

Modulation of immunity and gut microbiota



photo of gilthead seabream © Héctor Cordero

Animal bodies have many bacterial cells and a large part of them live in our digestive system. The relationship of gut bacteria to many aspects of wellness and health including immunity it is known. Regrettably, the current diet is mainly poor in foods that feed these bacteria in a healthy way (e.g. many are pasteurized or irradiated). In this context, many strategies are focus on the improvement of gut bacteria and one of them is the use of probiotics. Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit to the host. To our days, the viability of live bacteria during large-scale production of food (i.e., commercial diets), during long-term storage and during transition through the gastrointestinal tract (i.e., the presence of acids or bile salts) is not reliable. For these reasons, different methods have been developed to preserve probiotic viability. Among them, encapsulation is one of most relevant due to ensure the survival of bacteria when supplied orally. Several types of polymers produced by living organisms have been tested for probiotics encapsulation being alginate one of the most used. Alginate is a naturally occurring polymer typically obtained from brown seaweed, and has been extensively used for many biomedical applications, due to its low toxicity and cost. Due to the numerous beneficial effects of probiotics not only in humans, but also in other farmed animals, we decided to study the effect of probiotics on gilthead seabream (*Sparus aurata*) one of the most important fish of Mediterranean aquaculture. Regarding fish, the studies about the use of encapsulation of probiotics are just starting.

Fish also have many microorganisms in their gut which could be treated with probiotics. As occurs in mammalian and other vertebrates, in fish the probiotic bacteria has to attach itself to the gut as one of the initial steps in order to exert their positive effects in the host. The efficacy of such

probiotics on fish is usually limited by poor availability of viable microorganisms on the gut. Therefore, there is currently much interest in getting better or prolong the viability of probiotics to be administered in the diet. Furthermore, one of the major benefits of probiotics on fish is also their positive effects on the immune system; the improvement of the immune system is a usual prophylactic strategy in farmed fish because it is a way of improving all the functions of the fish. Due to all these main considerations, our aim was to study the effect of the dietary administration of the probiotic *Shewanella putrefaciens* (a probiotic bacteria isolated from skin of healthy seabream specimens) encapsulated on calcium alginate beads to seabream specimens. Fish were fed for a month with diets containing encapsulated probiotics and then, their effects on the fish immune status and gut microbiota were studied. Results demonstrated that administration of alginate encapsulated SpPdp11 improve many parameters of the immune system which were determined in blood serum. Furthermore, significant increases were also detected in the expression levels of different genes (*mhcII?* and *tcr?*) in the immune cells (leucocytes from the head kidney, which is the main hematopoietic organ, similar to bone marrow, of fish). Furthermore, the administration of SpPdp11 encapsulated in alginate beads produced important changes in the intestinal microbiota. The most significant was the detection of lactic acid bacteria (*Lactococcus* and *Lactobacillus* strains) on gut from fish fed with the probiotic. The main goal of studies like this one is that the potential benefits of probiotics when administering to fish could improve aquaculture production, which is one of the main ways of produce proteins of high quality for feed humans.

Publication

[Modulation of immunity and gut microbiota after dietary administration of alginate encapsulated *Shewanella putrefaciens* Pdp11 to gilthead seabream \(*Sparus aurata* L.\).](#)

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