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Effect of Feeding Fry Red Tilapia with Spirulina on Fish Health

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Abstract

Feeding of Red Tilapia with commercial Spirulina microalgae experimental study (this volume) gave remarkable results. A complementary study investigating fish health was carried out. It showed that the best results were obtained for fish feed with 3% Spirulina in concordance with the experimental study in which the best return was achieved by this ration. Survival rate, reduction in mortality and protection from bacteria infection was ubiquitous with 3% ration showing maximum results.

Keywords: Red Tilapia; *Spirulina* feed; Survival rate; Bacterial infections**.**

المستخلص

أجريت دراسة تجريبية على تغذية سمك البلطي الأحمر بواسطة طحالب السبريولينا الدقيقة التجارية (هذا المجلد) وقد أعطت نتائج بارزة. كما تم اجراء دراسة تكميلية عن صحة السمك والتي اضهرت أن أفضل النتائج قد تم الحصول عليها من وجبة 3% سبريولينا وهو ما يتوافق مع الدراسة التجريبية التي أظهرت افضل مردود بهذه الوجبة. أن معدل فرص البقاء على قيد الحياة وتخفيض الوفاة ومقاومة الإصابة بالبكتريا كانت عامة غير ان وجبة 3% أعطت أفضل النتائج.

Introduction

The global aquaculture industry has expanded in the last few decades, reaching maximum production value in 2010. FAO foresees that world production of fisheries and aquaculture sector will reach 172 million tons in 2021, due to increased demand for fish. This rise will be attributed mostly to aquaculture production projected to expand by 33% in the period 2012–2021 (FAO, 2012).

Tilapia is among three genera species of economic importance (Eljaziri and Bin Omar, 2021 and refrences cited therein). Eljaziri and Bin Omar (this volume) showed, after trials with different percentages of microalgae Spirulina feed, showed that 3% ration gives excellent return in feeding Red Tilapia

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In this short note we present results of the consequence of feeding Red Tilapia with Spirulina on the health of the fish under the aforementioned experiment conditions for different ratios of feed.

Materials and Methods

A total of twelve cages were used and arranged in a concrete tank at the hatchery, TPU, UP Malasysia. Details of the specifications of the cages, experiment conditions and analytical methods are described in Eljaziri and Bin Omar (2021). A mixture of Spirulina commercial fish feed with ground commercial fish feed was used. Feeding rations of 0%, 1%, 3%, 5% and 7% were used twice a day for three months.

Results and Discussion

Nutritional Composition of Feed

Among the different ratios of spirulina, ranging from 1% to 7%, the 3% ration gave the best economic return in terms of growth patter, fish length, fish activity and coloration (Eljaziri and Bin Omar, 2021).

Effect of Feed Diet on Survival Rate of Red Tilapia

For the entire experimental period, positive survival rate was achieved with 1% and 3% forming the highest compared to other treatments (Table 1). This shows the impact of feed incorporated with spirulina on fish survival as it may bust the fish immune system. This is consistent with the studies of El- sheek et al. (2014), Jana et al. (2014) and Abdurrahaman and Ameen (2014).

Table 1. Percentage of Survival.

Treatment	Percentage of Red Tilapia survival %
0%	58.33%
1%	75.00%
3%	75.00%
5%	54.17%
7%	54.15%

Effect of Spirulina Feed on Fish Immune System

In order to test Spirulina ability in strengthening the fish immune system, a bacteria stock was formed using streptococcus aglactea, after been diluted with 10^{-5} colony to reach the standard count of 30 – 300. A 0.3ml of bacteria was injected into fish samples taken from different rations of spirulina fed fish. For two weeks, after the injection, the mortality rate was recorded.

Out of thirty samples, injected, fish fed with 1% and 3% had the lowest mortality rate. The one-way ANOVA analysis result shows no significant difference between the ratios at $p>0.05$. This proved that spirulina has the ability to strengthen the fish immune system, though excessive feed may result in negative effect (Nakagawa and Gomez-Diaz, 1995).

For comparison, a new fish sample, fed with different rations, was injected with 0.04ml of bacteria for two weeks. The result showed a bit higher mortality rate when compared with sample fed with spirulina for 13 weeks (Table 2). This, also, is a prove of the adapitbility of spirulina to fish resulting in strengthening of the fish immune system resulting in less mortality rate. High mortality rate, however, was observed for two weeks feed with no much difference between the ratios.

Table 2. Mortality for fish injected with 0.04ml bacteria (230.5×10^{-5} FCU/ml).

Spirulina	No of fish die	No of fish live	%of die fish	%of live fish
0%	21	9	70%	30%
1%	18	12	60%	40%
3%	16	14	53%	47%
5%	15	15	50%	50%
7%	15	15	50%	50%

Effect of Spirulina on Fish Hemoglobin

Hematological parameters are presented in Table 3. The results indicate that Erythrocyte RBC count is almost within the same range across the concentrations except for 3% with lowest count 1.9±0.3mg/l as well as hemoglobin of blood (HB) with 8.3±1.6g/dl. The PVC was also at the same range but lower (20%) in 3% and 5%.

Mean Corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) also show almost equal count among the concentrations. With regard to thrombocytes andplasma protein, the results also fall almost within the same range across all concentrations. However, WBC count differed between the concentrations with 5% having the highest 10.8±9.3g/l concentration.

The hemoglobin result for the parameters is within the references range reported by some studies. RBC ranges, from 1.9 – 2.4g/µl, are within the range described for hybrid tilapia 1.91 – 2.83 10^6//µl, (Hrubic et al, 2000) and for Nile tilapia 0.7 – 28 x10^6/mm^2 (Bettencourt et al, 2003). The HB count on the other hand ranges from 8.2 – 10.9 g/l.It is also within the range described for Nile tilapia 6.8 – 15.98g/dl (Bettencourt et al, 2003) and 7.0 – 9.8g/dl described for hybrid tilapia (Hrurbic et al, 2000) though a slight difference occurs at 5% with 10.9g/dl. The PVC range 20 – 30% are also, within what described for hybrid tilapia.

The MCV mean value obtained in this study is within the range of corresponding values described for hybrid tilapia (Hrubic et al, 2000) and Nile tilapia (Bettencourt et al., 2003). The MCHC mean value ranged 348 – 413g/l in this study which is similar to those reported for Nile tilapia 19.84 – 87.73% (Bettencourt et al., 2003) and in Nile tilapia (Isikawa et al., 2007) while the thrombocyte value and plasma protein is similar to those for hybrid tilapia (Hrubic et al, 2000).

Table 3. Hemoglobin response of red tilapia feed different spirulina ratio.

Spirulina Concentrations					
Parameters	**0%**	**1%**	**3%**	**5%**	**7%**
RBC(g/µl)	2.4±0.25	2.2±0.26	1.9±0.31	2.2±0.47	2.2±0.20
HB(g/dl)	8.2±1.4	9.7±0.27	8.3±1.6	9.7±1.1	10.9±1.8
PCV (%)	30±0.3	30±0.3	20±0.2	20±0.5	30±0.3
MCV(FL)	108.0±8.1	118.0±3.2	119.6±14.7	110.4±6.0	131.8±9.8
MCHC (g/l)	413.3±35.9	360±14.7	376.0±11.0	391.2±14.4	348.2±15.5
WBC (g/l)	2.1±1.0	5.7±4.7	5.3±3.5	10.8±9.3	2.8±2.6
THROMBO(g/l)	17.8±8.5	22.4±12.1	23.3±12.4	20.4±15.9	23.6±18.7
P PROT	5.7±5.9	40.8±6.6	39.4±3.2	39.8±3.3	43.8±3.1

The WBC mean value range 2.1 – 10.8g/l in this study is also similar to those reported for hybrid tilapia 2.1 – 15.4g/l (Hrubic et al, 2000). The result indicated the spirulina impact on fish immune system as lymphocyte developed for immune response.

Conclusion

Feeding fish with commercial spirulina diet has shown encouraging results in terms of overall growth of fish (Eljaziri and Bin Omar, 2021). A complementary study also showed that it promtes survival rate, health and strengthen the immune system.

Among the different ratios of spirulina studied, 1% and 3% showed overall remarkable performance in fish growth rate, survival rate, reduction in mortality rate and strengthening of the immune system to protect the fish from any bacterial infection as well as the fish activity and coloration as compared to the blank. Acceptable results were shown by the other ratios which, however, were below the 1% and 3% ration.

Authors' Resposibility

The authors substantially contributed to the conception and design of the study, acquisition, analysis and interpretation of data; all authors are responsible for the intellectual content of the manuscript and approved the final version of the article to be published.

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