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Genomic Based Innovation Platform to Overcome the Metabolic and Nutritional Bottlenecks of Poor Use of Plant and Animal Based Ingredient Sources in African Aquaculture

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Abstract

The worldwide supplies of fish meal and fish oils have reached their sustainable limits. Thus, profitability of aquaculture will depend on the efficiency of nutrient utilisation from alternative ingredients. The long term challenge for aquaculture is improvement in productivity and expansion of sustainability to meet the growing demands for diverse aquaculture products. Consequently, there is ongoing effort to reduce feed cost by using low priced ingredients or novel alternative feedstuffs. Another way of reducing feed costs is by increasing the efficiency with which cultured fish could convert feed into the marketable product. This can be done by nutritional modification, and using early genetic programming cues for better nutrient metabolism coupled with selecting those individuals with superior genetic potential for efficient use of nutrients. The present work revealed that using genomic technologies to understand how early nutritional events of feeding plant and animal based feeds to early life history stage of fish during the critical developmental windows, resulting in permanent changes in juvenile and adult growth potential, health and metabolic status. Also, revealed an important window for potential modification of the long term physiological functions and lead to development of commercial formulations that could exploit the genetic variability to advance production efficiency and profitability of aquaculture. Understanding how the molecular mechanisms of nutritional programming effect intestinal microbiota and health in African fish could reveal factors that control important traits, such as disease resistance, feed efficiency, growth rate, and tolerance to environmental stressors. The expression of specific microRNAs involved in metabolism, and the composition of gut microbiome was estimated. Thus, the primary objective was to assess the short and long term effects of feeding of African fish with plant or animal based dietary ingredients on metabolic programming with respect to the regulation of genes involved in digestion/transport/metabolism. This work will provide African decision makers with background knowledge that will allow them to appreciate the impact of aquaculture in the African agriculture at large.

Keywords: Africa, animal, Aquaculture, ingredients, metabolism, microRNAs, nutrigenomics, plant, poor