Influence of dietary protein and fibre concentrations on key rumen microbial populations

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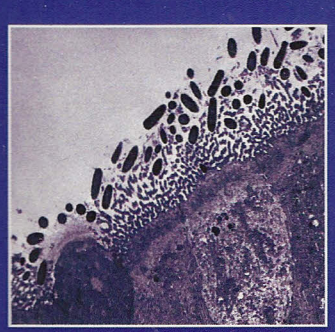

Gut Microbiology:

new insights into gut microbial ecosystems

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The non-culturable gut microbiota in cultured Atlantic cod (*Gadus morhua* L.) larvae and juveniles as function of diets and performance

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Cultured Atlantic cod larvae are vulnerable to bacterial infections during the earliest stages due to poorly developed immune defence and rearing conditions that often favour opportunistic microbes. Both during the larval stage, when larvae feed on the yolk sac and subsequently on cultivated live feed organisms, and during development into juveniles and weaning to formulated diets, high mortality rates and variable growth is very often the case in many cod hatcheries. To counteract microbial problems it is necessary to have good characterizations of how the microbiota in the larval and juvenile stage establishes, especially in the gastrointestinal tract as this is where the negative interactions are most likely to start. In this study the development of the gut microbial community in cod larvae and juveniles were characterized in fish from three groups fed different diets during the larval stage. The different diets induced larvae that performed differently regarding growth and stress resistance. The microbial communities in 10 single fish, water, and feed are characterized on day 4, 17, 32 and 61 after hatching, by use of DGGE analysis of 16S rDNA fragments amplified by PCR. Before the larvae were sampled they were not fed for around 12 hours, to allow for digestion of the feed and possibly excretion of the ingested bacteria that not were colonizing the intestinal surfaces. The sizes of the larvae and juveniles were determined by analysis of photographs of the single fish. The results will be used to evaluate how the gut microbiota of cod larvae and juveniles depends on larval diets and performance.

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Nitrogen losses from dairy production systems that exceed crop requirements can lead to soil eutrophication. Several feeding strategies can be used to increase nitrogen use efficiency in dairy cows, the most appropriate of which is the use of low protein diets coupled with a suitable carbohydrate source. However, modifications in the nutrient supply to the rumen can alter the balance of the microbial ecosystem, causing substantial changes and potentially detrimental effects on the rumen microbiota. The aim of the present study was to monitor the effect of dietary protein and fibre concentrations and sampling time on selected key rumen microorganisms.

Five rumen-cannulated Holstein cows in peak lactation were used in a 2x2 factorial design experiment to evaluate the effects of two protein (14.4 vs. 10.8 % CP in the DM) and two fibre (50 vs. 39 % NDF in the DM) concentrations using iso-energetic diets. At the end of each four week experimental period rumen content was sampled at 0, 2.5 and 5h after feeding. Quantitative PCR was used to assess changes in abundance of the following microorganisms: protozoa, anaerobic fungi, archaea, total bacteria and ten different bacterial species. This study showed that the most fibrous diet promoted an increase in the concentrations of protozoa, fungi and archaea, while it decreased the abundance of *Ruminococcus flavefaciens* and *Selenomonas ruminantium*. Moreover, the concentrations of *Prevotella bryantii*, *Butyrivibrio fibrisolvens*, *Ruminococcus albus* and *Fibrobacter succinogenes* decreased with the low protein diets. The sampling time also modified the concentration of some microorganism studied.