

Evaluate the usability of low-fish meal diets form of extruded pellet with animal and plant protein sources for olive flounder *Paralichthys olivaceus* at farm scale

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Introduction

Olive flounder (*Paralichthys olivaceus*) is one of the commercially important fish species in South Korea. It's production (43,813 tons) occupied around 50.1% of the total fish production of South Korea in 2023.

Animal protein sources are being considered as fishmeal (FM) alternatives due to their high protein content and lower cost, but they vary in nutrient content based on their composition. Plant protein sources are cheaper and more available but contain anti-nutritional factors (ANFs) that cause inflammation in fish. Secondary processed plant proteins like wheat gluten and soy protein concentrate, with high protein and low ANFs, are promising FM substitutes but are expensive and hard to use in large quantities.

Fishmeal (FM) has been the main source of protein for aquaculture species because it contains nutrients such as protein, lipids, minerals and vitamins for fish. However, the continuously rising demand for FM causes problems such as ecosystem destruction and supply and price instability. Replacing FM with other protein sources is essential for the development of a sustainable aquaculture industry. Therefore, this study was designed to evaluate the availability of low-fish meal (LFM) diets made using a mixture of animal and plant proteins as a FM replacement for olive flounder at farm scale.

Materials & methods

The main protein source of the control diet was sardine and anchovy FM (1:1; v:v) and contained 70% FM. Two experimental diets replaced FM with tankage meal, wheat gluten and soy protein concentrate and the FM level was reduced to 30 and 25%, respectively (designated as FM30 and FM25). The detailed formulation of the experimental diets is presented in Table 1.

Table 1. Dietary formulation of the experimental diets for olive flounder *Paralichthys olivaceus*

Ingredients	Diets (g/kg)		
	FM70	FM30	FM25
Fish meal, sardine	350	150	125
Fish meal, anchovy	350	150	125
Soybean meal	114	90	90
Tuna byproduct	-	150	175
Tankage meal	-	165	190
Wheat gluten	-	50	50
Soy protein concentrate	-	30	30
Starch	107	107	107
Fish oil	42	42	42
etc. ¹	37	66	66
<i>Proximate composition (g/kg)</i>			
Crude protein	562	558	547
Crude lipid	117	120	123
Ash	133	133	141

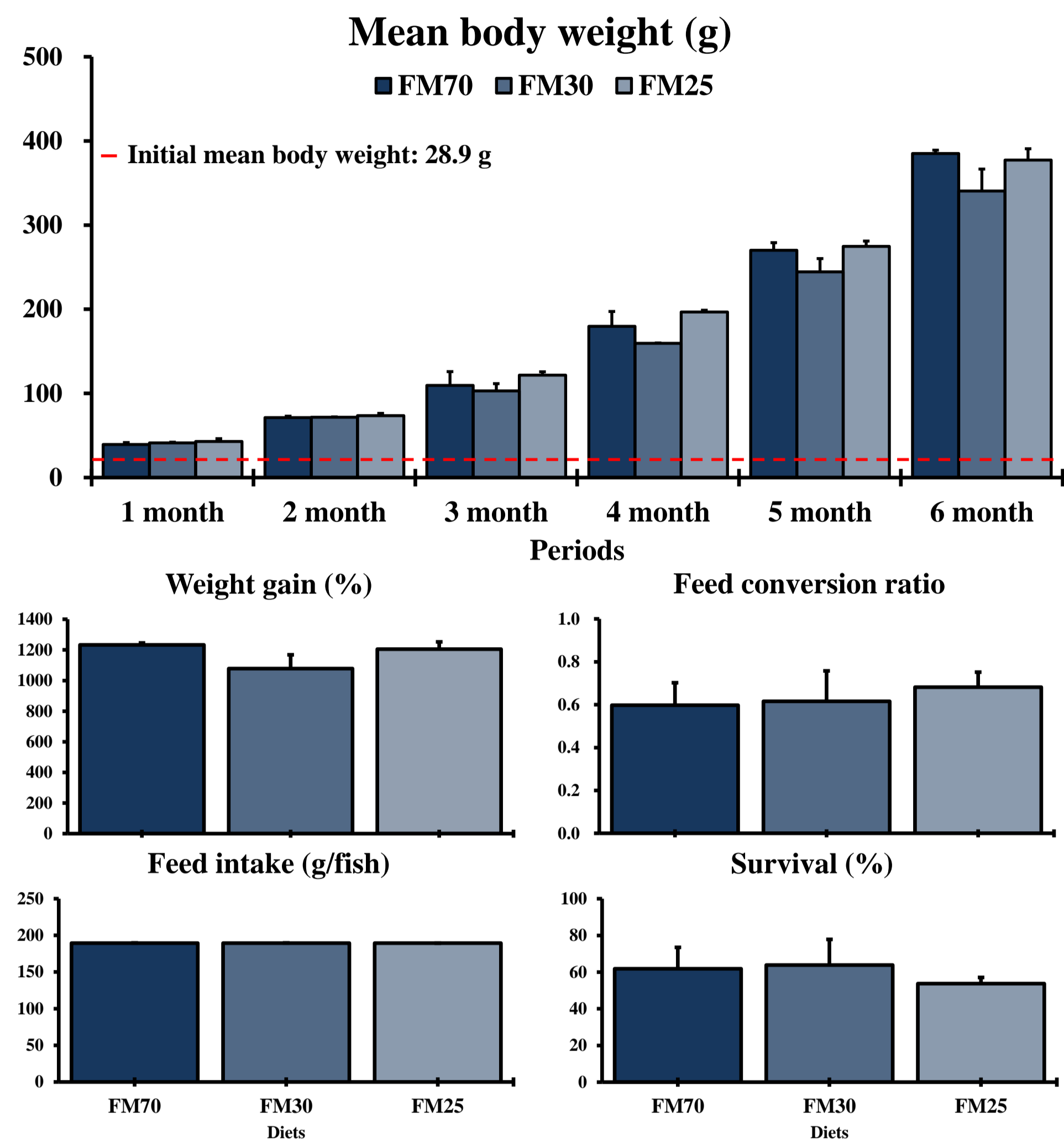
¹Ect contain lecithin, mono-calcium phosphate, choline, vitamin premix, Vitamin C and E, Mineral premix, methionine, taurine, lysine and betaine

The fish were acclimatized to the experimental conditions by being fed a commercial diet (Suhyup, Jeju, Korea) for 2 weeks. At the end of acclimatization, 60,000 juvenile olive flounder (22.3 ± 0.01 g) were randomly distributed into 6 square tanks at a stocking density of 10,000 fish per tank. For 6 months of the feeding trial, fish were fed one of the experimental diets twice a day (08:00 and 16:30 h) to apparent satiation. Every 30 min after each feeding, 70% of the culture water in each tank was exchanged with clean water.

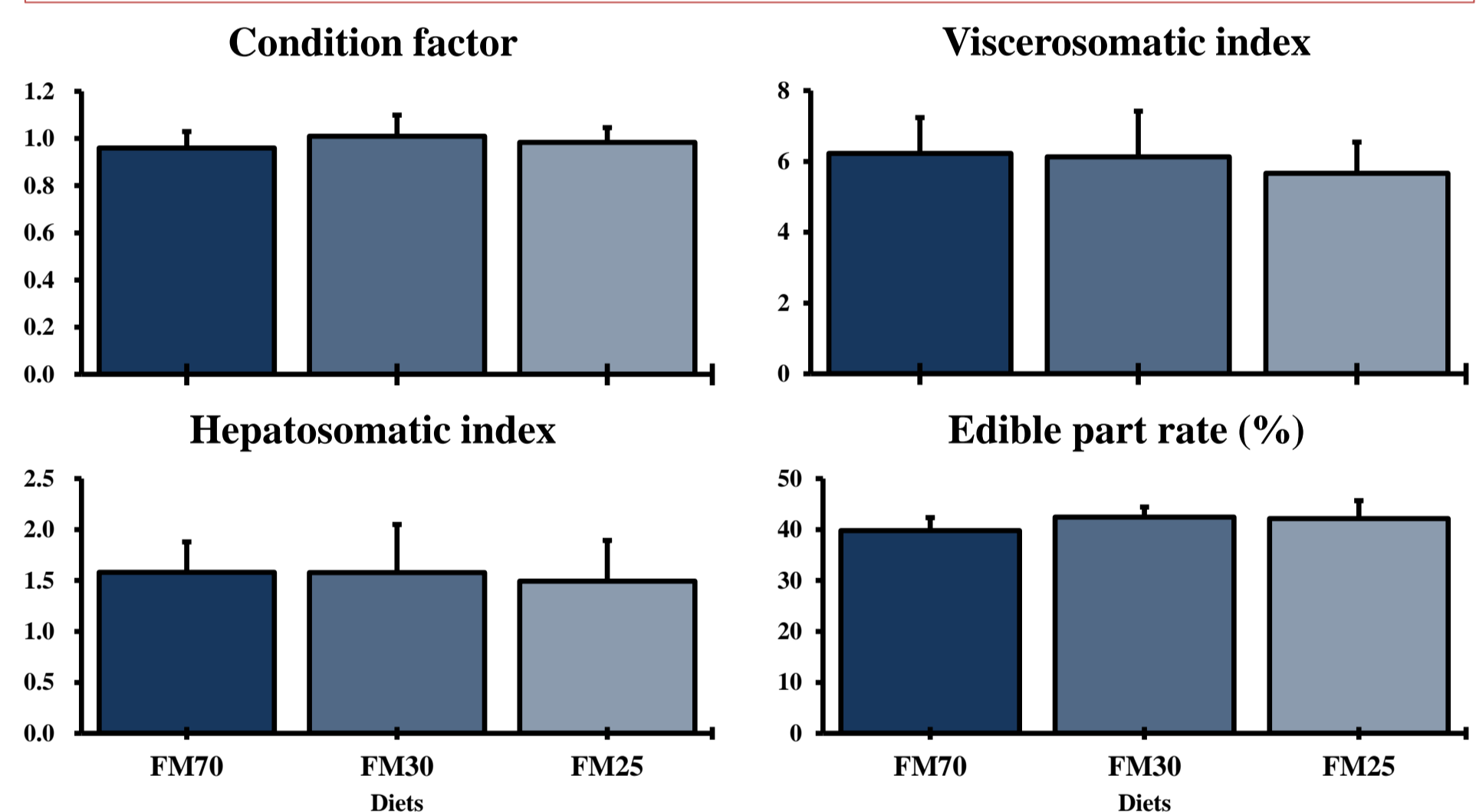


Results

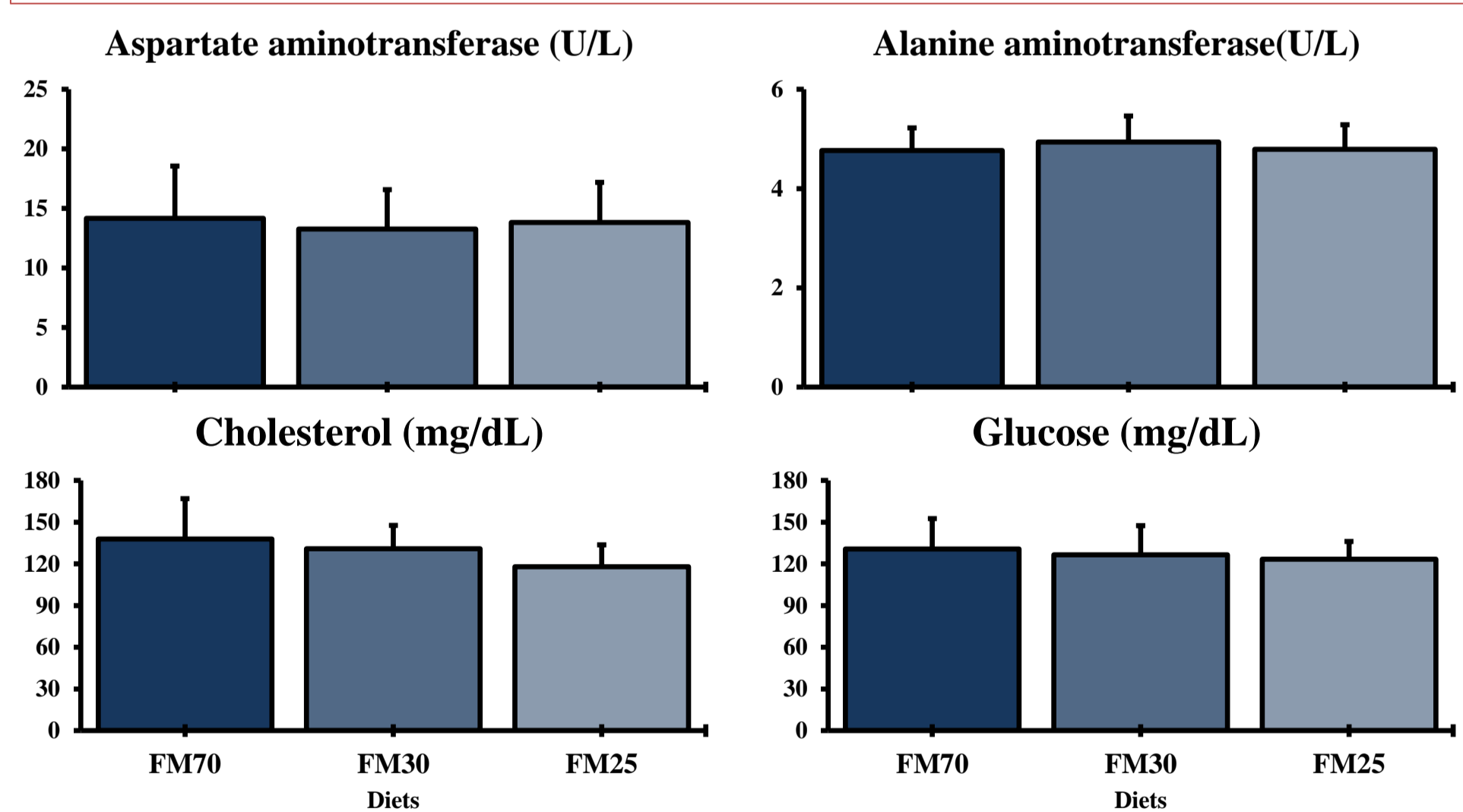
Growth performance, feed utilization and survival



Biological indices



Hematological parameters



Conclusion

- ✓ Even though the LFM diets were fed for a long period of time (6 months), there was no adverse effects on growth performance or biological indices and the FM levels in the diet could be reduced to 25%.
- ✓ We found that tuna byproduct meal, tankage meal, wheat gluten, and soy protein concentrate can successfully replace FM in juvenile olive flounder diets. In future studies, based on our findings, there is a need to develop the LFM diets with lower FM levels.

Acknowledgments

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