PepSoyGen in the diet of red drum, *Sciaenops ocellatus*

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Due to the limited supply and skyrocketing prices of fishmeal, the aquaculture industry is shifting towards the utilization of alternative protein feedstuffs in aquafeeds. Among the alternative feedstuffs with increased utilization, soybean meal (SBM) has been the foremost alternative ingredient partial substituting for fishmeal. In addition to its wide availability and competitive price, SBM has high protein content and a reasonably balanced amino acid profile with high digestibility coefficients for many aquaculture species. Nevertheless, as in the case of other monogastric animals, the presence of anti-nutritional factors (ANFs) including non-starch polysaccharides and protease inhibitors in SBM can negatively affect the physiological status of fish. Especially in the case of carnivorous fish species, such as red drum, studies have shown that production performance and survival may be reduced when high dietary levels of SBM are used to replace fishmeal, thereby limiting its utilization.

To overcome this problem, a solid-state fermentation process has been employed by Nutraferma® as a novel technology for improving the quality of SBM. As a result, the PepSoyGen®, a fermented and functional soy protein ingredient was introduced to the feed industry. The production process of PepSoyGen involves the inoculation of specific microbes (*Aspergillus oryzae* and *Bacillus subtilis*) to dehulled, low-temperature sterilized SBM, utilizing solid-state fermentation and enzymatic hydrolysis which reduces the concentration of most ANFs, increases protein content and digestibility, and enriches the final product with beneficial microbes and important metabolites. Overall, these characteristics make PepSoyGen a promising alternative ingredient meriting evaluation in diets of aquaculture species.

In an 8-week feeding trial conducted at the Aquacultural Research and Teaching Facility of Texas A&M University, the nutritional value of PepSoyGen in the diet of red drum was accessed. All experimental diets were formulated to contain 32% digestible protein (DP), 12% lipid, and an estimated digestible energy (DE) content of 13.8 MJ/kg. In total, seven diets were formulated including a fishmeal reference diet (designated as PSG-0), designed to contain all its protein from menhaden fishmeal, and six PepSoyGen test diets designed to replace the DP from fishmeal in the PSG-0 diet on a isonitrogenous basis, at 15% incremental levels (PSG-15 to PSG-90). Diets were supplemented with taurine at 1% along with DL-methionine and L-lysine in excess of the established requirements for red drum, and glycine was added for palatability. In addition, the established vitamin and mineral requirements of red drum were met through the supplementation of mineral and vitamin premixes. All diets were prepared by mixing dry ingredients in a V-mixer. Then the dry mixture was blended with menhaden fish oil and water using an industrial mixer with a meat grinding attachment, and pelleted through a 3-mm die. Resulting pellets were dried for 24 h using forced air at 25° C and stored at – 20° C until utilized. The Analyzed composition of the diets is presented in Table 1.

The feeding trial was conducted in 110-L aquaria operated as a recirculating system, whereby waste water gravity flowed to a settling chamber, then to a biological filter and was pumped through a sand filter and a UV-light system before being returned to the aquaria. Synthetic seawater was prepared using well water mixed with stock salt and Fritz brand synthetic sea salts to provide culture water of 7 - 10 g/L salinity. Water temperature was maintained at 26 ± 2°C by conditioning ambient air, and dissolved oxygen was maintained near air saturation using supplemental aeration. A 12h light:12h dark cycle was maintained using fluorescent lighting controlled by timers. Twenty red drum juveniles (mean weight of 1.5 ± 0.5 g/fish) were stocked in each aquarium and a 1-week conditioning period was given prior to the commencement of the feeding trial. Each of the test diets was randomly assigned to three replicate aquaria. Fish were fed twice daily for 8 weeks at a rate approaching apparent satiation. The feeding rate was adjusted weekly after group weighing all fish in each aquarium and maintained at a level that maximized intake without overfeeding. The feeding trial ended after 8 weeks of feeding, when red drum in each experimental tank were sampled for data collection and analysis.

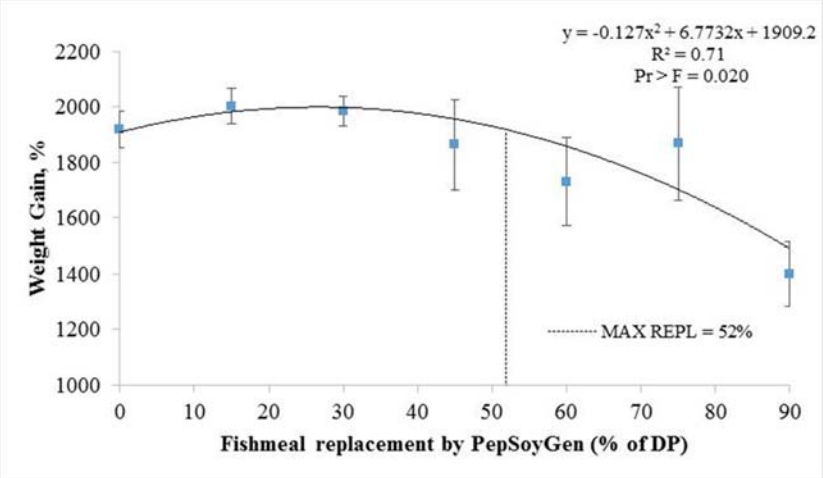
With the present experimental design, PepSoyGen was evaluated as a potential replacement for fishmeal at levels ranging from 15% to 90% of DP, allowing the estimation of the maximum replacement value (MAX REPL) of PepSoyGen for fishmeal using regression analysis. Red drum survival in the study ranged from 70 to 85% and

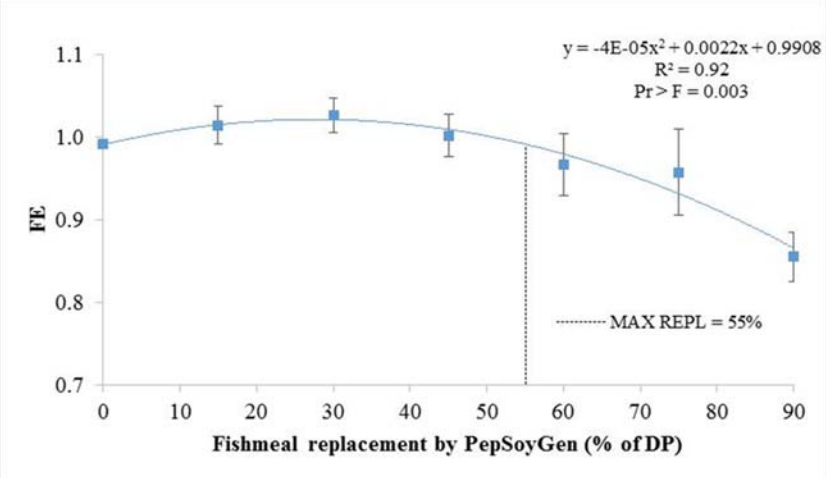
Proximate composition	PSG-0	PSG-15	PSG-30	PSG-45	PSG-60	PSG-75	PSG-90
	g/kg of dry matter						
Moisture	57.8	60.3	63.2	64.2	66.3	73.5	75.5
Crude Protein	431.8	428.8	428.5	429.5	426.6	430.8	421.4
Lipid	116.5	115.2	113.4	122.2	112.2	117.7	114.2
Ash	155.7	144.6	149.5	153.6	154.3	152.0	155.3

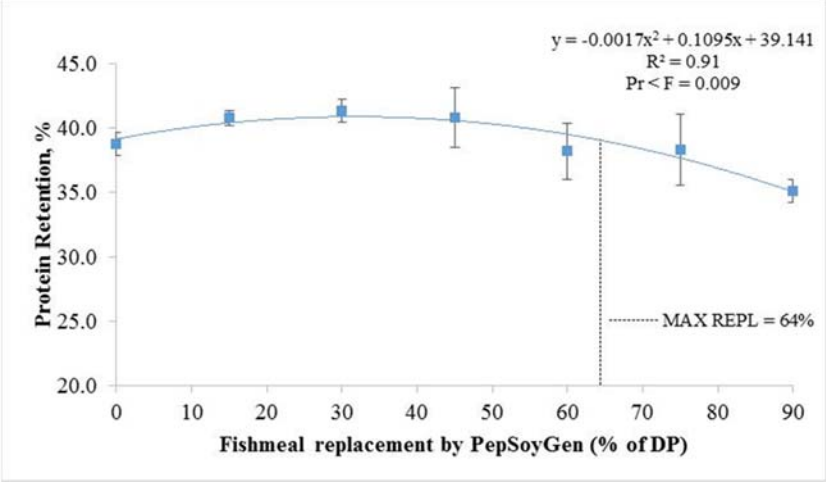
Table 1. Analyzed composition of experimental diets containing graded levels of PepSoyGen (PSG)

showed no relationship with dietary treatment. The overall production performance of red drum fed diets with incremental levels of PepSoyGen was best explained by second-order polynomial regression models. Weight gain expressed as a percentage of initial fish weight ranged from 1400 to 2000% (equivalent to the observed mean final weight of 25.1 and 36.2 g/fish, respectively), feed efficiency (FE) ranged from 0.86 to 1.03, and protein retention ranged from 35.1 to 41.3%. The results indicated that the MAX REPL of PepSoyGen for fishmeal in the diet of red drum was 52% for weight gain, 55% for FE, and 64% for protein retention (Figures 1-3, respectively).

Based on these results, PepSoyGen can be included in the diet of juvenile red drum replacing around 50% of fishmeal protein without affecting the overall production performance of the fish. Considering the actual market price of fishmeal (~ $1900.00 per metric ton), a 50% replacement of fishmeal with PepSoyGen in a 32% DP red drum diet would represent a 12 – 15% range reduction in formulation costs (depending on the cost of PepSoyGen). Therefore, PepSoyGen represents a cost-effective and environmentally sound alternative ingredient for red drum aquaculture. Further evaluations are needed to access its nutritional value in advanced stages of red drum production.







More information

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