

Probiotics

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Introduction

- As we know, aquaculture is growing faster than beef cattle production (10% vs. 3%)
 - Epizootics (disease) = major limiting factor in fish/shrimp developments!
 - Disinfectants, antimicrobial drugs have had little effect in controlling disease.
 - Massive use of antimicrobials increases selective pressure on microbes and encourages natural emergence of bacterial resistance
 - Resistant bacteria thrive after non-resistant strains have been killed and can even pass on resistance genes to other bacteria that have not been exposed to antibiotics
 - Emphasis should be place on prevention
 - More cost-effective than cure!
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Marine Probiotics and Prebiotics

- Marine Probiotics are microorganisms that are believed to provide health benefits when consumed. The term probiotic is currently used to name ingested microorganism associated with beneficial effects to humans and animals.
- We usually think of bacteria as something that causes diseases. But your body is full of bacteria, both good and bad. Probiotics are often called "good" or "helpful" bacteria because they help keep your gut healthy.
- We can find them in some Natural Products and supplements.
- Lactobacillus and Bifidobacterium are the most common probiotic bacteria.

- Antimicrobials, disinfectants and pesticides largely treat symptoms of the problem and not the cause
 - Alternative strategies are just catching on
 - **Example:** via vaccination, Norway has reduced chemical therapeutant use from 50 MT in 1987 to less than 747 kg in 1997 (with 7x concomitant production increase!)
 - **Other:** use of immunostimulants w/or w/out vaccines
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- Use of bacteria as a food source and as a biological control agent of fish disease was first proposed by Yasuda and Taga (1980)
 - *Vibrio alginolyticus* has been used as a probiotic in shrimp hatcheries in Ecuador since 1992
 - Reduced hatchery down time from 7 days per month to less than 21 days per year!
 - FAO has now designated use of probiotics as a major means for improvement of aquatic environmental quality
 - **Ultimate goal:** make aquaculture products more acceptable to consumers
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Definition of Probiotics

- Many proposed, however: *a live microbial feed supplement which beneficially affects the host animal by improving its intestinal balance*
 - Historically: terrestrial animals, genus *Lactobacillus*
 - Definition (above) requires some additional considerations:
 - 1) bacteria in aquatic medium influence composition of gut microbiota and vice versa
 - 2) immediate ambient environment has much greater influence on microbiota than with terrestrials
 - In aquatic environments, hosts and microorganisms share the ecosystem
 - Terrestrials: the gut represents a moist habitat in a water-limited world
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- Marine Bacteria as Probiotics
- Types of Probiotics
- Role of Probiotics & Prebiotics in Human Health
- Marine Probiotics in aquaculture
- Probiotics in Animal Health



Marine Bacteria as Probiotics

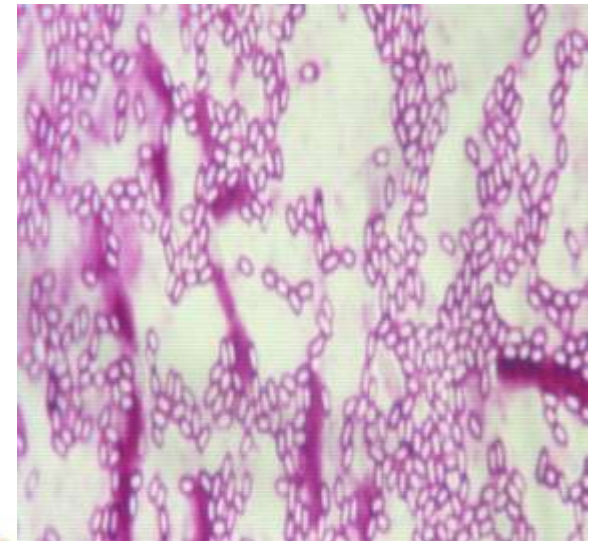
Bacteria *Vibrio* sp., *Pseudomonas* sp., and *Bacillus* sp. and many other *Lactobacilli* sp. have been used successfully as probiotics in mollusk, crustacean, and finfish aquaculture and most of them were identified from aquatic animals culture environment or from the intestine of different aquatic species.



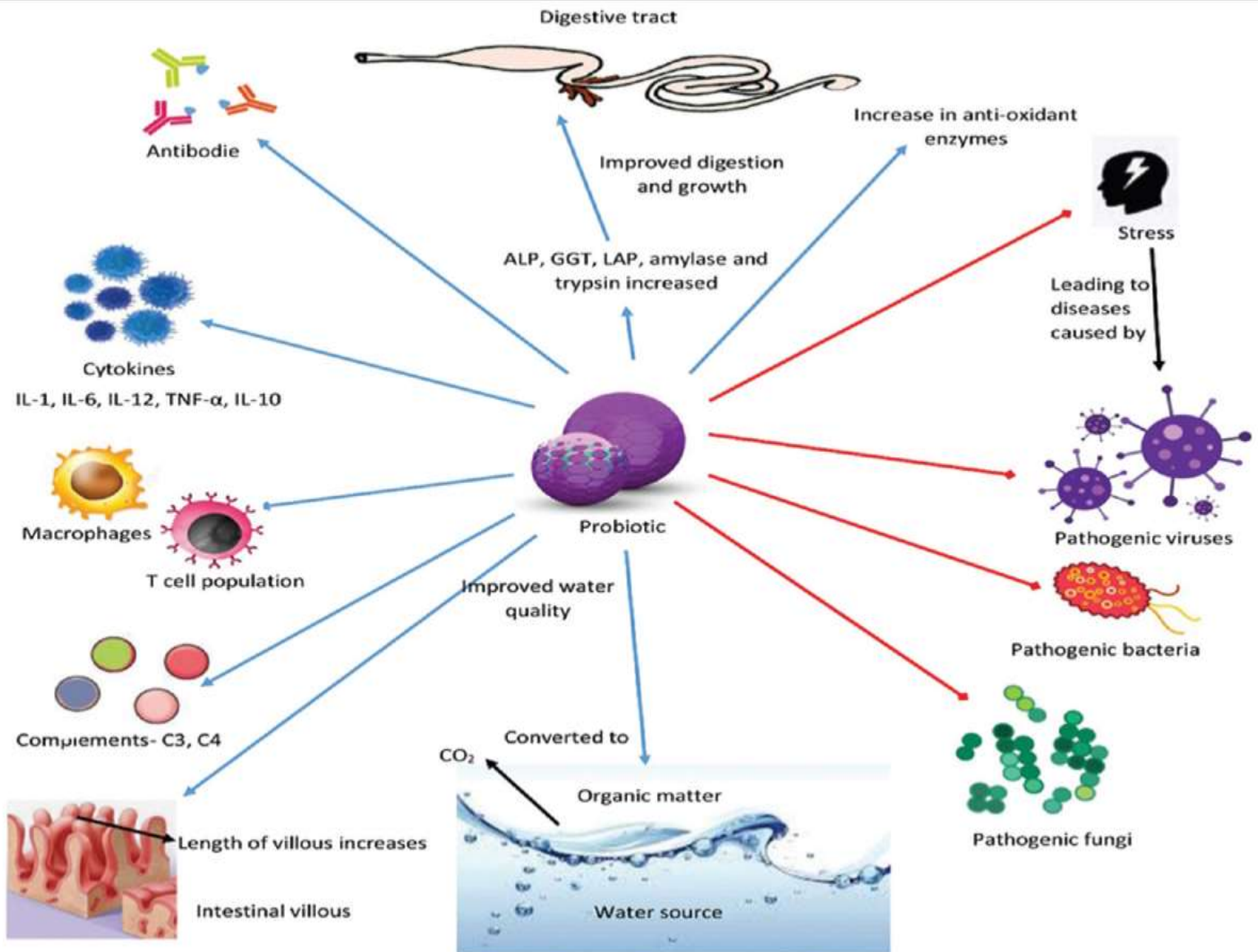
Bacteria Vibrio sp



Pseudomonas sp.



Bacillus sp.



Types of Probiotics

There are many types of probiotics. They include lactobacilli (like *Lactobacillus acidophilus* and *Lactobacillus GG*), bifidobacteria (like *Bifidobacterium bifidus*) and some yeasts (like *Saccharomyces boulardii*). Different probiotics have different effects. While one may help treat diarrhea or a vaginal infection, another may have no effect. Before you start taking a probiotic supplement, talk to your health care provider to make sure that you get the treatment most likely to help.



Role of Probiotics & Prebiotics in Human Health

Probiotic bacteria are found in the intestines of humans and other mammals where they provide health benefits to the host. They do so by

- (1) providing nutrients and cofactors,
- (2) successfully competing with pathogens,
- (3) stimulating host immune responses by producing specific polysaccharides.

These bacteria can also alleviate the symptoms of disease-related metabolic disorders. Prebiotics are substances, usually poorly metabolized polysaccharides and oligosaccharides, that cannot be ingested effectively by the animal.



Marine Probiotics in aquaculture

- The first application of probiotics occurred in 1986, to test their ability to increase growth of hydrobionts (organisms that live in water).
 - Later, probiotics were used to improve water quality and control of bacterial infections.
 - Nowadays, there is documented evidence that probiotics can improve the digestibility of nutrients, increase tolerance to stress, and encourage reproduction.
 - Currently, there are commercial probiotic products prepared from various bacterial species such as *Bacillus* sp., *Lactobacillus* sp., *Enterococcus* sp., *Carnobacterium* sp., and the yeast *Saccharomyces cerevisiae* among others, and their use is regulated by careful management recommendations.
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Probiotics in Animal Health

- ❑ Probiotics are defined as live microorganisms which can confer a health benefit for the host when administered in appropriate and regular quantities.
 - ❑ Once ingested, the probiotic microorganisms can modulate the balance and activities of the gastrointestinal microbiota, whose role is fundamental to gut homeostasis.
 - ❑ It has been demonstrated that numerous factors, such as dietary and management constraints, can strongly affect the structure and activities of the gut microbial communities, leading to impaired health and performance in livestock animals.
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- ❑ In this review, the most important benefits of yeast and bacterial probiotics upon the gastrointestinal microbial ecosystem in ruminants and monogastric animals (equines, pigs, poultry, fish) reported in the recent scientific literature are described, as well as their implications in terms of animal nutrition and health.
 - ❑ Additional knowledge on the possible mechanisms of action is also provided.
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