FEEDING THE FUTURE: THE POTENTIAL OF POLYCHAETE MEAL FOR EUROPEAN SEABASS FUNCTIONAL DIETS

M. Monteiro[a,1], R. S. Costa[a,1], J. Silva[d], K. Kousoulaki[b], L. Thoresen[b], Luisa M.P. Valente[a,c]

[a] CIIMAR/CIIMAR-LA, Centro Interdisciplinar de Investigação Marinha e Ambiental, Universidade do Porto, Terminal de Cruzeiros do Porto de Leixões, Av. General Norton de Matos, S/N, 4450-208, Matosinhos, Portugal;
[b] Nofima, Nutrition and Feed Technology department, Kjerreidviken 16, 5141 Fyllingsdalen, Norway.
[c] ICBAS, Instituto de Ciências Biomédicas de Abel Salazar, Universidade do Porto, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal.
[d] FCUP, Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre 1021 1055, 4169-007 Porto
[1] These authors equally contributed to this work.
Email: mailingmarta@gmail.com

Introduction

Common practices in aquaculture production often include procedures as fish manipulation for triages and transportation, which can act as stressors. Stressed fish are more susceptible to infection, potentially leading to massive losses for aquaculture produces. Hence, stress mitigation strategies, including the development of new functional feeds are on demand. Due to its high protein content and biochemical composition, polychaeta meal (PM) is emerging as a viable alternative to fishmeal and potential functional ingredient to modulate fish immunological system and/or stress response.
The overall aim of this study was to evaluate the potential of PM as a functional ingredient in European seabass diets by assessing its impact on intestinal health, metabolic and immune status, and hepatic oxidative response towards a stress challenge.

Materials and Methods

A growth trial with European sea bass (*Dicentrarchus labrax*) juveniles (14.5 g) was performed using four isoenergetic (22% dry matter, DM), isoproteic (51% DM), and isolipidic (17% DM) diets. A fish meal-based diet (FM, control) was compared with three experimental diets including 2.5% (PM2.5), 5% (PM5) and 10% (PM10) of spray dried PM (*Alitta virens*), to replace 10%, 20% and 40% of FM, respectively. All experimental diets were extruded (Nofima, Norway). Homogeneous groups of fish (initial body weight: 14.5g) were distributed by twelve 160 L fiberglass tanks and fed the experimental diets to satiety, three times a day (9h, 12h, and 16h), for 93 days. Triplicate groups were established per diet. The fish were subjected to a 12-h light/12-h dark photoperiod regime and kept in a recirculating saltwater system (salinity 35‰, 22 ± 1 ºC). Upon trial conclusion, fish were weighted and measured and a small part of the posterior intestine was fixed in phosphate-buffered 4% formalin, for histologic evaluation. The remaining fish underwent an acute stress challenge: 1-minute air exposure followed by 5-minute overcrowding. After 1 hour of recovery, plasma and liver samples were collected. Plasma metabolite levels, immune parameters and liver oxidative status of stressed fish were compared to those of non-stressed fish (n = 18).

Results

All diets equally promoted growth and ensured high feed efficiency. Posterior intestine health status was assessed by histologic analysis. No statistically significant differences were found among dietary groups concerning submucosa lymphocytes and granulocytes presence and lamina propria granulocytes. However, lamina propria lymphocytes presence was reduced in fish fed PM2.5 and PM10. PM impacted plasmatic metabolic status. Plasma glucose levels were significantly higher in fish fed PM10 compared to fish fed FM, independently of stress (**Figure 1**). Both the diet and stress condition affected the hepatic redox status. In non-stressed fish the basal GST activity was significantly higher in fish fed PM diets compared to those fed the CTRL, but no differences were observed in stresses fish. Likewise, the glutathione content was highest in fish fed PM2.5 and PM5 before stress.

Upon stress, a significant increase was observed in all biomarkers analyzed, regardless of the dietary treatment. Cortisol, lysozyme and peroxidase levels were not affected by diet. Although basal plasma lactate levels were similar between diets, levels after stress were significantly higher in fish fed PM2.5 compared to fish fed FM (**Figure 1**). On the other hand, no differences were observed in the hepatic redox status among dietary treatments.

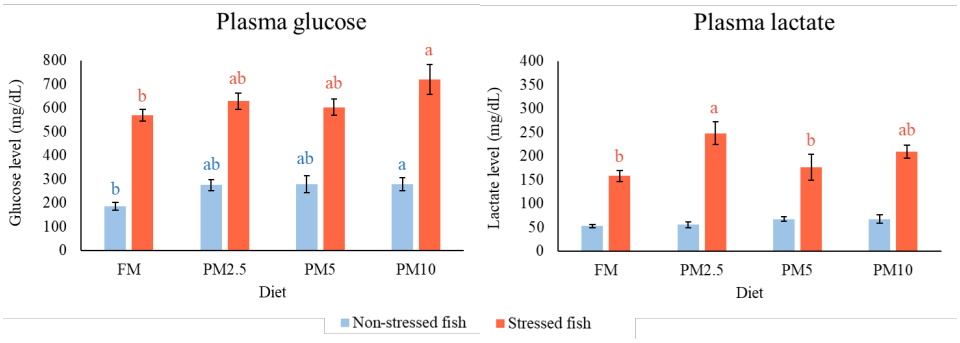

Figure 1. Plasma glucose and lactate of stressed and non-stressed European seabass juveniles fed the experimental diets.

Discussion and Conclusion

Our results suggest that dietary replacement of fishmeal with PM can modulate European seabass intestinal health and acute stress response, although dietary impact appears to be limited to metabolic (glucose and lactate) alterations. In the present work, PM10 fed fish exhibited higher glucose levels, independently of stress. Plasma glucose is commonly used as a sensitive indicator of stress in fish. However, the observed increase in this parameter, particularly in fish fed PM10 diets, may be attributed to an increase in gluconeogenesis to provide energy to meet the higher metabolic demands of these fish, independently of stress condition. Cortisol and lactate did not follow glucose increasing trend, supporting the idea that increased glucose in fish-fed PM may be linked to metabolic alterations not related to stress. Furthermore, the metabolic alterations triggered by PM in the hepatic redox status before experiencing stress, including increased activity of glutathione and GST, remain to be explored.

Acknowledgments

This work was subsidized by Project SIDESTREAM, funded through the ERA-NET BLUE BIOECONOMY COFUND by FCT – Foundation for Science and Technology (BLUEBIO/0005/2019). CIIMAR acknowledges FCT funding (UIDB/04423/2020, UIDP/04423/2020).