
The interplay between osmoregulation and digestive functioning in the gastrointestinal tract in salmonids: impacts of dietary factors

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Modern feeds, used in aquaculture, have an extremely high dry matter (DM) content which may be challenging for proper functioning of the gastrointestinal tract (GIT) in farmed fish (Buddington *et al.*, 1997). The majority of physiological studies has been carried on using fasted fish. Therefore, the dietary impact on GIT osmoregulation and the interaction between osmoregulation and digestion is largely unknown. Nowadays, it is recognized that feeding entails a physiological strain inside the GIT by altering ion balances (Wood and Bucking, 2010). Moreover, different challenges are faced by fish depending on the diet composition and environment (i.e., freshwater or saltwater). It is hypothesised that the diet composition has an impact on several osmoregulatory processes including mineral uptake and excretion, which also depend on the salinity of the aquatic medium. Therefore, the overall objective of the present project is to understand the interaction between osmoregulation and digestive functioning of GIT in salmonids during freshwater (FW) and saltwater (SW) life stages. Fish will be fed diets with contrasting levels of moisture content, dietary electrolyte balances (dEB), calcium (Ca²⁺) load and buffering capacity. The experimental design has been planned in order to test the above-mentioned dietary factors through *in vivo* experiments (Phase 1) using freshwater rainbow trout (*Oncorhynchus mykiss*) as experimental animal. Phase 1 aims at identifying which of the aforementioned factors interact with osmoregulation and digestion within the GIT of freshwater rainbow trout by altering chyme conditions through the diet. The observed alteration in chyme conditions *in vivo* in Phase 1, will be studied *in vitro* (Phase 2) at three levels of digestive functioning namely (a) digestive enzyme activity, (b) epithelial nutrient uptake and (c) gut motility/peristalsis. Finally, the consequences of moving from freshwater into seawater on digestive functioning (macronutrients and mineral absorption, enzyme activity and gut motility) will be studied in Atlantic salmon (*Salmo salar*) during Phase 3. The experimental diets composition of the last Phase will be assessed depending on the outcome of the previous experiments (Phase 1 & 2).