

## Review Article

### Turmeric Feed Additives in Fish Feed

#### ABSTRACT

Feed additives are feed additives that are added to fish feed in small quantities, but their presence is needed for special functions such as antioxidants or antimicrobials in increasing the growth and efficiency of fish feed. The use of synthetic feed additives in the form of antibiotics is currently prohibited because it often causes negative effects and has an expensive price, so an alternative to synthetic feed additives is needed, including from the rhizome group such as turmeric. This article review aims to collect and provide information about some research results regarding the use of turmeric as a feed additive in fish feed. The addition of turmeric (turmeric flour, turmeric extract, and turmeric juice) to fish feed can have a significant effect on growth, feed conversion ratio, feed utilization efficiency, gonad development, survival, and digestive enzymes. The addition of doses to turmeric varies greatly, as turmeric flour ranges 2-60 ml/kg of feed, although there are cases that the addition of turmeric has no significant effect on fish growth performance. This is influenced by the variety and type of fish, feed quality, and aquaculture environmental conditions.

**Comment [MOU1]:** It's a good idea to add a recommendation at the end of the Abstract

**Keywords:** feed additive, fish, survival, turmeric, growth

#### 1. INTRODUCTION

Feed is one source of nutrients that are very important for the development and growth of fish. Feed also plays an important role in controlling the metabolic system of fish and to help maintain the immune system of fish to avoid disease attacks [1]. Feed is the largest operational cost in fish farming activities, so it requires effective and efficient feed processing including by providing additional feed or feed additives [2].

Feed additives are additives added to fish feed in small quantities with the aim of increasing fish growth and fish feed efficiency, and to reduce the accumulation of waste in aquaculture aquatic environments derived from feed consumption that is not utilized optimally by the farmed fish [3].

Feeding synthetic additives that are usually used to be mixed into feed are synthetic enzymes, antibiotics, antimicrobials and probiotics [4]. The use of synthetic feed additives in the form of synthetic enzymes, probiotics, antimicrobials and antibiotics including feed additives at relatively expensive prices that can increase feed production costs. The use of synthetic feed additives also includes ingredients that are less guaranteed security aspects because there are chemical residues in the feed, so it requires efforts or substitutes for synthetic feed additives in the feed, one of which is the use of feed additives or natural feed additives in the form of turmeric [5].

Turmeric is an herbal ingredient that is often used in fish farming activities as a feed additive in feed [6]. This is because turmeric is an herbal plant that is easily found, has a very affordable selling price, and its existence is quite abundant [7]. Therefore, based on the description above, the author is very interested in making a review article by collecting and providing information about some research results that use turmeric as a feed additive in fish feed.

**Comment [MOU2]:** What chemical compounds are contained in turmeric, to be able to support the efficiency of feed utilization in fish, and ultimately support fish growth?. Review some research results on the use of turmeric in fish feed. So that there is a novelty from this article

#### 2. METHOD

The data collection method is carried out by literature study. The data was obtained by searching the literature related to the use of turmeric extract in fish farming activities through search sites on internet media published in the last twenty-three years (2000-2023). The literature used in this article review is obtained from internet media with the keywords "Turmeric", "Turmeric Flour", "Turmeric Extract", "Turmeric Essence", "Fish Feed", "Fish Farming", "Feed Additive".

Turmeric is an herbal plant originating from the Asian region, especially Southeast Asia [8]. Turmeric also includes herbal plants that can help increase the productivity of living things [9] (Ibrahim et al. 2018). This is because turmeric contains curcuminoid compounds that are useful as antioxidants, as well as anti-inflammatory [10].

Turmeric also has a rhizome-shaped root (turmeric tuber) which is often used for traditional medicine, preservatives, cooking spices, or used in the field of aquaculture. The turmeric rhizome includes bioactive compounds that act as antioxidants that can give curcuminoids their yellow color [11]. Turmeric rhizomes have an elongated and rounded shape with a diameter ranging from 1-2 cm and a length ranging from 3-6 cm. Turmeric also has hairy, contented, lanceolate flower stalks, and tubular hairy petal leaves, and has a length ranging from 9-13 mm [12]. The classification of turmeric plants according to, among others, as follows:

Phyllum : Spermatophyta  
 Class : Monocotyledoneae  
 Ordo : Zingiberales  
 Family : Zingiberaceae  
 Genus : *Curcuma*  
 Species : *Curcuma domestica* [13].



Figure1. Turmeric (*Curcuma domestica*)[14]

**Comment [MOU3]:** These 2 paragraphs should be included in the Sub.Bab 3 **Advantages and Potential of Turmeric**

### 3. Advantages and Potential of Turmeric

The use of turmeric as a feed additive is because turmeric contains curcumin, essential oils, fats, carbohydrates, proteins, vitamin C, mineral salts in the form of phosphorus, iron, and calcium [9]. The main content that plays an important role in turmeric is curcumin which ranges from 9.61%. Curcumin is the main active substance that is antioxidant, as an appetite enhancer, and serves to prevent tissue damage in fish [15].

Curcumin in turmeric can function to stimulate the gallbladder wall in fish in order to remove bile into the small intestine, so that it can affect the increasing process of digestion of carbohydrates, fats, and proteins. Increasing the process of digestion of carbohydrates, fats, and proteins can also have an impact on the process of absorption of food substances or nutrients derived from feed consumed by the fish [7]. Furthermore, it is known that turmeric also contains active substances other than curcumin, namely essential oils ranging from 3.18% which play a role in helping the digestive process of fish by stimulating the secretory nervous system to secrete gastric juice containing enzymes to be secreted in the stomach and intestines. This process can certainly cause an increase in the metabolic process of food substances that can accelerate gastric emptying, so that it can affect the level of fish feed consumption [7].

Table1. ProximatAnalysisofTurmeric

Composition	Nilai Gizi (%)
Crude Protein	11,70
Crude Fat	3,79
Carbohydrat	65,77
Ash	7,12
Moisture	11,62

Refference :[11]

### 4. RESULT AND DISCUSSION

Tabel2. Some research on the use of turmeric (*Curcuma domestica*) in fish feed

No	Types of Fish	Form and Usage	Result	Refference
1	Snapper ( <i>Lates calcarifer</i> ,	Turmeric flour with levels 5, 10, 15, and 20	Increasing absolute biomass growth (6.6 g), White Snapper ( <i>Lates calcarifer</i> , Bloch) FCR	[16]

**Comment [MOU4]:** For review articles, there is no need for a results and discussion chapter. Preferably Chap. Results and Discussion replaced with "Study of the Utilization of Turmeric in Fish Feed"

		g/kg of feed.	(1.4), as well as 100% survival rate with the best level at 20 g / kg feed, water quality during the study was in optimal condition	
2	Nilem Fish <i>Osteochilus sp</i>	Turmeric flour with dose levels of 0, 0.2, 0.4, and 0.6%/kg of feed.	Increase growth and accelerate the process of gonad development with the best dose ranging from 0.6% per kg of feed.	[9]
3	White Snapper <i>(Lates calcarifer)</i>	Turmeric extract with dose levels of 0, 0.1, 1.15, and 0.2% / kg feed.	Increase the growth and efficiency of white snapper ( <i>Lates calcarifer</i> ) feed, with the best dose at a dose of 20 ml / kg.	[7]
4	Eel Seed <i>(Anguilla spp.)</i>	Turmeric juice with dose levels of 0, 20, 40, and 60 ml/kg of feed.	Increases weight growth (17.00 ± 3.61 g), length growth (27.33 ± 8.74 cm), survival 100 ± 0.00 %, EPP (73.03 ± 2.80 %), FCR (1.09 ± 0.36) with the best dose of 60 ml/kg feed.	[20]
5	Tilapia <i>(Oreochromis niloticus)</i>	Turmeric extract with dose levels of 0, 5, and 10% / kg feed.	Increase tilapia growth with the best dose of 10% in P3 treatment with weight gain ranging from 1 gram, and body length increases by about 0.5 cm.	[17]
6	Carp, <i>Cyprinus carpio</i> Linnaeus, 1758)	Turmeric flour with dose levels of 0, 1, 2, and 3%/kg of feed.	Increase amylase 7.012 U/mg, protease 0.032 U/mg and growth performance of carp 2.22% with the best dose at 2%/kg feed.	[18]
7	Pomfret <i>(Colossom amacropomum)</i>	Turmeric flour with dose levels of 0, 5, 10, 15, and 20 g/kg of feed.	Increase absolute weight (21.08 g), specific growth (7.12%) at the best dose 15 g/kg feed.	[19]
8	Patin Fish <i>(Pangasius hypophthalmus)</i>	Sari kunyit with dose levels of 0, 0.5, 0.7, and 0.9 g/kg feed.	Increased weight (55.8 g), & absolute length (89.3 cm), daily growth rate (5.17%), 97% survival rate, and condition factor range 3.50. Feed efficiency is 86%, and feed conversion value ranges from 1.16 with the best dose being in the dark 24-hour treatment (24G) with turmeric juice dose ranging from 0.7 g / kg feed.	[21]
9	Peres Fish <i>(Osteochillus skappeni)</i>	Turmeric extract with dose of 1, 2, 4, and 6 ml/kg of feed.	Increase the growth of absolute weight of peres fish by 1,332 g with the best dose ranging from 2 ml / kg of feed.	[15]

The addition of turmeric flour (*Curcuma longa* Linn.) can affect white snapper (*Lates calcarifer*, Bloch) with the best dose ranging from 20 grams / kg of feed with absolute biomass growth of 6.6 grams and FCR 1.4 [16]. This is because the use of high doses will increase fish growth, so that the addition of a dose of 20 g / kg of feed does not cause toxic or death in the white snapper, and can affect the decrease in the FCR value of the fish [16]. The addition of turmeric extract also affects the growth of tilapia with the best dose of 10% in P3 treatment with an average weight increase of around 1 g / head, and body length

increases by about 0.5 cm. This is because the higher the dose given, the effect will be increased appetite of fish to consume feed added turmeric extract [17].

The addition of turmeric flour to *Cyprinus carpio* carp feed can increase amylase enzyme 7.012 U/mg, protease 0.032 U/mg and carp growth performance 2.22% with the best dose ranging from 2% dose [18]. This is because turmeric contains curcumin which can increase the amount of feed consumption, so the higher the feed consumed by the fish, the higher the amount of substrate for enzymes which has an impact on increasing the activity of these digestive enzymes. Increased activity of digestive enzymes will cause high utilization of feed consumed so that it affects the growth rate of the fish [18]. The addition of turmeric flour to pomfret feed can affect absolute growth of 21.08 grams and specific growth of 7.12% with the best dose ranging from 15 grams / kg of feed [19]. This is because turmeric contains curcumin which can affect the emergence of sufficient antibacterial inhibitory power, so that it can spur growth and increase feed efficiency by reducing disruptive microorganisms or increasing the population of beneficial microbes in the digestive tract so that the efficiency of feed use will increase [17].

The addition of turmeric flour can also affect the increase in weight and length of seruka fish with the best dose ranging from 0.6% / kg of feed [9]. This is influenced because turmeric has the benefit of increasing appetite so that it can increase the growth of seruka fish. The increase in the growth of seruka fish is also caused by nutrients from the feed added turmeric is absorbed optimally by the fish [9]. The use of turmeric can affect the growth and efficiency of the use of white snapper feed (*Lates calcarifer*) with the best dose ranging from 20 ml / kg of feed [7]. Increased growth and efficiency of white snapper feed utilization because turmeric contains curcumin which can increase appetite and is antioxidant so that it can stimulate digestive enzymes to absorb nutrients from the feed consumed [30].

The addition of turmeric juice to feed had a real effect ( $P < 0.05$ ) with the best dose of 60 mL/kg on weight growth with a result of  $17.00 \pm 3.61b$  grams, long growth with a result of  $27.33 \pm 8.74b$  cm, survival with a result of  $100 \pm 0.00c$ , EPP with a result of  $73.03 \pm 2.80b$ , FCR obtained a result of  $1.09 \pm 0.36a$  [20]. The addition of turmeric to feed can affect fish growth because turmeric can increase the performance of fish metabolism in the digestive system, and can increase the absorption of food substances so that fish feed consumption increases. Increased feed consumption will certainly affect the rate of gastric emptying so that it has an impact on increasing the digestive process of fish [16].

The combination of Photoperiod and turmeric feed can affect body weight growth, body length, daily growth rate, survival. The best treatment was in the G24K0.7 treatment with an average body weight of 55.8 grams, an average absolute length of 189.3 with a daily growth rate of 5.17% and a survival rate of 97%, a condition factor of 3.50, feed efficiency in the photoperiod group with a value of 86%, a feed conversion value of 1.16 [21]. The feed conversion ratio can be seen when the feed conversion is getting smaller, it can be interpreted that the amount of feed given is more effective for fish growth. Meanwhile, when the feed conversion value is greater, it can be interpreted that the amount of feed given is less effective for growth [16]. The growth of fish is also influenced because turmeric has active compounds in the form of curcumin which functions as an antioxidant so that it can increase fish immunity which can also affect the growth of the fish [21]. The addition of turmeric extract to peres fish feed can affect the growth of absolute weight of peres fish by 1.332 grams with the best dose ranging from 2 ml / kg of feed. This is because the feed added turmeric extract has a balance of protein components so that it can increase the growth of the fish [15].

However, based on literature studies there are several studies that state that the addition of turmeric does not affect fish growth. Some of these studies state that the addition of turmeric has no real effect on the growth performance of baung fish (*Hemibargusnemurus*) [6].

#### 4. CONCLUSION

The use of turmeric (turmeric flour, turmeric extract, and turmeric juice) in fish feed can have a significant effect on growth, feed conversion ratio, feed utilization efficiency, gonad development, survival, and digestive enzymes. The use of turmeric in feed varies greatly, such as turmeric flour ranging from 1-20 g / kg feed, turmeric extract and turmeric juice ranging from 2-60 ml / kg feed. However, in some studies there are cases that the addition of turmeric does not have a real effect on fish growth performance. This is influenced by the lack of the right dose of turmeric addition to fish feed so that it does not get maximum results.

#### 5. REFERENCE

**Comment [MOU5]:** We recommend that you add recommendations from this review article. The 3 questions that need to be answered and reviewed briefly in the Concluding Chapter are: 1) is turmeric extract feasible to be developed as an additive in fish feed, 2) which is the most effective in supporting fish metabolism and growth as well as feed efficiency by fish ???, what is turmeric flour?, turmeric extract?, and turmeric essence?); 3) If all three are suitable for use in additional feed for fish, what is the right or ideal dose ??

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