

**EFFECTS OF DIETARY SOYBEAN MEAL ON THE APPARENT
DIGESTIBILITY AND GALLBLADDER WEIGHT
OF RAINBOW TROUT**

Pyong Kih Kim
Dept. of Fisheries Development, Kangwon Province University,
Kangnung, 210-800, Republic of Korea
Tel. +391 6603421 Fax. +391 660 3425 e-mail: pkkim@kangwonpu.ac.kr

Joong-Kyun Jeon
Faculty of Marine Bioscience & Technology, Kangnung National University,
Kangnung 210-702, Republic of Korea
Tel +391 6402412 Fax +391 6472410 e-mail: jkjeon@knusun.kangnung.ac.kr

EXTENDED ABSTRACT ONLY - DO NOT CITE

Introduction

Attempts to replace the fish meal component of practical fish feed with soybean meals (SBM) have met with valuable success. However, applications of high level SBM in diets have resulted in reducing growth and poor feed conversion efficiency by anti-nutritional factors, amino acid imbalance, and lacking of phosphorus utilization of fish. No studies have been carried out on gallbladder relating to dietary SBM, although there were a few works with bile acid after feeding (Talbot and Higgins 1982; Avery et al. 1992). To evaluate the nutritional utilization of the SBM diet, in this study long-term feeding trial (120 day) was conducted to estimate the relationship between apparent digestibility of protein and lipid and gallbladder weight in rainbow trout fed SBM diets.

Materials and Methods

Eight experimental diets were used; 0%, 10%, 22%, 34%, 46%, 58%, 70% of SBM with approximately 44% protein content in seven formulated diets and commercial diet (CD) was used for control. Rainbow trout (mean weight 29g) was divided into 7 groups (73 fish each tank) with duplicate trials, and fed twice a day with *ad libitum*. Water temperature was maintained constantly at 17 . Digestibility of SBM diets was measured at 60 and 120 days of experimental period following Kim et al. (1996). The gallbladder of rainbow trout (n=8-9) starved for 40 hrs was weighted at 30, 60, 90, 120 day of experimental period for effect of long-term fed SBM diet. To find out changes of gallbladder weight ratio (GBWR) with time, the gallbladder of rainbow trout starved for 48 hrs was weighted after supplying 2% feed per fish weight at 120 days of experimental period. Then, the weight of gallbladder and the volume of serum bile acid of fish (n=8-10) from each treatment were measured at before feeding, after feeding 1 hr, 3 hrs, 6 hrs, 12 hrs, 18 hrs and 24 hrs, respectively.

Results and Conclusions

The digestibility of protein was 91.5~94.2% and 88.6~92.2% at 60 days and 120 days, respectively ($p>0.05$). The digestibility of lipid at 60 days of experimental period was 91.2~92.7% fed experimental diets contained less than 34% of SBM, while that of lipid at same time was 84.0~88.9% % fed experimental diets contained more than 34% of SBM ($p<0.05$).

Table 1. Gallbladder weight ratio (GBWR¹) of rainbow trout fed with soybean meal diets.

SBM Content (%)	Experimental period (day)			
	30	60	90	120
0	0.31±0.10 ^{abc}	0.30±0.08 ^{bc}	0.26±0.10 ^{ab}	0.30±0.08 ^a
10	0.29±0.13 ^{bc}	0.32±0.08 ^{ab}	0.27±0.10 ^a	0.32±0.10 ^a
22	0.33±0.08 ^a	0.34±0.07 ^a	0.25±0.09 ^{ab}	0.32±0.08 ^a
34	0.31±0.05 ^{abc}	0.26±0.06 ^{cde}	0.25±0.09 ^{ab}	0.28±0.09 ^a
46	0.26±0.05 ^{cd}	0.22±0.06 ^{def}	0.23±0.03 ^{bc}	0.20±0.02 ^b
58	0.21±0.02 ^{de}	0.21±0.04 ^{ef}	0.14±0.05 ^{cd}	0.14±0.02 ^{bc}
70	0.19±0.04 ^e	0.17±0.05 ^f	0.12±0.03 ^d	0.13±0.03 ^c
CD	0.33±0.08 ^{ab}	0.28±0.05 ^{cd}	0.25±0.05 ^{ab}	0.30±0.09 ^a

¹ Weight of gallbladder/wet body weight $\times 100$, values within column with same superscript are not significantly different ($p>0.05$).

The weight change of gallbladder that related digest of lipid was shown at Table 1. GBWR was significantly decreased in experimental groups, which fed diets contained more than 46% of SBM ($p<0.05$). The changes of GBWR were shown at Fig. 1.

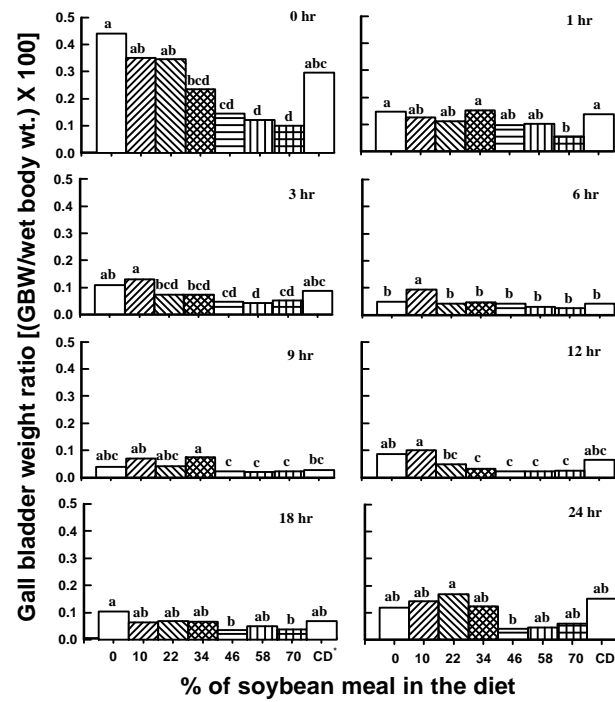


Fig. 1. Changes of gallbladder weight ratio (GBWR) in the rainbow trout tested with soybean meal diets. Hours indicate before and after feeding.

There was not significantly different GBWR of experimental fish fed diet contained SBM less than 22%, but the level of GBWR was significantly decreased at experimental fish fed diet contained SBM more than 34% ($p < 0.05$). The level of GBWR was suddenly decreased after feeding, reached minimum level at after 9 hrs then slightly increased from 12 hrs and finally recovered by 27.3~60% of beginning of experimental time. The level of serum bile acid of control group was $20.2 \pm 3.8 \mu\text{mol/l}$ but that of 58% SBM group was 10.4 ± 2.1 .

Above results showed that rainbow trout could digest dietary protein well but digestibility of lipid was decreased due to reducing circulation of bile acid when the fish fed diet contained more than 34% of SBM.

Acknowledgement

This work was supported by the Korea Science and Engineering Foundation (KOSEF) through the East coastal Marine Bioresources Research Center at Kangnung National University, Kangnung, KOREA.

References

- Avery, E. H., B. L. Lee, R. A. Freedland & C. E. Corneliust. 1992. Bile pigments in gallbladder and freshly-secreted hepatic duct bile from fed and fasted rainbow trout, *Oncorhynchus mykiss*. Comp. Biochem. Physiol. 101A :857-861
- Kim, P. K., J. K. Jeon & H. T. Huh & J. Y. Jo. 1999. Effects of dietary soybean meal in rainbow trout (*Oncorhynchus mykiss*). J. of Aquaculture 9 :265-278
- Talbot, C. & P. J. Higgins. 1982. Observations on the gallbladder of juvenile Atlantic salmon *Salmo salar* L., in relation to feeding. J. Fish. Biol. 21 :663-669.

