Chapter 6

EFFECTS OF FLAX SEED (*LINUM USITATISSIMUM*) AND CHIA SEED (*SALVIA HISPANICA*) MACERATED OILS ON THE FEED CONVERSION RATIO (FCR) AND HEMATOLOGICAL PARAMETERS OF RAINBOW TROUT (*ONCORHYNCHUS MYKISS L.*)

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Introduction

In the past two decades, aquaculture has increased significantly, which has increased the need for new fish feed formulations. Feeds used in the industry constitute 60% or more of the production cost (1). Traditional Asian cultivation methods have been used for a long time in aquaculture. Fish meal and fish oil are used extensively in shrimp and fish farming enterprises. Moreover, the use of fish meal and oil continues to increase (2). The constant development of aquaculture limits the difficulties in the supply of fish oil (FO) and fish meal (FM). Generally, feeds in a fish farm account for 70% of the variable production cost, mostly due to the high price of FM and FO. Due to fish feed uncertainty and FM has doubled in price in recent years, many researchers have intensified efforts to find alternative sources of protein instead of fish feed and fish meal (3). In addition to reducing costs and using them as feed additives, plants are used in fish in various ways as disinfectants or therapeutics in different studies (4, 5). Recently, there has been a lot of concern in this area and different ingredients have been studied to investigate an alternative source of protein for fish food. Soybean meal, rapeseed, canola meal, cottonseed meal, leucaena leaf, spirulina (6), green tea (7), common yarrow, cinnamon, rosemary (8), poppy, ginger, turmeric (9) and garlic (10) are among these investigated substances.

Chia (*Salvia hispanica* L.) is a plant that has a one-year life. The homeland of this plant is southern Mexico and northern Guatemala, recently marketed from South America to the world (11). Chia seed, a seed that has attracted attention in recent years, is a food containing high amounts of dietary pulp, n-3 fatty acids,

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was understood that the decrease in the chia seed oil group suppressed the bone marrow where the PDW was produced and thus the platelet production.

Decreases in WBC and MID (monocyte) values were similar because chia oil contains higher omega-3 than flax oil. The anti-inflammatory effect of omega 3 has been shown to be associated with a decrease in these values.

The hematocrit value increases with low oxygen and stress, and it has been found that the fish fed with flax group added feed exhibit a behavior to correct anemia caused by low hematocrit seen in the control group and Chia group. However, the increase in RDW and MCV values in the linen group and the decrease in PDW and PLCR values (anemia is also high) shows that flax oil has an anemia effect (30). However, the Chia group was not effective in anemia. It shows that the increase in the NBT value of flaxseed compared to the control group is an excellent stimulator against nonspecific immune response.

Conclusion

At the end of the study, flax and chia oils have different effects on trout. While chia oil positively affects the FCR ratio, flax oil appears to provide the greatest weight gain. In addition, flax and chia oils have been found to have different positive effects on blood values. It is thought that the use of powder or oil forms of these plants as additional nutrients in trout feeds will be beneficial.

KeyWords: Feed conversion ratios (FCR), *Linum usitatissimum*, macerated oil,nitroblue tetrazolium (NBT), *Oncorhynchus mykiss, Salvia hispanica.*

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