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Are probiotics worth the cost?

by Bill Mancini

I am often asked if I think the effectiveness of probiotics justifies their cost. I don't have to think long, and answer with an emphatic, "Yes, in the vast majority of cases."

Over the past 10 years, I have really grown to appreciate the value of probiotics, based primarily on how they work, and the alternatives to them.

Let's take a closer look at precisely how probiotics do what they do.

In the simplest terms, probiotics are beneficial bacteria. Think of them as foot soldiers in a ground war, each armed with an ability to drain the enemy (i.e., pathogenic or disease-causing bacteria or viruses or fungi or parasites) of their ability and "will" to fight.

The way probiotics work can vary. But an interesting analogy to their most common mode of action is what happened to United Nations forces at Chosin Reservoir during the Korean War, a bone-chilling November of 1950.

During this battle, 30,000 American and UN forces had advanced far north into North Korea to the Chosin Reservoir, almost to the Yalu River—the border between North Korea and China. This action greatly alarmed and threatened the communist Chinese, and elicited a response that was surprising at the time.

American generals Douglas MacArthur and Edward Almond failed to anticipate the Chinese reaction, and were convinced that superior American weaponry and tactics would win the day, regardless of any efforts by the Chinese to resist the offensive.

Chinese leader Mao Zedong subsequently ordered 120,000 Chinese troops to cross the Yalu and halt and repel the advance of American and UN forces.

With a 4-to-1 advantage in numbers, the Red Army stunned the American commanders and forced a hasty retreat, with the majority of Marines and other troops barely escaping with their lives.

Sheer numbers, life-threatening cold weather, and attack from higher ground won the day for the Chinese forces.

This is precisely the manner in which probiotics can turn the tide of disease, or prevent it from happening in the first place.

Probiotic bacteria can be applied to a culture environment in which fish live, or added to feeds that are consumed by the fish stocks. This hoard of beneficial bacteria then take up residence, and can effectively overwhelm any existing pathogenic organisms, or prevent them from establishing a foothold that leads to disease.

Many pathogens use a strategy called quorum sensing to coordinate an assault on a victim—your fish. This strategy involves occupying a space (e.g., the water surrounding a fish or the fish's gut), reproducing within that space if numbers are initially low, reaching a “critical mass” of numbers, and then launching a coordinated attack on the victim by using and sensing biochemical attack signals after critical mass—or a quorum of individual pathogens—has been reached.

Individual pathogenic bacteria become a much more formidable opponent—by many orders of magnitude—when they act in unison against the victim. Indeed, the whole becomes much greater than the sum of the parts. The coordinating attack signal when a quorum is reached is the key.

Probiotic bacteria counter this strategy by several means. First, they are applied by you in overwhelming numbers. They effectively out-compete the pathogens for space.

Next, out-competing the pathogens thwarts quorum sensing by preventing the pathogens from reaching a critical mass. The signal to attack the fish is never released.

Finally, the probiotic bacteria themselves form a highly dense population that uses quorum sensing to release beneficial biochemicals such as vitamins or other compounds that are actually beneficial to the fish or have other anti-pathogenic properties.

Quite literally, they change the physical and chemical landscape (i.e., the environment) of the “battlefield.”

In my view, this approach to treatment of fish disease and the promotion of fish health is far superior to more conventional methods such as antibiotics—which are limited in use to treating pathogenic bacteria, carry side effects, threaten people on multiple levels, and eventually cause disease resistance—and even vaccines which again run the risk of failure as pathogens of all kinds mutate and “out-flank” the strategy.

Indeed, all antibiotic therapies eventually fail through pathogenic mutation, and ironically encourage the formation of so-called “super bugs” that confound further use

of any other existing antibiotics, and threaten our fish stocks (and people!) with complete annihilation.

That must change, and probiotics are a great place to start.

Let's be clear. Probiotics, and prebiotics (which are often applied and added with probiotics as a food source on which the probiotic bacteria can multiply), are not a panacea.

They are not effective in all cases, and can be less effective against specific strains or species of bacteria, viruses, fungi, and parasites. That said, in their current form and state of the art, they do not have many of the drawbacks or downside of current disease-treatment and fish-health strategies and approaches.

The future of probiotics lies in our ability to take this relatively constrained success and apply genetic technologies, such as the CRISPR-Cas9 system of gene editing, to greatly enhance the types and effectiveness of probiotic bacteria in ways that either I do not have time to expand on here, or cannot yet imagine.

As I alluded to above, probiotics can today (and certainly tomorrow) be counted as potential vehicles for the introduction of nutritional compounds such as vitamins and other immunostimulants and nutrients to fish feeds, or directly into the guts of our fish stocks.

Quite simply, I envision a future where these "silver bullets" called probiotics virtually eliminate pathogenic disease as a meaningful consideration in our calculus of costs for fish production, and greatly enhance in wonderful ways the nutritional efficiency and status of our fish.

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