

Unit - IV

संरक्षित व जिवानु दध आनि अन्य Aquaculture and Probiotics

1) Introduction and Definition

Intro:- Probiotics are microorganisms that are believed to provide health benefits when consumed.

→ The term Probiome is currently used to name ingested microorganisms associated with beneficial effects to humans and animals.

→ Introduction of the concept is generally attributed to Nobel Prize recipient Elie Metchnikoff, ~~who~~ in 1907.

→ which suggested that "The dependence of the intestinal microbes on the food makes it possible to adopt."

→ It measures to modify the flora in our bodies and to replace the harmful microbes by useful microbes.

→ Studies on the medical benefits of probiotics have yet to be conclusively prove towards the good effect on animal body.

⇒ commonly claimed benefits of probiotics include the decrease of potentially pathogenic gastrointestinal microorganisms.

→ The reduction of gastrointestinal discomfort.

→ The strengthening of the immune system.

→ The improvement of the skin's function.

→ The improvement of bowel regularity.

→ The strengthening of the resistance to cedar pollen allergens.

→ The decrease in body pathogens.

→ The protection of DNA.

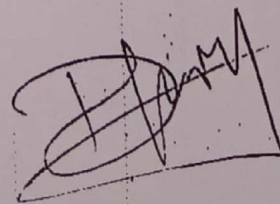
→ The protection of proteins & lipids from oxidative damage.

→ The maintaining of individual intestinal microbiota in subjects receiving antibiotic treatment.

Fishery

(Unit IV)

— bonde sir —



Definition :-

- 1) - Probiotics is a useful microorganism.
- 2) - Probiotics is a substance produce by one protozoan which stimulate another.
- 3) - Animal feed supplements which has a beneficial effect on the host animal by affecting its gut flora.
- 4) - A live microbial feed supplement, which beneficially affects the host animal by improving its intestinal microbial balance.
- 5) - Probiotic bacteria as viable bacteria when applied in single or mixed culture, exhibit a beneficial effects on the health of the host.
- 6) - Probiotic as viable microbial food supplements which beneficially influence the health of the host.
(Schrezenmeier and Do Vorges, 2001)
- 7) - Probiotic are live microorganisms which when administered in adequate amounts confer health benefit on the host.
- 8) - Probiotics are viable microorganisms; sufficient amount of which reach the intestine in an active state and thus exert positive health effect. (Recombact in Germany)
- 9) - Probiotic foods contain living probiotic microorganisms in a adequate matrix and in sufficient concentration so that after their ingestion, the postulated effect is obtained, and is beyond that of usual nutrient supplies.

2) History of Probiotics :-

- The history of Probiotics can be traced to the first use of cheese and fermented products. ~~which were~~ ^{that were} well known to the Greeks and Romans who recommended their consumption.
- The fermentation of dairy foods represents one of the oldest techniques for food preservation.
- Food products containing probiotics are almost dairy products that due to the historical association of lactic acid bacteria with fermented milk.
- The origin of fermented milk can be traced back long before the Phoenician era and placed in the middle East.
- The traditional Egyptian fermented milk products, ~~are~~ ^{Laban Rqayeb, and Laban Khad,} were consumed as early as 7000 B.C.
- The fermented ~~and~~ milk product initially established in the middle and east of Asia, the tradition of fermenting milk was spread throughout the east Europe and Russia.
- A wide range of fermented dairy products still exist in these regions and some popular products seen as Yoghurt and Kefir are claimed to originate from the Balkans and Eastern Europe.
- Metchnikoff (1907) first introduced the probiotic concept which observed the long life of Bulgarian farmers, who consumed fermented milk foods.
- He suggested that lactobacilli might counteract the good effect of gastrointestinal metabolism.

3) Selection criteria for Probiotics

- The selection of probiotics is the determination of its taxonomic classification, which may give an indication of the origin, habitat and physiology of the strain.
- Some criteria are discussed below
- Safety criteria :- origin, pathogenicity and infectivity, virulence factors like toxicity, metabolic activity and intrinsic properties i.e. antibiotic resistance.
- Technological criteria :- Genetically stable strains, Desired viability during processing and storage, Good sensory properties, Phase resistance, Large scale production.
- Functional criteria :- Tolerance to gastric acid and juices, Bile tolerance, Adhesion to mucosal surface, validated and documented health effects.
- Desirable :- Immunomodulation.
- Physiological criteria :- Antagonistic activity towards gastrointestinal pathogens i.e. *Helicobacter pylori*, *Candida albicans*, cholesterol metabolism, Lactose metabolism, Antimutagenic and anticarcinogenic properties.

4) Composition and dosages (हसिवाय प्रमनान प्रिकर ले।)

Composition :- The most frequently used bacteria in these products belong to the genera *Lactobacillus*, *Bifidobacterium* and *Streptococcus*.

→ Listed the following organism as special used in probiotic preparation.

→ *Lactobacillus bulgaricus*, *Lactobacillus casei*, *E. coli*, *Streptococcus thermophilus* etc.

Dosage :- The dose effect relationship must be carefully determined so as to avoid overdosing which may result in lower efficacy while increasing cost, or conversely underdosing which reduced the efficacy of the probiotic.

→ For the purpose of administering probiotics, a dose can be defined as the concentration in number of probiotic cells mL^{-1} that is available to the aquatic host.

→ At this dose, they can be added directly to the water, attached to the live food or incorporated into the artificial diet.

→ Additional doses may be required to maintain the desired probiotic concentration in the culture water, the frequency of which may depend on the probiotic species, stage of fish development, diet, culture conditions and desired probiotic concentration.

⇒ It has been suggested that aquaculture systems cannot support bacterial concentrations greater than $10^6 \text{ cells mL}^{-1}$.

→ *Lactobacillus rhamnosus* at a dose of 10^9 CFU g^{-1} of feed protected rainbow trout from induced furunculosis.

→ In *Crassostrea gigas*, addition of CH2 bacteria at a culture environment concentration of $10^5 \text{ cells mL}^{-1}$ increased larval growth.

→ *Pseudomonas fluorescens* AH2 at a concentration of $10^5 \text{ cells mL}^{-1}$ followed reduced mortality from *Vibrio anguillarum*.

⇒ A single dose may be used for probiotics capable of surviving within the gut and attaching to the mucus and intestine.

→ The doses higher than $10^6 \text{ cells mL}^{-1}$ may be unnecessarily high.

→ Regular dosing at lower concentrations may be required to ensure the bacteria persist in the water and subsequently the intestinal tract.

5) Potential of probiotics

18/11/19

1) Pathogen Inhibition

population and/or

→ Microbial population may release chemical substances that have a bactericidal effect on other microbial populations which can alter inter-population relationships by influencing the outcome of competition for chemicals or available energy.

→ The presence of bacteria producing inhibitory substances in the intestine of host, on its surface or on its culture medium is thought to constitute a barrier against the proliferation of pathogens.

ii) Growth Promoters :-

- ⇒ Growth Promoters activity requires high-quality feed which should ~~not~~ contain not only necessary nutrients but also complementary feed additives to keep organisms healthy as well as favour growth and environment-friendly aquaculture.
- ⇒ Feed additives are substances which are added in trace amounts which provide a mechanism by which such dietary deficiencies can be addressed which benefits not only the nutrition and thus the growth rate of the animal concerned, but also its health and welfare in modern day fish farming.
- Some of the most utilised growth-promoting feed additives include hormones, antibiotics, ionophores, salts and probiotics.
- ⇒ Probiotics are feed additives which are defined as live microbes that may serve as dietary supplements to improve the host intestinal microbial balance and growth performance.
- The use of probiotics in aquaculture has been shown to have several benefits: competitive exclusion of pathogenic bacteria through the production of inhibitory compounds.
- Improvement of water quality, enhancement of immune response of host species and enhancement of nutrition of host species through the production of supplement digestive enzymes.
- Thus the use of probiotics in aquaculture has received a great deal of attention. Some common strains used as probiotic products include *Lactobacillus acidophilus*, *L. bulgaricus*, *L. plantarum*, *Streptococcus lactis* and *Saccharomyces cerevisiae* for growth performance, feed utilisation, body composition and economic evaluation of feed costs.

iii) Water quality maintenance

- Probiotic bacteria improve water quality by modifying the microbial community composition of the water and sediment.
- Probiotic bacteria controlled pathogens from water so water become free from pathogen.
- For water quality improvement specially used a

Bacillus species

- It is gram positive bacteria & more efficient for converting organic matter back to CO_2 .
- The converted CO_2 is more useful for growth of Phytoplankton which consume CO_2 and convert O_2 .
- The dissolved O_2 is most essential factor for fishes.
- For this purpose the species used are Bacillus, Nitrobacter, Pseudomonas, Enterobacter, Cellulomonas, and Rhodospseudomonas.
- A lot of bacterial cultures containing nitrifying bacteria for control the ammonia level in culture water.
- Nitrifiers are responsible for the oxidation of ammonia to nitrite and subsequently to nitrate.

6) Overall significance of Probiotics in aquaculture

⇒ Probiotics, the natural beneficial bacteria are now well accepted and widely used in aquaculture. Potentially they may have one or more beneficial functions for aquaculture producers.

1) → Water and pond bottom sediment quality are improved, leading to less stress on fishes and thus improved health.

2) → Effluent water is cleaner, thus environmental impact is low.

3) → Pathogenic bacteria and their virulence can be controlled, and the overall microbial ecosystem can be managed.

4) → Antibiotics are not used. This stops the increase in virulence and pathogenicity in aquatic bacterial pathogens due to antibiotics. It will also minimise the risk of multiple antibiotic resistance.

5) → Stimulation of the fish immune system.

6) → Improved gut flora and hence lower disease incidence and increased food assimilation.

→ Hence, productivity and profits are increased when selected probiotics are used.