FEED ADDITIVES IN AQUAFEEDS

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Abstract

Activities for alternative sources in order to prevent irreversible or long standing destructions resulting from the use of chemicals in all areas has increased. These kind of researches have been done and made progress in agriculture and animal husbandry. Aquaculture has not been far from this area, as alternative to chemical use; a lot of materials such as probiotics, bacteria compounds, animal extracts and polysaccharides have been used in studies. In addition, studies like the use of various spices and medicinal plants in aquaculture has gained importance today. Probiotics that will be used as a feed additive was need to increase body weight and the utilization rate of feed, to prevent gastrointestinal disorders caused by stress and pathogenic microorganisms, to reduce mortality, to improve water quality when the fish is infused into water, to settle fish on the skin mucus and defense it against pathogenic microorganisms, also to preserve immune-system from pathogens. On the other hand, it has been demostrated that the use of enzymes and plant extracts in food has increased the request for body weight and intake in fish. In this study, it has been analysed some researches about enyzmes, herbal feed additives and probiotics used as an additive in fish feed

Key words: Fish, Feed, Probiotics, Enyzmes, Feed Additives

INTRODUCTION

The amount of fisheries production has been increasing in our country and in the world. The obtained amount of fisheries through cultivation has reached about 73 million tons in the world while in Turkey it has reached 240 thousand tons [1]. This situation leads to more intensive use of the resources and increases the risk of stress and makes fish suffer from diseases. Antibiotics and a variety of synthetic chemicals used for the prevention of diseases and stress cause undesired chemical usages in terms of environment and consumers as well as economic losses [2]. In addition, the problems arising from the different stages of production of fish and fish exposed to such applications directly affect the production and business economy. Sudden light changes, pathogenic microorganisms in adaptation periods and species-specific developmental stages, manipulations, water quality and stocking density are some of the examples [3,4]. Furthermore, fish are influenced by various stress factors such as stress effects caused by excessive stocking density of fish in various stages of cultivation activity, poor water conditions, inadequate food, grading and transportation. These conditions adversely affect fish health and increase the risk of disease. Various chemicals (antibiotics, hormones, chemotherapeutics and vitamins) in order to reduce or prevent such effects have been used for many years in aqua-culturing [5]. Moreover, synthetic substances are intended for the treatment of diseases, coloration, strengthening the immune system, prevention of stress, improvement of the feed intake and to promote the growth. However, damages caused by the chemicals to the environment, fish and human as a result of fish consumption are undesirable [6]. Therefore, the additives used for combating the diseases to increase production through aquaculture, to grow fish faster, to make them more resistant to the ambient conditions and the drugs used in various stages in today's cultivation are being replaced by organic products. The use of

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synthetic pigments in coloring, appetizers, antibiotics, hormones and chemical pesticides are also prohibited for organically cultured fish. Today, activities related to alternative sources have been increased in all areas to prevent everlasting destruction of irreversible damages caused by the use of chemicals. These kinds of researches have been conducted and progressed in the field of agriculture and animal husbandry. As an alternative to the use of chemicals; many substances such as marine algae, probiotics, bacterial compounds, vegetable feed additives and enzymes have been used in many studies.

Herbal feed additives

It has attracted the attention of researchers that in recent years, plants and plant extracts are used in the treatment or prevention of diseases in humans as an alternative additive substance. Today, the use of medicinal plants and spices in direct nutrients and for therapeutic purpose is increasing. The total production of these plants occupies a significant place in world trade which is 6.5 million tons with a value of $ 2.8 billion. World spices exports have reached 3.3 billion dollars and Turkey was ranked as 13th among the spices exporting countries with 68 million dollars [7].In addition, as of 2009, Turkey's total medicinal plants and spices export value has reached 96 million dollars[8]. While there are many positive aspects of medicinal plants and spices, there are also side effects. Side effects of plant sources contain toxic components and may be caused by overdose usage of these sources. However, it is not encountered with any problems as a result of appropriate dose and use of the said sources [9]. For example, adding very high rates of thyme to the feed of mice such as 8.5% adversely has affected serum biochemistry and hematological findings of mice. Early detection of the effects of plant sources that will be used in aquaculture will be able to provide to perform the aquaculture activities in a healthy way and the economic loss that may result in disease and developmental disorders can be remedied in advance. In this context, one of the most important physiological indicators that provide information on fish health is hematological and biochemical parameters [10,11,12]. Because, the positive or negative effects created by a variety of factors may cause changes in blood parameters in a short time on fish as well as on humans and other animals. According to the studies, plants and plant extracts have been demonstrated to have positive effects on the growth performance of the fish. [13] states that the garlic used in *Oreochromis niloticus* fish feed causes an increase of productivity on the specific growth rate and protein efficiency ratio. It has been reported that the use of 100 mg / kg of purple clover in another type of tilapia *Oreochromis aureus* fish feed improves the growth performance and feed conversion ratio [14]. It has been determined that the use of 15g/100g ratio of maca extracts in the rainbow trout feed whose fishing is conducted intensively in the world increases the specific growth rate and protein efficiency [15]. Using Garcinia kola in Catfish (*C. gariepinus*) feed has increased the food conversion ratio, the specific growth rate and weight [16]. Plants have positive aspects as well as side effects. These side effects are usually due to excessive doses. It is not encountered with any problems as a result of appropriate dose usage [9].

Probiotics

In the past years, intensive zootechny made large use of industrial feeds and anti-microbial substances added to conventional diet in order to promote growth. Nowadays, the interest of consumers quests for safe, pharmaceutical-free products, and the need of a sustainable aquaculture has encouraged the scientific research community to use probiotics as an ecofriendly health strategy to counteract aquaculture diseases. In addition, the concerns regarding animal farms and farming conditions, together with the necessity of producing increasingly larger amounts of fish andmeat, have added interest in improving not only animals' growth but also welfare [17,18,19,20]. Probiotic strains commonly used for aquaculture practices include members of the *Lactobacillus, Lactococcus, Leuconostoc, Enterococcus, Carnobacterium, Shewanella, Bacillus, Aeromonas, Vibrio,*

Enterobacter, Pseudomonas, Clostridium, and *Saccharomycesgenera* [21]. [22] has stated that carps fed with the feeds added brewer's yeast *S. cervisiae* have grown better compared to the control group. [23] have stated that after adding Biogen (commercial probiotic) into Egyptian tilapia (*O. niloticus*) fingerling feeds in various rates, probiotic added feeds show higher growth performance and benefit when compared to the feeds in which probiotic is not added. *Labeo rohita* was fed with the feed containing *B. Subtilis*.The rate of weight gain and survival in the experimental group which was fed with feed containing *B. Subtilis* was significantly higher [24]. It has been examined the effect of probiotic Bacillus on the feed digestion of rainbow trout (*O. mykiss*) tiddlers, growth and survival rate. For this purpose, five different levels of probiotic were added into the experimental diets. At the end of the experimental diet, it has been stated that adding appropriate density of commercial probiotic Bacillus into the initial feed of trout is beneficial especially for its growth and survival in the growing conditions [25].[26] state that adding probiotics into the Pacific oyster (*Crassostrea gigas*)'s larval culture enhances the development of oyster larvae completely. Aquaculture industry is in a rapid rise. The use of probiotics needs to become widespread in a short time to make healthy and profitable production that does not have a negative impact on the environment.

Enzymes

It has been stated the enzymes are used in the feeds based on plant-derived raw materials in various countries in order to increase digestibility and a better weight gain and feed conversion [27]. Enzymes are catalysts in the realization of chemical reactions in the body. Endogenous enzymes are produced by the organisms and microorganisms in the digestive tract, but they are insufficient in the degradation of compounds which are difficult for digestibility. Therefore, the studies about the digestibility of the feed with exogenous enzymes have accelerated. Among the main enzymes used in the mixed feed fisheries industry are phytase, carbohydrase, protease and lipase. When it is considered that feed cost takes place in the largest cost of the aquaculture industry, economic feed production is inevitable and economic feed production will also be possible with the use of inexpensive vegetable protein source in feeds. The addition of the enzymes which facilitate digestion of vegetable protein sources to feeds costs as low as extra 8 TL per 1 ton of feed [28]. Today, commercial feed enzymes are sold to be used in poultry feeds, however especially the enzymes produced for fish feed have begun to take a new position in the market.[29] evaluated the effects of an enzyme cocktail (protease and carbohydrases) on growth and waste outputs of rainbow trout (*Oncorhynchus mykiss*) fed diets containing soybeanmeal at up to 20% of weight. Results from that study presented a statistically significant effect of exogenous enzyme supplementation on apparent digestibility of dry matter, crude protein, nitrogen-free extract, phosphorus and gross energy. However, the authors indicated that these effectswere very small and inconsequential, possibly because all diets in the study were highly digestible. Similarly, an effect of exogenous enzymes on rainbow trout growth was not found. Nonetheless, these authors reported that exogenous enzymes greatly decreased the cohesiveness of the fecal material produced. This could potentially result in less localized accumulation of fecal material in fresh water cage culture operations, reducing potential impact on the benthic biota. Conversely, in other culture systems such as raceways or recirculating systems, increased cohesiveness of fecal material may aid in its accumulation and removal. [30] determined the effect of enzyme supplementation (Energex™[hemicellulases], Bio-Feed™ [protease] and Alpha galactosidase™ [α-galactosidase]) of dehulled lupin-based diets on rainbow trout performance. The supplemented enzymes did not improveweight gain of rainbowtrout fed lupin-based diets, as reported previously by [29] with soybean meal-based diets. However, the mixed enzyme significantly improved protein efficiency ratio. These authors also suggested that enzyme supplementation studies should be carried out

when animals are under restricted feeding regimes as the beneficial effects of enzyme addition may be hidden by increased feed intake under an ad libitum feeding regime. [31] did an additional studywith rainbowtrout in which independent diets with high inclusion levels of three different plant-based feedstuffs (soybean [344 g kg^{-1}], sunflower [246 g kg^{-1}] and rapeseed [264 g kg^{-1}]) meals were supplemented with three different enzymes (β-glucanase [67 mg kg^{-1}], xylanase [208 mg kg^{-1}] and protease [228 mg kg^{-1}]) and apparent nutrient digestibility was assessed. Enzyme supplementation had onlymoderate effects on apparent nutrient digestibility in the sunflower and rapeseed experiments, while β-glucanase and protease improved the apparent digestibility of all nutrients in the soybean experiment. The effect was more pronounced for lipids than for other nutrients. β-Glucanase had a positive effect on energy retention of the fish in the soybean experiment, while there were no effects on nitrogen retention or fish performance in any of the three experiments. This was the third study in which no effects of carbohydrase enzyme supplementation on rainbow trout growth performance were observed [30,29]. Although, in the case of this study, the feeding trial only lasted 19 days. [32] carried out a 12-week feeding study in order to examine the effects of protease, mixed enzyme cocktail and phytase additions, which were used in bream feeds as soybean flour (40% soybean flour, 25% fish flour) instead of fish flour, to the growing, benefitting from the feed and nitrogen-phosphor pollution. At the end of the trial, while there were no significant differences between the groups in terms of weight gain and specific growth rate, the phytase group showed significantly better feed conversion compared to the control group. In this study, it was observed that the highest nitrogen digestibility was in the protease group, the lowest was in the control group, the best phosphorus digestibility was in phytase group and the lowest was in the control group. [33]concluded in the 47day of feeding study that growth was not affected significantly by adding 0.2% fish pancreatin (digestive enzyme extract) enzymes to the feed of the average weight of 587 mg of yellow perch (*Perca flavescens*), thus there was no need to contribute enzymes into the feed of yellow perch fish. [34]state that when 250 g/t protease is added to trout feeds containing Canola - pea, digestibility of protein lipid energy and dry matter increase.It has been demonstrated with the conducted studies that use of enzymes to improve the effective use of herbal raw materials used in fish feed shows positive results. Furthermore, it has been specified in the studies thatthe damage to the environment decreases by leaving less waste to the environment by using enzymes.

RESULT

Aquaculture industry shows rapid development in our country. The purpose of the use of feed additives in aquaculture is to increase efficiency, quality and profits. However, due to ecosystem degradation, environmental pollution and leaving residues of the feed additive to the environment, finding alternative feed additives has been obligatory. Therefore, because of appetite increasing, digestion regulating and supporting effects of probiotics, enzymes, plants and their extracts as well as growth performance increasing effects on the fish and other cultured fisheries and due to the risk of leaving residuals, use of additives in feeds has increased in recent years.

In addition to the studies about growth and combating diseases, using additives in feeds should also be considered financially. As probiotics used in animal breeding, the enzymes and herbal feed additives are natural and do not threaten animal and human health, they are the alternatives of antibiotics and chemotherapeutic agents. Performing more researches aimed at increasing the productivity of fish by using additives will enable the appropriate fish feed rations for the cultured fish depending on the positive results reached or to be reached.

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