

PANCOSMA'S FEED ADDITIVE SOLUTIONS FOR AQUACULTURE

Enhancing performance and improving resistance to environmental or pathogenic stresses: evidence from experimental challenges

The developing market for aquaculture today represents a rising share of the global feed market, accounting for 5% in volume and 10% in value of total feed production. Farm-raised fish contribute to 50% of all sea food consumed around the world, and this number is expected to increase to more than 60% by 2030. With the mounting need for appropriate and high performing solutions for use in aquaculture farms, there has been a significant rise in the demand for compound feed to raise farmed aquatic species, and in particular for sophisticated and well-formulated products. Accordingly, feed additives have the potential to add greater nutritional value to aquaculture feed, and provide the benefits of advanced technology.

To satisfy this crucial need in the industry, Pancosma & Associates, the Switzerland-based global leader in feed additives for livestock, has recently introduced innovative tools and products targeted for aquaculture nutrition. With years of experience as a pioneer in the field of phytonutrients, including a 100% plant extract-based product that has received zootechnical approval for use in broilers, Pancosma & Associates has developed two original feed additives for aquaculture: XTRACT®Fish and XTRACT®Shrimp. These products consist of standardized micro-encapsulated particles, containing carefully selected combinations of bioactive substances found naturally in aromatic plants and spices, which function to enhance health and performance.

These promising solutions have the potential to boost the nutritional status of aquatic species and improve their natural defence systems to withstand external challenges, without the need for antibiotics in feed, and consequently limit major economic losses faced caused by commonly occurring pathogens in aquaculture farms. Created using advanced manufacturing processes, these additives go one step further to overcome the loss of product efficacy resulting from harsh feed production methods, which hampers productivity in farms. XTRACT®Shrimp and XTRACT®Fish are made in a manner which allows them to be mixed with fish oil and top coated, or added directly to feed prior to the

harsh extrusion or pelleting conditions, which the additives have been proven to resist.

In the following studies, the health and immune enhancing properties of XTRACT®Fish and XTRACT®Shrimp were evaluated in the Pacific white shrimp and Nile tilapia, under two different situations: optimal conditions and in response to external challenges.

XTRACT®Shrimp improves performance and resistance to disease in Pacific white shrimps



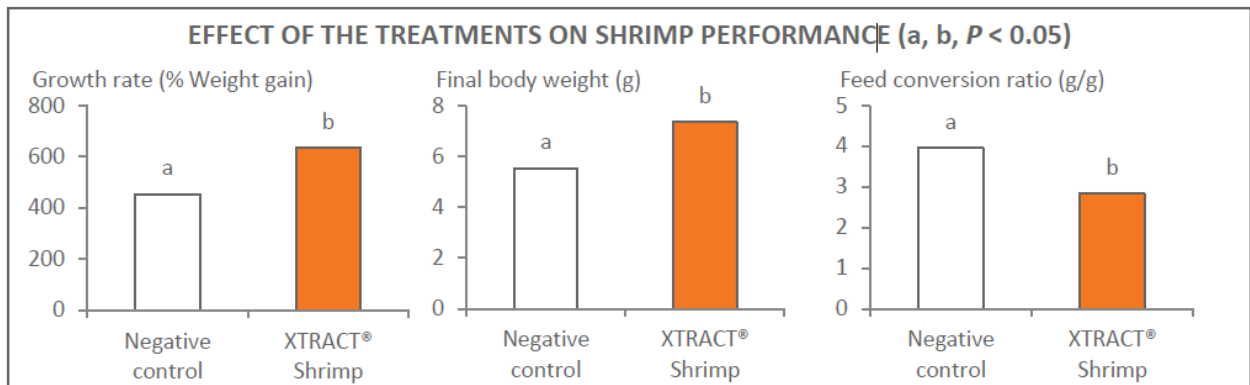
Pacific white shrimp

The major challenges in shrimp farming include optimizing parameters of productive performance such as the growth rate, final weight, and feed efficiency, while at the same time limiting mortality resulting from external stresses and challenges. Among these factors, infection with the *Vibrio* strain of bacteria has been shown to be a major threat to a large number of farms, and is known to cause one of the major diseases affecting aquaculture. In a trial led by a research team at the Chulalongkorn University in Thailand, the effects of XTRACT®Shrimp on overall performance and resistance to *Vibrio cholerae* in Pacific white shrimps (*Penaeus vannamei*) were studied. The results support the role of XTRACT®Shrimp in enhancing immune function and strengthening host resistance in response to pathogen challenge.

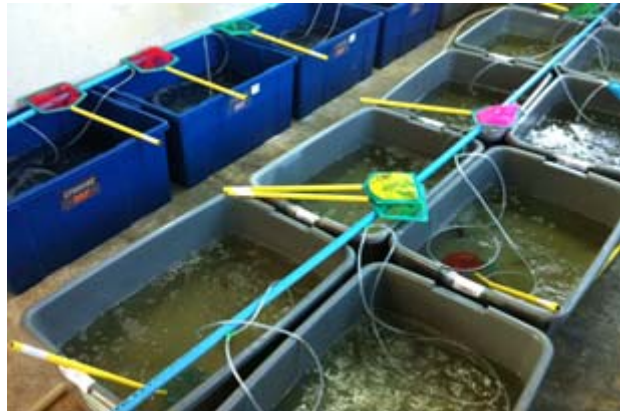
Trial protocol

Pacific white shrimps (post larvae 15 days), each weighing 1 g, were transferred to tanks, with each tank containing 20 shrimps in total. The shrimps were treated with either the negative control or with feed supplemented by XTRACT® Shrimp, and each treatment was replicated five times. The negative control consisted of a basal diet composed of fishmeal, squid powder, squid liver powder, shell meal, wheat flour, soybean meal, vitamins, and minerals. The supplemented feed comprised the basal diet in addition to 200 g/t XTRACT® Shrimp, mixed with fish oil and top coated at 1.5% onto the pellets. The trial was divided into two parts; during part one of the trials, the shrimps were evaluated for a period of four months under optimal conditions, and in part two, the shrimps were studied following exposure to the pathogenic *Vibrio cholerae*.

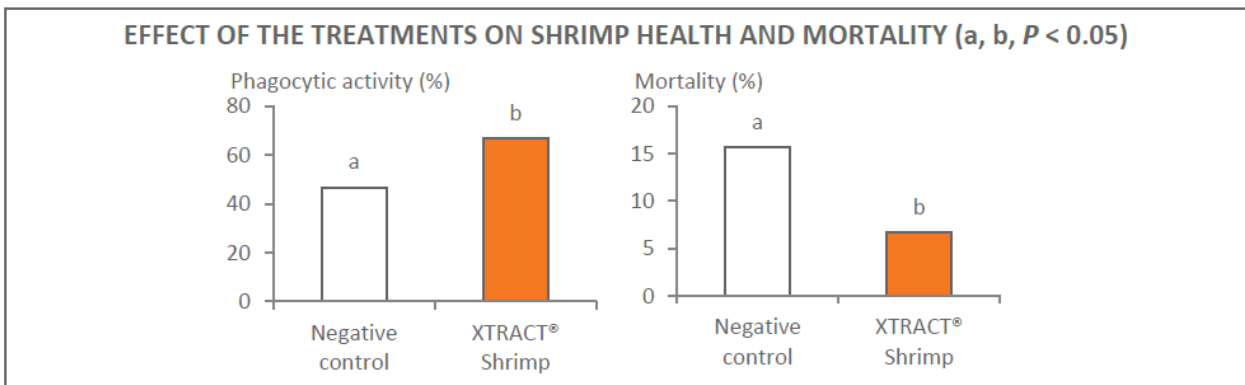
Optimal conditions



During optimal conditions, exposure to XTRACT® Shrimp resulted in a significantly improved growth rate, which resulted in a higher final body weight ($P < 0.05$). In addition, the feed efficiency of shrimps fed with XTRACT® improved compared to shrimps receiving the basal diet only ($P < 0.05$). In addition, XTRACT® exerted immune-modulating properties as demonstrated by the greater phagocytic activity, resulting in a reduced mortality rate during this period ($P < 0.05$, see figure below).

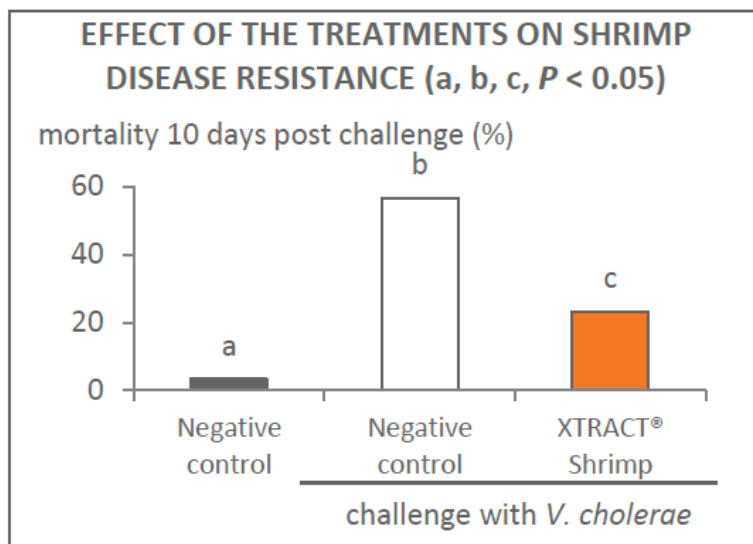


Sampling of hemolymph from ventral sinus to measure phagocytic activity. Trial led at the Chulalongkorn University in Thailand



Challenge with *Vibrio cholerae*

During part two of the study, the shrimps were closely observed for a period of 10 days following the intra-muscular injection of *Vibrio cholerae* at the LD50 dose. Subsequent to pathogen challenge, the shrimps supplemented with XTRACT® showed a reduced mortality rate that was 2 fold lower compared to the challenged negative control (mortality rates of 23.3% and 56.7% respectively; see figure). These studies support the role of XTRACT® in enhancing the resistance of the shrimps to pathogen infection.



XTRACT®Fish improves performance and resistance to disease in Nile tilapia



Nile tilapia

digestion and reduced intestinal inflammation, leading to better nutrient absorption and improved gut integrity and health. As a result, the use of XTRACT®Fish results in a greater availability of energy for optimal performance of the organism and a reduction in sensitivity towards stress. In a trial led in Israel by the AquaVet Wet Lab Facility, the effects of XTRACT®Fish on performance and resistance to environmental stress in Nile tilapia (*Oreochromis niloticus*) were evaluated.

One of the critical factors affecting tilapia farming is poor water quality, which negatively affects crucial performance indicators such as growth rate, final body weight, and feed efficiency, and often results in high mortality rates. The bioactive components of XTRACT®Fish function to promote improved feed



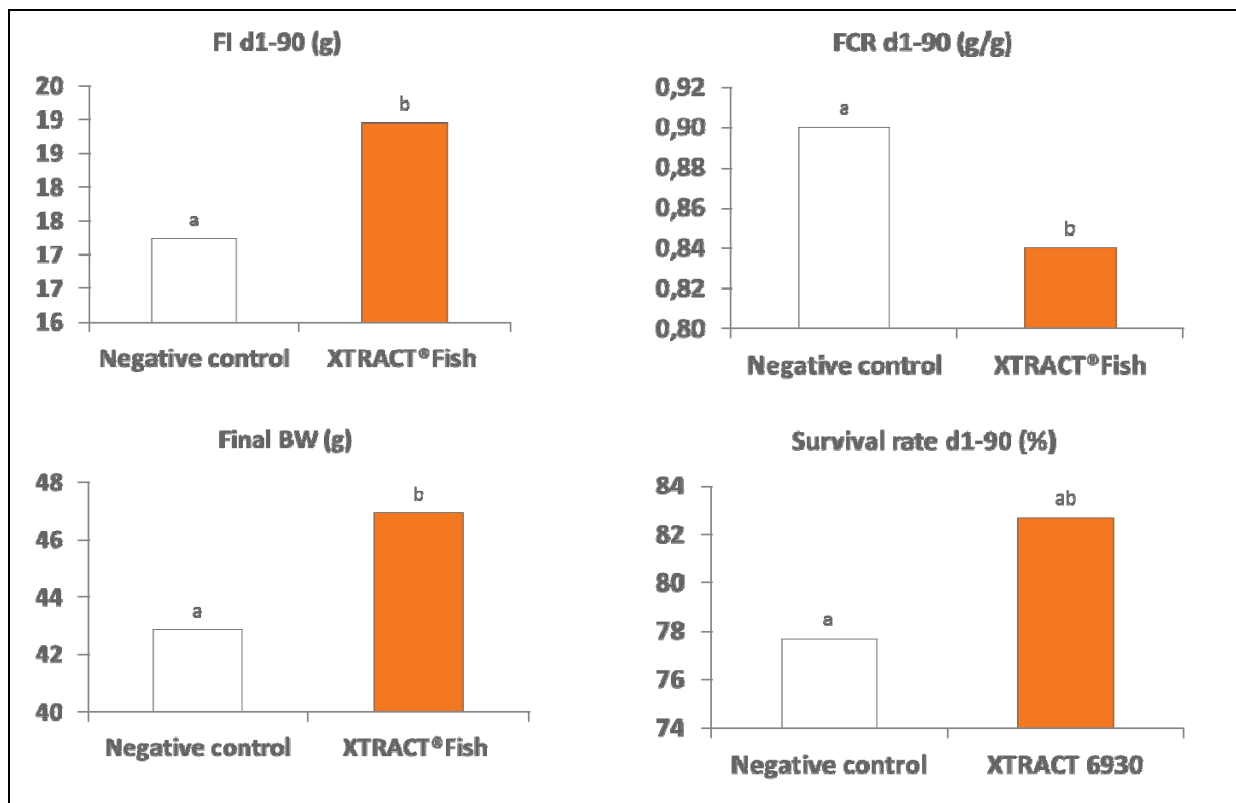
Trial led at the AquaVet Wet Lab Facility, Israel

Trial protocol

Juvenile tilapia fish with a body weight of 0.22 g were transferred to tanks, and each tank was allocated 50 fish. The tilapia were administered either the negative control or the XTRACT®Fish supplemented feed. Each treatment was replicated six times. The negative control consisted of a basal diet made of fishmeal, de-hulled soybean meal, protein by-products, cereals, and a premix. The supplemented feed consisted of the basal diet with the addition of 200 g/t XTRACT®Fish mixed with fish oil and top coated at 1.5% onto the pellets.

Similar to the previous study, this trial was divided into two parts; during part one of the trial, the tilapia were evaluated for a period of three months under optimal conditions, in which the water was maintained at an optimal quality level (temperature > 25°C, oxygen > 6 ppm, ammonia < 0.5 ppm, nitrite < 0.4 ppm). During part two, the tilapia fish were studied in response to challenging water conditions.

EFFECT OF THE TREATMENTS ON TILAPIA PERFORMANCE (a, b, c, $P < 0.05$)



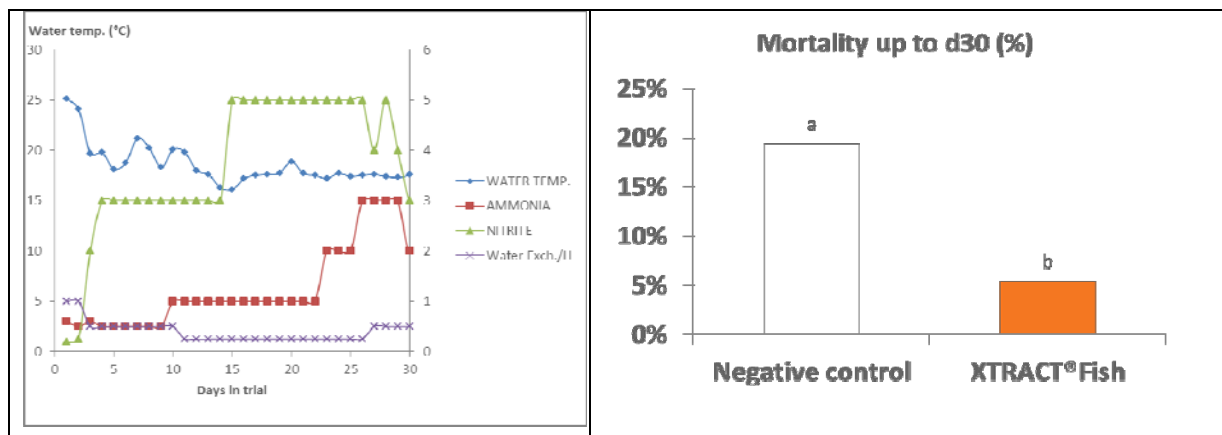
Compared to the fish administered the negative control, tilapia fed with XTRACT®Fish showed an increase in feed intake by 9.9%, and final body weight by 9.4%. Furthermore, they demonstrated a higher survival rate by 6.4% ($P < 0.05$), and reduced FCR by 5.7% ($P < 0.05$).

Challenge

The second part of the trial was performed in challenging conditions, in which for a period of one month, the water quality and temperature were progressively deteriorated. The water temperature was decreased from 25 to 17°C, and the levels of ammonia and nitrate were increased from 0.6 to 3 ppm, and from 2 to 5 ppm, respectively. In addition, the water exchange rate per hour was reduced from 100 to 25%. The resulting condition led to a state of progressive anorexia.

Juvenile tilapia fish fed a diet supplement with XTRACT® and placed in an environment with poor water conditions, exhibited a significantly lower

mortality rate compared to the negative control, suggesting that XTRACT® helps Nile tilapia resist challenging environmental conditions.



Conclusion

The two feed additives, XTRACT®Fish and XTRACT®Shrimp, improved overall performance and resistance to environmental or pathogenic stress in the Pacific white shrimp and the Nile tilapia, two aquatic species that represent the largest potential for commercial aquaculture feed globally. These phytonutrient solutions were shown to improve the performance efficiency of fish and shrimp, which has the potential to generate greater financial profit for farmers.

Aquaculture faces numerous challenges hampering the health of aquatic species, as well as the economic performance of farms themselves. In addition to phytonutrients, Pancosma & Associates has designed additional feed additives based on their extensive expertise in a wide-range of nutritional solutions, to aid aquaculture farms in overcoming these challenges. This diverse portfolio of products targeted for aquaculture includes, organic trace minerals, microbiota modulators and toxin binders.

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