"Science Stays True Here"
Advances in Ecological and Environmental Research (ISSN 2517-9454, USA) | Science Signpost Publishing

Effects of Turmeric Powder as a Supplement on Growth and Survival Rate of Mixed Sex *Oreochromis andersonii* (Three Spotted Bream)

SAUTI KALIMA[1], JERE W. L[2]., LWEENDO M,[3] ISEKI JUSTIN[4]

Received: June 14, 2022 / Accepted: July 22, 2022 / Published: Vol. 8, Issue 10, pp. 27-32, 2023

Abstract: Feed contributes 60 to 70 percent of the cost of fish production. Using feed additives is one technique to improve feed efficiency. Turmeric contains curcumin, which can boost meal absorption and stimulate fish appetite. The goal of this research was to see how turmeric affected mixed sex *Oreochromis andersonii* development and survival. Mixed sex *Oreochromis andersonii* fry were grown in 1m x 1m hapas with a stocking density of 20 individuals/m^2 in the current study, with2g/kg feed and without turmeric. The treatment and the control were replicated thrice. The treatment and control groups were tested twice, once every fortunate. The results showed that *O. andersonii* with the addition of turmeric gave Final Mean Weight (FMW), Specific Growth Rate (SGR) and Apparent Feed Conventional Ratio (FCR), which were 4.78g, 2.16g/day and 1.67 respectively and were higher than without the addition of turmeric. The survival rate of *Oreochromis andersonii* with the addition of turmeric and without the addition of turmeric was 83 and 86%, respectively. It can be concluded that the addition of turmeric at 2g/kg^{-1} feed can increase the growth of *Oreochromis andersonii* and survival rate above 80%.

Key words: Feed Additives, *Oreochromis andersonii*, *mixed sex*

1. Introduction

Oreochromis andersonii is adaptable to fast-flowing rivers and can be found in both river and swamp settings [1]. Adults seek deep open waters, youngsters remain inshore among plants; hardy, tolerating

[1] Department of Fisheries, Chipata Aquaculture Research Station, Ministry of Fisheries and Livestock, Chipata, Zambia.
[2] Department of Aquaculture and Fisheries Science, Africa Centre of Excellence in Aquaculture and Fisheries (AquaFish ACE), Faculty of Natural Resources, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi.
[3] Department of Fisheries, Chipata Aquaculture Research Station, Ministry of Fisheries and Livestock, Chipata, Zambia.
[4] Department of Fisheries, Chipata Aquaculture Research Station, Ministry of Fisheries and Livestock, Chipata, Zambia.

fresh and brackish water, preferring slow-flowing or standing water [2]. Hippo pools are a favorite getaway; prefers moderately deep, tranquil water with some weed cover. Forms diurnal schools; a detritivore that feeds on fine particulate matter such as algae, diatoms, detritus, and zooplankton; larger individuals also eat insects and other invertebrates [3]. The feeding schedule is flexible, and the diet adjusts depending on food availability. Mouth brooder for females [4]. One of the most significant aspects of the cultivation process is the feed and can support fish's growth and survival because about 60% of production costs come from a feed [5]. Adding feed additives to the feed is one technique to improve feed efficiency. Turmeric (Curcuma domestica Val) is a Southeast Asian spice and medicinal plant that can be used as a feed additive because it is inexpensive and contains the essential oil curcumin. Adding feed additives to the feed is one technique to improve feed efficiency. Turmeric flour promotes appetite and can be used as a feed ingredient [6]. The purpose of this study was to see how adding turmeric to the feed affects the growth and survival rate of *Oreochromis andersonii*.

2. Material and Methods

Experimental site

The experiment was carried out at Chipata Aquaculture Research Station (CARS) located in Eastern province of Zambia (Coordinates: S 13°32.32’232”, E32°587291”).

Experimental fish

The experimental fish were sourced from within the farm, average weight (2.87±0.29g) and standard length of (49.0±0.96mm) and total length (55.0±0.804mm) fingerlings. A total 120 mixed sex fingerling (*O. andersonii*) were stocked in hapas of size (1m x1mx1m) placed in randomized way, in a fenced earthen pond. The fingerlings were conditioned for a period of 14 days to ensure acclimatization. Mortality during this period was replaced.

Experimental diet.

A commercial feed (Novatek fry mash (45% cp) and pre starter (45% cp) was used in the experiment. The fry were fed 4 times a day at 10% of the body weight, adjusted every fortnight. Based on previous studies, the feed additive (Treatment: T2); Turmeric extracts was supplied to the fry at an inclusion rate of 50mg once daily (As provided for by R Cahyani *et al*., 2021) Fry that were devoid of the supplements was the control (T1). The treatments (T1 and T2,) were replicated thrice.

Fish Rearing

Oreochromis andersonii were reared for 30 days with a stocking density of 20 fry/m^2. The amount of feed given was 5% /day of the fish biomass with a frequency of feeding 2 times in the morning (09.00hrs) and evening (15:00hrs). The type of feed given was commercial feed (Novatek fry mash (45% cp).

Growth and Feed parameters

The parameters measured in this study as outlined by Kefi *et al* (2012) included;

$BWG = Wf(g) - Wi(g)$, AWG (g/day) = Wg/Wt(days), SGR(%/day^{-1}) = ([In Wf-inWi]/t) *100

- Survival Rate %= (100 x Initial number of fish - number of dead fish/Initial number of fish).
- Where; Wf: Final Weight, Wi: Initial Weight, AWG: Average Weight Gain, SGR: Specific Growth Rate
- FCR=Weight gained/Total Feed consumed

Water Quality Parameters

Water quality parameters; DO, pH, and temperature using water quality control which was carried out twice a day in the morning (09.00) and evening (16.00).

Data Analysis

Independent sample T test was used to determine the level of significance between the treatments ($p < 0.05$). Before analysis, the data were subjected to Shapiro-Wilk test to test for normality and flinger-Killeen test to for homogeneity of the variance) A statistical package R version 3.6. 3 [7] was used to analyze the data.

3. Result and Discussion

3.1. Growth of *Oreochromis andersonii*

The growth of *Oreochromis andersonii* with and without the addition of turmeric was studied for 30 days, with the results shown in Table 1. The results of a statistical analysis based on the independent sample t-test showed that with the addition of turmeric, growth (FMW), specific growth rate (SGR), and feed conversion ratio (FCR) were 4.78 g, 2.16 g/day and 1.67 respectively indicating that there was a significant difference ($P < 0.05$), (Figure 1) between the addition of turmeric and without it. Palatability influences the amount of feed consumed. The level of preference displayed by cultured animals to ingest a certain feed ingredient during a given time period is known as palatability. Shape, size, taste, smell, scent, and color, which are physical and chemical elements in feed, impact its palatability [8]. This is due to the curcumin concentration in turmeric, which increases palatability and hence stimulates fish appetite, resulting in enhanced growth [9]. The capacity and pace of stomach emptying are also related to total meal intake. The fish become hungry rapidly due to the fast rate of stomach emptying, and their appetite grows [5].

Table 1. Growth List of *Oreochromis andersonii* (*Oreochromis* sp.) Feed with Addition of Turmeric

Parameter	**Treatment**		**P value**
	Control	**Addition**	
	Mean ± SE	Mean ± SE	
FMW (g)	2.89 ± 0.132	4.79 ± 0.176	0.000042414
SGR (%/da)	2.609 ± 0.986	2.167 ± 0.819	0.001030717
FCR	1.277 ± 0.483	1.390 ± 0.526	0.041395013

The sort of easily digestible feed ingredients can contribute to high feed efficiency. Turmeric's essential oil can help to decrease the release of excess stomach acid, making it easier to absorb nutrients [10]. Another benefit of adding curcumin is that it boosts the immune system of the fish, which indirectly increases the appetite for fish, which affects the fish's final weight.

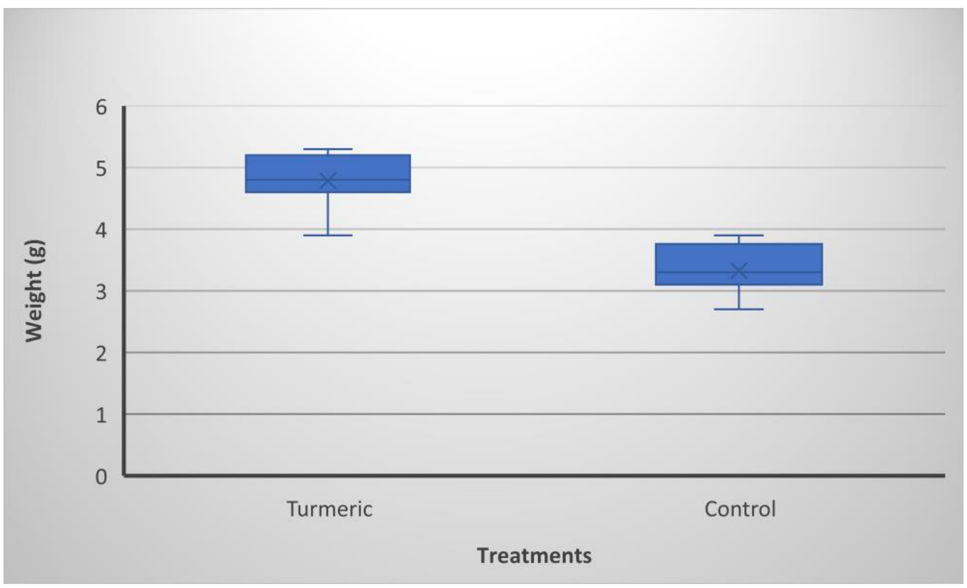

Figure 1: Box plot depicting growth of *O. andersonii* treated and not treated with Turmeric.

Survival rate of *Oreochromis andersonii*

The low survival rate value after adding turmeric could be due to an insufficient feeding %, which leads to cannibalism among the reared *Oreochromis andersonii* fish. The presence of cannibalism in the hapas is induced by the fish's increased appetite, which encourages them to attack weaker fish, resulting in death. Curcumin extract can boost fish appetite by improving nutrient absorption by improving the digestion of carbohydrate, lipid, and protein feed elements [11]. Furthermore, the cause is thought to be that the fish are stressed as a result of the excessive herbal addition. Tilapia have a survival rate of 83-100 percent [12].

Water Quality Parameters

Quality of water (Table 2) shows the average water quality during the rearing process with and without the addition of turmeric. The temperature values are between 22.5 and 25.6°C based on the water quality measurement data. Tilapia development is hampered by low temperatures of 14°C and hot temperatures of 38°C. Tilapia was perish in temperatures of 6°C and 42°C optimal water temperature for culture of tilapia is around 20 to 28°C [13]. the was water temperature still therefore, were within the optimum range for *Oreochromis* species growth at the time of the investigation. The pH resulted in a range of 7.4 to 7.6.

Table 2: Water quality parameters for *O. andersonii* raised on a commercial feed supplemented by treated and not treated with Turmeric.

Period	**Water Quality Parameter**						
	Temperature (°C)		**pH**		**Conductivity (ms/cm)**	**Dissolved oxygen (g/mL)**	**Nitrite (g/mL)**
Month	Morning	Afternoon	Morning	Afternoon	Morning	Morning	Fortnight
Mid May – Mid June	24.15±0.24	25.4±011	7.6±0.02	7.4±0.08	0.091 ±0.001	7.116 ± 0.024	0.153 ± 0.012

The optimal pH for rearing tilapia is 6.5-8.5 [13]. Measured pH is still suitable for the growth and survival of *O. andersonii.*

The DO levels obtained ranged from 7 to 7.1 mg/l. The optimal dissolved oxygen level for rearing tilapia is more than 3 mg/l [13]. During the study, the DO levels were still at the optimal limit to support the growth of *O. andersonii*. The colour of the pond water with the addition of turmeric becomes yellowish cloudy, which can cause the fish to experience stress to harm the fish. This however, did not affect the water quality parameters during the study period.

4. Conclusion

The addition of turmeric in feed gives in higher growth to mixed sex *Oreochromis andersonii* than fish without the addition of turmeric. The addition of turmeric 2g / kg feed can increase the growth of *Oreochromis andersonii* with the survival rate is 83%.

Acknowledgement

The Zambia Aquaculture Enterprise Development Project (ZAEDP) for the financial support. Staff at Chipata Aquaculture Research Station (CARS) for their tireless efforts in ensuring that the research goals were obtained. This work was performed as part of research activities which are carried by Department of Fisheries, Aquaculture Research Station, Chipata, Zambia and supplemented by Africa Centre of Excellence in Aquaculture and Fisheries (AquaFish ACE) for publication and technical support.

References

1. de Moor, I.J. and M.N. Bruton, 1988. Atlas of alien and translocated indigenous aquatic animals in southern Africa. A report of the Committee for Nature Conservation Research National Programme for Ecosystem Research. South African Scientific Programmes Report No. 144. 310 p. Port Elizabeth, South Africa. DOI 0-7988-4496-5 (pbk.)
2. Skelton, P.H., 2001. A complete guide to the freshwater fishes of southern Africa. Cape Town (South Africa): Struik Publishers, 395 p. DOI/ISBN 1-86872-643-6.
3. Thorstad, E.B., C.J. Hay, T.F. Næsje, B. Chanda and F. Økland, 2003. Space use and habitat utilisation of tigerfish and two cichlid species nembwe and threespot tilapia in the Upper Zambezi River. Implications for fisheries management. NINA Proj. Rep. 24:1-23
4. Froese R and D. Pauly, 2022.Fish base. World wide web electronic publication.www.fishbase.org, (Accessed on 13/06/2022)
5. Widianto B, Heni, and Nuryadi (2015) JIIP. 25 28-35 [in Indonesian].
6. Nova T. D, Sabrina, and Trianawati (2015) JPI. 7(3) 200-209 [in Indonesian].
7. R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.
8. Arief M., Faradiba D., and Al-Arief A. M., (2015) J Ilmu Perikana dan Kelautan. 7(2) 207-212
9. Christi R. F, Rochana A, and Hernaman I., (2018) JIT. 18(2) 121-125 [in Indonesian].
10. Putri W. I, Setiawati M, and Dedi J. (2016) JII. 17(1) 11 [in Indonesian].
11. Pujianti N. A, Jaelani A, and Widaningsih N., (2013) JIP. 36(1) 49-59 [in Indonesian].
12. Al hassan E. H., Abarike E. D, and Ayisi C L (2012) Afr. J. Agric. Res. 7(15) 2405- 2411.
13. Brett, J.R. (1979) Environmental factors and growth In: Fish physiology, Vol. VIII (Eds W.S.Hoar, D.J. Randall and J.R. Brett) Academic Press: London, pp. 599-667.
14. Kefi, A. S., Kang'ombe, J., Kassam, D and Katongo, C. (2012). Growth, reproduction and sex ratios in Oreochromis andersonii (Castelnau, 1861) fed with varying levels of 17 α – Methyl Testosterone. Journal of Aquaculture and Research Development 3:1-7 Doi:10.4172/2155-9546.1000155.