. This feeding trial performed during the summer season. Five treatments of fish with 3 replicates were prepared for this study. Fish in the control group (C) was fed to satiation twice daily throughout the feeding trial. Fish in the S1, S2, S3 and S4 experienced 1, 2, 3 and 4 weeks of starvation, respectively, before being fed to satiation twice daily during the remainder of the experiment. The experiment lasted for 6 weeks. At the end of the feeding trial, fish were collectively harvested and totally weighed. Five randomly chosen fish at the beginning and from each tank at the end of the feeding trial were sacrificed for proximate analysis based on standard method (AOAC, 1990). One-way ANOVA test was applied to test the significance of treatments. And if the significance was observed, Duncans multiple range test (Duncan, 1955) was applied to detect the difference among treatments by using SAS.

Results

Survival of juvenile flounder in S4 was significantly lower than that of C, S1, S2 or S3. Weight gain of flounder in C and S1, which was not significantly different, was significantly ($P<0.05$) higher than that of fish in S2, S3 or S4. The poorest weight gain was achieved in fish of S4. However, specific growth rate (SGR) for flounder among C, S1, S2 and S3 was not significantly different, but significantly ($P<0.05$) higher than that for fish in S4. Feed efficiency ratio (FER) and protein efficiency ratio (PER) for flounder in C, S1, S2 and S3, which were not significantly different, were significantly ($P<0.05$) higher than that for fish in S4. Proximate composition of flounder, such as moisture, protein and lipid content except for ash content was significantly ($P<0.05$) affected by treatments. In considering results of this feeding trial, juvenile flounder achieved compensatory growth when properly re-fed after 1-week feed deprivation even during the summer season. Compensatory growth of flounder was well supported by improvement in SGR, FER and PER in fish re-fed after starved.

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