EFFECT OF DIETARY PROTEIN LEVELS ON GROWTH AND FEED UTILIZATION IN HYBRID GROUPER (*Epinephelus akaara* ♀ × *E. lanceolatus* ♂)

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Introduction

The red spotted grouper (*Epinephelus akaara*), a temperate species found mainly in rocky and coral reef areas, is commercially valued for its taste and desirable body color. However, it has a slow growth rate, taking around three years to reach the marketable size of 0.6 kg. The giant grouper (*E. lanceolatus*) is known for its rapid growth, reaching 3 kg in the first year and 20 kg by the fourth year, and is used as broodstock for producing fast-growing hybrid groupers. Hybridization is researched to develop commercially valuable species with better growth rates, disease resistance, and environmental adaptability. Protein is the most expensive component in fish diets and plays a major role in fish growth and health under cultured conditions. However, research related to the protein requirements of the hybrid grouper remains insufficient. This study evaluated the effects of optimal dietary protein levels on the growth performance, feed efficiency, and hematological responses of the hybrid grouper.

Epinephelus akaara **♀** ***E. lanceolatus*** **♂**

Hybrid grouper

Materials and methods

Four hundred fifty hybrid groupers (239.6 ± 0.02 g) were randomly distributed into 18 tanks (6 treatments in triplicate groups) and fed six types of feed with varying protein levels (40, 45, 50, 55, 60, and 65%). During the 11 weeks feeding trial, the water temperature was maintained at 24.5 ± 2.0°C, dissolved oxygen levels at 6.4 ± 1.3 mg/L, and salinity at 32.6 ± 1.3 psu. After the end of the experiment, growth performance and hematological parameters were analyzed for each experimental group.

Table 1 Ingredient and proximate composition of the experimental diets

	Experimental diets					
	P40	**P45**	**P50**	**P55**	**P60**	**P65**
Ingredient (% dry matter)						
Fish meal	26.5	34.5	42.5	50.5	58.5	66.5
Soybean meal	10.0	10.0	10.0	10.0	10.0	10.0
Wheat gluten	10.0	10.0	10.0	10.0	10.0	10.0
Wheat flour	43.6	36.3	29.0	21.7	14.4	7.1
Fish oil	5.9	5.0	4.1	3.2	2.3	1.4
Soybean oil	0.0	0.2	0.4	0.6	0.8	1.0
Vitamin premix	1.5	1.5	1.5	1.5	1.5	1.5
Vitamin C	0.5	0.5	0.5	0.5	0.5	0.5
Choline	0.5	0.5	0.5	0.5	0.5	0.5
Mineral premix	1.5	1.5	1.5	1.5	1.5	1.5
Proximate composition (% dry matter)						
Dry matter	95.2	95.4	94.0	97.2	98.1	97.6
Crude protein	40.3	45.0	49.8	54.4	58.7	63.3
Crude lipid	10.7	10.7	10.6	10.7	10.5	10.5
Ash	7.8	8.9	10.1	10.9	12.1	13.2

Table 2 Amino acid profiles of the experimental diets

	Experimental diets					
	P40	**P45**	**P50**	**P55**	**P60**	**P65**
Essential amino acids (% dry matter)						
Arginine	5.10	5.38	5.29	5.44	5.53	5.72
Histidine	2.28	2.31	2.28	2.33	2.33	2.35
Isoleucine	3.91	3.94	3.99	4.10	4.07	4.23
Leucine	7.09	7.02	7.20	7.35	7.25	7.41
Lysine	5.40	5.86	6.12	6.50	6.59	6.99
Methionine	1.82	1.94	2.06	2.14	2.09	2.14
Phenylalanine	4.14	4.14	4.26	4.15	4.02	4.24
Threonine	3.54	3.70	3.77	3.89	3.85	4.03
Valine	4.80	4.81	4.85	4.91	4.89	5.05
Non-essential amino acids (% dry matter)						
Alanine	4.81	5.02	5.26	5.41	5.42	5.64
Aspartic	7.37	7.68	7.88	8.27	8.22	8.56
Cystine	0.99	0.96	0.91	0.82	0.82	0.72
Glutamic	21.65	20.82	19.20	18.93	17.95	17.82
Glycine	5.12	5.26	5.49	5.65	5.69	5.95
Proline	6.02	5.62	6.13	5.65	4.85	5.23
Serine	4.31	4.33	4.26	4.27	4.15	4.22
Tyrosine	2.68	2.82	2.92	2.92	2.88	2.90

Results

The hybrid grouper accepted all experimental diets, with a consistent survival rate ranging from 96% to 100%, displaying no significant differences among the experimental diets. As the protein level in the diet increased from 40% to 60%, there was a corresponding increase in final weight, specific growth rate, and feed efficiency. However, further increasing the dietary protein level to 65% resulted in a decrease. The experimental findings indicated that feed intake normally decreased with increasing dietary protein level, except in the P60 group where this trend was not observed. Hematological analysis results were not influenced by dietary protein levels.

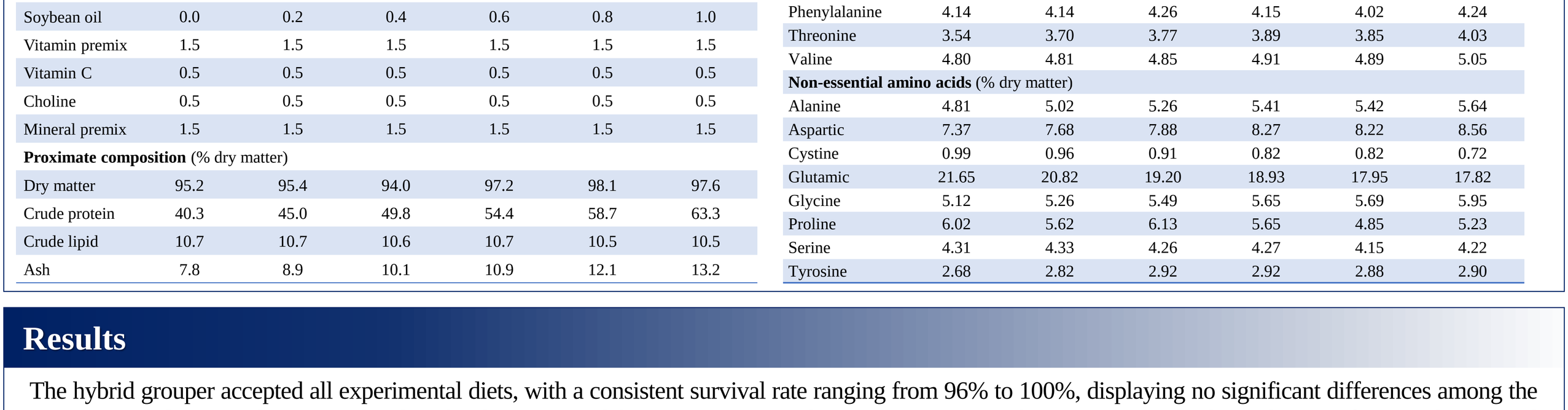

Fig. 1 Growth performance of hybrid grouper fed the experimental diets for 11 weeks. (A) final weight, (B) specific growth rate, and (C) feed efficiency. The data were stated as mean ± SE, where different letters were expressed as statistically different ($p < 0.05$).

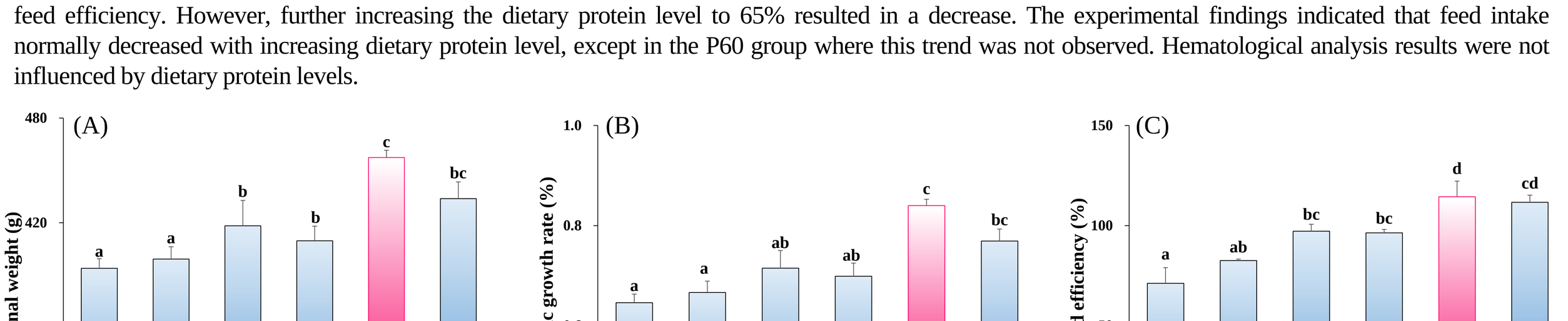

Fig. 2 Hematological parameters of hybrid grouper fed the experimental diets for 11 weeks. (A) Glucose, (B) Total protein, and (C) Glutathione. The data were stated as mean ± SE
ns: not significant

Conclusion

This study estimates that the optimal dietary protein level for the growth and feed efficiency of the hybrid grouper (*Epinephelus akaara* ♀ × *E. lanceolatus* ♂) is 60%

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