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## An overview on the use of oil in fish diet

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### Abstract

Oil is the essential compound of the animal's diet. The use of oil in the fish feed is the important key to increasing growth and sustainability of the aquaculture industry. Oils are the key provider of essential fatty acid omega-3 and omega-6. It can be interact in the coast of the fish feed production. For growing aquaculture in a supportable fashion, the use of oil must be in correct amount as the animal needs, the source of oil must be depend on the demand of the particular species and availability. Some authors revealed that oil have antimicrobial, anti-oxidative, growth promoting ability as well as it is enhance the feed properties (palatability, digestibility and binding capacity etc.).

**Keywords:** Growth promoter, production, oil, sustainability, digestibility, palatability, etc.

### 1. Introduction

Aquaculture is an important sector of food production, it provides nutritional security to the food basket contributing to the agricultural exports and engaging about 40 million people in different activities. India is the 2<sup>nd</sup> largest producer of fish after China [5]. The total fish production during 2016-17 was 11.47 million metric tones which included 7.77 and 3.64 million metric tones from inland and sector respectively. India contributes about 6.3% of the global fish production; the sector contributes to 1.1% of the GDP and 5.15% of the agricultural GDP [5]. Nutrients are the substances that can be digested and used by the body. There are 6 nutrients *viz.* Proteins, Fats/Lipids, Carbohydrates, Mineral elements Vitamins and Water. Fish require protein, lipids energy vitamins and minerals in their diet for growth performance, reproduction and physiological activities. Amount of oil required by Freshwater and Marine water fish is different in the diet. Dietary requirements of the oil can be varying among species and within species according to the stage of life cycle different sex reproductive state and environment. Oils from vegetables are less expensive and do not accumulate persistent organic pollutants (POPs) thus production costs can be minimum with vegetable oil based diets as well as contaminant exposure for fish and consumers [8].

### 2. Types of oils

Hydrocarbon liquid substances that are greasy to the touch and are formed by natural resources or the breakdown of fats are called as oils on the other hands organic compounds formed mainly from alcohol and fatty acids combined together by ester linkage are called lipids. It is made of 3 elements *viz* carbon, hydrogen and oxygen. The elements make units called glycerol and fatty acids each glycerol joins to 3 fatty acids to form a lipid. Oils also divided into the two parts. Vegetable oils and animal oils.

#### 2.1 Vegetable oils

Oils that are produced from the vegetable substances are called vegetable oils. The residue left after the removal of oil (oilcake or meal) is used as feed-stuff [7]. For example- Soybeans oil, Groundnuts oil, Sunflower oil etc.

#### 2.2 Animal oil

Oils obtained from animal substances are called animal oil. For example- Fish oil (Fish liver oil and fish body oil), dolphin oil etc.

### 3. Importance of oils and lipid

Oils play very important role in the physiology of the animals. Oil act as antimicrobial activity, ant-oxidative effects, it enhances the feed palatability, improves the gut functions [20]. It is feed

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additives, acts as growth promoter<sup>[20]</sup>. Lipids are important sources of metabolic energy (ATP). Lipid is the most energy rich of all classes of nutrients and gross energy value is 9.5 kcal g<sup>-1</sup>. Sometimes dietary lipids may be used to spare the more valuable protein for growth. Lipids are essential components of all cellular and sub cellular membranes. In particular free fatty acids derived from triglycerides (fats and oils) are the major aerobic fuel sources for energy metabolism in the muscle of the fish. It serves as biological carriers for the absorption of the fat soluble vitamins (A, D, E and K). Lipids play a role as a mechanical support for the vital body organs and aid in the maintenance of neutral buoyancy. Lipids are a source of essential steroids which in turn perform a wide range of important biological functions to the animals. Fish oil provides health-beneficial Omega-3 long-chain polyunsaturated fatty acids in the diet. From a viewpoint of feed technology, lipids act as lubricants for the passage of feed through pellet dies as substances which reduce the dustiness of feeds and play a role in feed palatability<sup>[7]</sup>.

#### 4. An overview on the recent study relating the incorporation of oil in fish diet

Study on the effects of adding various oils to the diet on growth, feed conversion and chemical composition of carp (*Cyprinus carpio*) were studied<sup>[19]</sup> where they concluded that the lipid-enriched diets with higher energy sources resulted in increased fat levels of the carp. Author<sup>[2]</sup> suggested that a diet supplemented with a mixture of different types of lipids will produce the best growth response in *Oreochromis niloticus*. An experiment conducted to find out the suitable dietary lipids for a practical diet for *Tilapia nilotica* containing corn oil, soybean oil, pollock liver oil, beef tallow and medium chain triglyceride (MCT) were tested and author<sup>[21]</sup> concluded that the best weight gain and feed efficiency were in the fish receiving corn oil or soybean oil, (both rich in 18: 2 omega 6). Another study concluded that as corn oil was replaced by pollock liver oil, the growth rate was significantly decreased, indicating that pollock liver oil has no growth enhancing effect of the fish<sup>[21]</sup>. Linseed oil (5%) in diets showed the most effective effects on the content of essential fatty acids in the tissue of carp as well as on other tested parameters<sup>[22]</sup>. Researcher<sup>[13]</sup> observed that the type of oil was not an important factor affecting fish survival and growth, but the weight gain of fish fed with the diet containing mildly oxidized oil was observed significantly less than that of fish fed the diets containing fresh oil. Author<sup>[12]</sup> concluded that a finishing fish oil diet can be effectively used to restore the human cardio-protective fatty acid profile in *rohu* fed with vegetable oils as lipid source. Vegetable oil partially can replace up to 50% in supplemented diet to enhance the growth of *Labeo rohita* juveniles<sup>[10]</sup>. Author<sup>[6]</sup> are concluded the results clearly revealed that sunflower oil could be partially 50 per cent replaced without any adverse effect on the growth performance. Fingerlings of rainbow trout (*Oncorhynchus mykiss*) can be reared on diets in which fish oil has been replaced with canola and flaxseed oils with no negative effect<sup>[14]</sup>. Authors<sup>[18]</sup> made a conclusion that there was an absence of relationships between levels of marine oil replaced and effect sizes for all outcomes. Authors<sup>[15]</sup> studied and they concluded that the dietary fish oil can be replaced by linseed oil or soybean oil at a high level of substitution (60%) without compromising marketable-size sea-bream growth. Authors<sup>[16]</sup> have worked out the economics of fish feed production and suggested that the

costs of the diets could be minimized by supplementing soybean oil, vegetable oil and palm oil instead of cod liver oil. The trend of the results indicated that though any of the 4 oil types could be used in the production of *Oreochromis niloticus*, soybean oil is the best prospect based on nutrient digestibility, nutrient utilization and cost effectiveness<sup>[15]</sup>. Authors<sup>[3]</sup> found that the fish oil with crude palm oil in the diet of Atlantic salmon (*Salmo salar*) affects the muscle fatty acid composition and hepatic fatty acid metabolism. Authors<sup>[4]</sup> investigated the effect of fish oil replacement with sunflower oil. They measured the changes in the tissue fatty acid profile in *Atlantic salmon*. However, there was no significant effect on growth suggesting that sunflower oil is a suitable alternative to fish oil in diets for Atlantic salmon parr when fish meal is also included<sup>[4]</sup>. Author<sup>[1]</sup> was studied by the effect of dietary oil sources and levels on growth, feed utilization and whole-body chemical composition of common carp (*Cyprinus carpio*), he concluded that mixed oil (1:1 v/v corn oil: fish oil) might be added to the diet for common carp fingerlings at a level of 6 per cent irrespective to the lipid content of the basal ingredients of the diet. Authors<sup>[17]</sup> studied that the replacement of fish oil with soybean or linseed oil in *sharpnose seabream* diets does not affect growth or feed utilization after three months of feeding. Fish on a soybean oil diet exhibited higher hepatosomatic indices, whereas fillet percentages were significantly lower in fish that had been fed an FO diet. Authors<sup>[11]</sup> studied the effect of long term feeding of diets with high levels of vegetable oils gilthead *seabream* juveniles were fed for 7 months with several diets containing vegetable oils at two inclusion levels. Anchovy oil was the only lipid source of FO (fish oil) diet, whereas in diets 60RO, 60LO and 60SO, 60% of fish oil was substituted by rapeseed (RO), linseed (LO) or soybean (SO) oils, respectively, and 80% was substituted by linseed or soybean oils in diets 80LO and 80SO<sup>[11]</sup>. Afterwards, all fish were fed only with fish oil diet to determine the progressive evolution of fillet fatty acid profiles, since fish muscle fatty acid composition changes by feeding vegetable oils affecting its nutritional value for human health<sup>[11]</sup>.

#### 5. Conclusion

Fish oil is one of the essential feed additives like protein, carbohydrates, vitamins and minerals. Oil requirement is very to the species to species and according to their age and size of fish. Fresh water and marine water fish required oil of different amount in the diet. Some authors revealed that oil have antimicrobial, anti-oxidative, growth promoting ability as well as it is enhancing the feed properties (palatability, digestibility and binding capacity *etc*). Finally it can be concluded that the growth of the fish can be affected by the use of oil in diet at desirable amount and the source of the oil. The use of oil in correct amount can be beneficial for farmers as well as the aquaculture growth.

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