

Growth and physiological effects of replacing fishmeal with dry-extruded seafood processing waste blended with plant protein feedstuffs in diets for red drum (*Sciaenops ocellatus* L.)

ABSTRACT

The utilization of seafood processing waste (SPW) is a potential means of reducing aquaculture's reliance on marine forage fish. Therefore, in an effort to recycle valuable nutrients such as high-quality proteins and polyunsaturated fatty acids from potentially wasted seafood processing, a novel approach was evaluated to enrich plant-derived feedstuffs. Four thermally-processed blends were manufactured by dry-extruding a mixture of either soybean meal (SBM) or distillers dried grains with solubles (DDGS) with two different ratios of SPW (60:40, and 40:60 of SPW: plant-derived feedstuffs on a wet-weight basis). Five diets were formulated to contain 36 % of crude protein and 12 % of lipid, and each of the four blends comprising treatments (SBM 60:40, SBM 40:60, DDGS 60:40, DDGS 40:60) which contributed 30 % of the dietary crude protein, with SBM providing 45 % and FM providing the remaining 25 %. The reference diet had its protein provided solely by FM. Groups of 30 fish (~98.8 g/fish) were distributed into 15 fiberglass tanks (1200 L), and fed the experimental diets in triplicate to apparent satiation twice a day for 8 weeks. At the end of the trial, four fish per tank had their intestine samples collected and flash frozen to measure digestive enzymes activities. The remaining fish were pooled per treatment, re-distributed into two tanks per treatment, and fed the experimental diets for an additional week. A transport-induced stress challenge was then performed, and fish were transported in a hauling tank for 2 h. Blood hematocrit, and plasma cortisol, lactate and osmolality, were measured from four fish per treatment at five sampling points: prior to and 30 min after transportation, and at 24, 36 and 48 h after the transport-induced stress challenge. Weight gain was significantly affected by the dietary treatments, with fish fed all blends but the SBM 40:60 outperforming those fed the reference diet. Fish fed all treatments also were significantly different from those fed the reference diet for hepatosomatic index. Dietary treatments also significantly impacted, relative to the reference diet, the activity of trypsin, alkaline phosphatase, and amylase. A lower percentage of red blood cells were observed for fish fed SBM 60:40 when compared to those fed the reference diet, but only before the transport-induced stress challenge. Based on the results of this study, the inclusion of both SPW blends had a favorable influence on production performance of red drum while reducing the fishmeal and fish oil in the diet formulation.

Keyword: Protein replacement; Digestive enzymes; Dry-extrusion; Fishmeal; Protein ingredient; Transport stress challenge