

A REVIEW ARTICLE ON A PPLICATION OF PREBIOTICS IN AQUACULTURE

Anup Kumar Mandal

Assistant Professor, Department of Zoology(H.O.D), Jangipur College, Murshidabad, West Bengal, India.

Abstract

Aquaculture productivity is increasing rapidly and it has been a exploding sector among all kind of aquatic food. To get economic profit, farmers uses several kinds of chemicals, drugs or antibiotics to increase the rate of production within a very small period of time. Because of these reasons; the aquatic environment of aquaculture is in loss. Not only that, the condition of water becomes poor. And by following this way, lots of disease arises in fish, affect the growth of fish and even several environmental stress condition appeared. Disease control in fish culture, rather aquaculture is more important to counter the economic losses as well as public health. Use of drugs, antibiotics and chemicals are old method to prevent disease. These type of method is not so much beneficial. So, new method is necessary to release these environmental stress and provide suitable environment for this culture. This review will present the effectiveness of application of pre and probiotics to improve better growth of fish, helps in growing beneficial bacteria and present infective bacteria.

Keywords: Productivity; Aquaculture; Organic pollution; prebiotics; Inulin.

1. Introduction:

The world population is increasing with the time, that is why the demand of food is Very high nowadays. It has been seen that the food production in aquatic medium; Play a major role to supply the food and also fulfil the demand of food in large scale (Pandiyan et al.,

2013). The Global demand of fish as a food consumption is Increased at the rate of 3.1 percent yearly from the year 1961 to 2017, and this rate is About twice the rate of yearly world population growth i.e. 1.6 percent in the same Period of time, it's higher than from all other animal protein food consumption which Increased in the rate of 2.1 percent every year (FAO, 2020). In most of the countries, aquaculture is the base of their economy. In recent studies we

found that, in most of places there is a huge aquaculture production in small area. So, there are some problems arise such as carrying capacity of that particular wetland, many diseases, fluctuations of several environmental factors etc. For these reasons; farmers have to face a huge economics (Bondad-Reantaso et al., 2005). To overcome their condition, disease control and prevention is necessary for improvement of public health. Use of chemically synthesized antibiotics is most common method because these synthesized antibiotics make non-functional to many of the beneficial microorganisms such as bacteria which eventually found in the gastrointestinal tract or gut of the fish body and responsible for growth of the fish as well as it become disease resistan (Pandiyan et al., 2013). Beside that; antibiotics do not pass away from the fish body, it is preserved in the fish as a food, these antibiotics come in our body and affects health. After evaluating of these matters, there need some change in the application of antibiotics. Then the concept of using prebiotics” is developed (Denev, 2008). “Prebiotics” is used with food composition of fish Which acts like innate immune system by resisting non-specific disease and it is also a Vital for much beneficial is still very little known to us. Even according to many Aqua-culturists, out of many non-antibiotic agents, probiotics lead in the maintenance Of aqua-health. Food and Agricultural organization of the United Nations or World Health Organization states that probiotics are living organisms. The Application of antimicrobials in aquas environment mainly begins with the work of Gut cells, WHO, acknowledged in 1946 that the potential use of antibiotics that is Sulphonamides for taking up arms against furunculosis. The non-selective use of Antibiotics resistance microorganisms and imbalance in the gut microflora, which influence the fish health and residual accumulation in the muscle of the fish which is a possible risk to consumers.

2. Prebiotic

Probiotics are considered as a food materials, which is not digested but can enhance the growth and increase the number of gut bacteria that is beneficial for the health of hosts (Gibson and Roberfroid, 1995). We can't claim a food material as prebiotic without having some criteria which must be satisfied. But in most of the cases for the purpose of commercial benefits we claim many food components are probiotics without following the criteria that must be fulfilled to become a prebiotic food materials.

The criteria for prebiotic food material are –

- a) Resistant to acidic environment (due to secretion of HCL by stomach); hydrolysis by pancreatic enzyme. (Oku et al., 1984).

b) Fermentation by microflora present in intestine. The most useful method to predict the prebiotic fermentation site is multi - chamber culture system which denote physical and nutritional character of gastrointestinal tract of host (Gmeiner et al., 2000).

Experiment on inulin selectively (in vitro-technique) in mixed batch culture and mixed culture fermentation are briefly demonstrated in table 4 and application of inulin to observe growth of bacteria and use of Oligofructose as a human feed are also briefly demonstrated in table 5.

Table 1:- Experiment on inulin selectively (in vitro-technique) in mixed batch culture and mixed culture fermentation (Gibson et al., 2004).

Experiment	Result	Reference
Growing ability of Lactobacillus and Bifidobacterium on MRS agar mixed with oligofructose (eight Bifidobacteria and sixteen Lactobacillus were taken for this experiment).	Among eight Bifidobacterium and sixteen Lactobacilli seven Bifidobacteria and twelve lactobacilli grow on MRS agar mixed with oligofructose.	(Kaplan and Hutkins, 2000).
Fermentation of oligofructose and branched fructan by applying faecal inocula in batch culture.	The experiment proves that among these two, branched fructan how better prebiotic nature than oligofructose with the help of fluorescence in vitro hybridisation.	(Probert and Gibson , 2002)

Table 2:- Application of inulin to observe growth of bacteria and use of Oligofructose as a human feed (Gibson et al., 2004) .

Experiment	Result	Reference
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<p>34 g inulin/d were given to eight subjects for 2 months.</p>	<p>By analysing fish technique, It is seen that there is an increase of 9.8 to 11.0 log₁₀ ceus/g dry faeces in case of Bifidobacteria</p>	<p>(Kruse et al., 19)</p>
<p>Oligofructose and intermediate hydrolyzed guar gum were given as a feed to thirty one subjects for 21 d interval for two times.</p>	<p>There is a increase in the number of faecal Bifidobacterium which is determined by FISH technique</p>	<p>(Tuohy et al. 2001)</p>

2.1. Types of prebiotics

The most specific type of prebiotics are of carbohydrate which can be found in such oath meal, tomatoes banana, wheat flaxseed barriers, chicory, onion and the legumes. Even, they have a large diversity in case of molecular structure. Those carbohydrate used to share a good number of physiological traits. Which are useful to their favourable result (Ghouri et al., 2014). A good number of studies and the most compatible proof of accumulation of prebiotic effects for a number of non-digestible oligosaccharides (NDOs) like the fructooligosaccharide (FOS). include polyols (mannitol, xylitol, sorbitol), oligosaccharides (soybean, raffinose), disaccharides (lactitol, lactulose), oligofructose, even other non-digestible oligosaccharides (lactosucrose, palatimose and isomaltose), polysaccharide (resistant search, inulin). It has a good establishment that short- chain oligosaccharide, lactulose, resistance starch, dietary fibre, inulin arenon poisonous even in case of high number of doses (Slavin , 2013). Prebiotic cannot be tumble down by gastric enzymes, but it can pass into the large intestine without a change and in that place they will be specifically fermented and it will create a advantageous results (Williams et al., 2010).

2.2. Characteristics feature of ideal prebiotics

- a) It cannot be hydrolyzed or absorbed by enzymes and tissue of any mammals.
- b) It will beneficially alter the micro flora of intestine and their respective activities.

- c) it is specifically in rich for some limited number of favourable bacteria.
- d) It will favourably alter the systematic aspects or luminal of the defence system of host.

2.3. Origin of Prebiotics

The respective sources of prebiotics include soybean, raw oats, in barley, yacon, unrefined wheat, inulin sources (i.e. Chicory root, jicama). There are some oligosaccharides are present that can be obtained from breast milk and it will play and beneficial role in case of development of any healthy immune system in new born. The breastfeeding new bronze have the flora which is controlled by Bifidobacteria and Lactobacilli, I these are a part of new born's defence system against the pathogen, which is beneficial primer of immune system. This type of floras are provided by the breast milk's oligosaccharides, which aur considered as the original prebiotic. There are some peptides, certain lipids and proteins are nondigestible carbohydrates, potential prebiotics, in specific nondigestible oligosaccharide, got the serious attention (Anandharaj et al., 2020).

4.3. Importance of prebiotic in aquaculture or fish culture

Prebiotics use as a supplement with dietary food to improve host health increase the number of gastrointestinal bacteria beneficial for health and immune system. It can resist against acidic environment of host body (i.e. acidic pH of stomach).

2.2.1. Application of prebiotics as growth promoter

Prebiotics are mainly applied to organism as a dietary supplement for better improvement for growth as well as health of most body and also increase the number of beneficial gastrointestinal bacteria or enhance its activity for several metabolic activities such as digestion. But it is found that not all prebiotics are of some beneficial effect. Thus the growth of performance very by the quality of prebiotics we use. The efficiency of prebiotics is also dependent on the type of aquatic specimen. Some aquatic organisms take prebiotics more frequently and thus better growth is observed in that case, but some organisms don't take prebiotics more easily as dietary supplement and thus less growth is observed. In an experiment, It is seen that inulin produce fructooligosaccharide by intermediate hydrolysis of enzyme using oligofructose and observed that there is an increase in growth of larva of turbot but coincidentally inulin show no effect in this growth increase (Austin, 1995).

2.2.2. Effect of prebiotics on immune system

In modern era, use of chemicals as a treatment of several bacterial disease of fish is to be avoided by the safety of aquatic experiment as well as for the health safety of the aquatic organism consumers. However antibiotics is used to control the bacterial disease of fish but the main problem is that antibiotics don't digest by the aquatic organisms, it is accumulated in the gut of the organisms and release in water thus it damage the quality of water. On the other hand, some bacteria make resistant against the particularly antibiotics, then the thought of applying vaccination method is come into the mind of many researchers but this method had some difficulty due to lack of sufficient vaccine in early development stage of aquatic organisms. In recent decades many alternative strategies have been adopted to control the disease, the most effective and fruitful strategy is the application of prebiotics as a dietary supplement to enhance the growth and health condition of many land animals (Gibson et al., 1999) reported that prebiotics can make change or transferred into an advanced form of bacteria or microorganism which resides in the gastro-intestinal tract of host body to stimulate innate immunity.

2.2.3. Use of prebiotics on GI tract microorganism

Different kind of microorganism such as virus, bacteria that are present in vertebrates and invertebrates resides in the cut of that organism and replicate thus increase their number. They reside in the gut, for escaping the humoral immune response and enzymatic degradation degradation (Flickinger et al., 2003).

Prebiotic food material such as inulin which is a oligosaccharide and oligofructose is fermented by beneficial colony bacteria resides in the colon by which the enhance the growth of beneficial GI tract bacteria which will help to maintain host health as well as proper functioning of colon. These are not used by disease causing bacterial species. Beneficial bacteria protect host by preventing the activity of harmful or pathogenic bacteria and act as a defensive barrier. Besides that, it also help in digestion process by secreting a wide variety of digestive enzyme (Ramirez and Dixon, 2003). Bacteria in the gastrointestinal tract perform the function of selective stimulations of immune response and developed GALT (Picchiatti et al., 2007). It is seen that Bifidobacterium; Lactobacillus which are under the group of lactic acid bacteria is able to survive in acidic and basic both condition of the intestine. LAB by converting lactose which decrease the pH of GI tract, make unfavourable by many bacteria .

(Galtin and Burr, 2009) made an experiment in which they applied dietary supplement in the form of fish meal or soybean meal with inulin at 1% of dry weight and their result found that it has no prominent effect on the various kind of microorganism present in the gastrointestinal tract.

3. Conclusion

The present population of whole world is increasing rapidly. As a result, it is going to be difficult to supply food as per demand for the government and international Community. So, aquaculture industry take the challenges to fulfil the demand of food And in recent decades aquaculture is the fastest growing industry all over the world. But there are some challenges also such as technological application, that changing Environmental condition, lack of public awareness, loss of biodiversity and so on. We Have to overcome these challenges for the sustainable development of aquaculture. In Modern era, probiotics play a major role in aquaculture production. It maintains water Quality, reduce organic pollution, enhance immune response, increase growth and Prevent disease in fish. Prebiotic work in the intestine through cross talk with the host and the bacteria in different path, that till the present time, are not completely cleared regarding the specified molecules that bestow on the health benefits directly, the host aim of those molecules and the signal active pathways. Thus to control aquatic disease use of prebiotics are more effective and safety process than the old process i.e. use of antibiotics, antimicrobial drug etc. Prebiotic is host specific, so the identification of probiotic is also important with the development of technologies, modern gene sequencing techniques easily identify probiotic micro-organism phylogenetic ally without using “cultivation techniques” hobe

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