ผลของการเสริมใบมะรุมในอาหารต่อการเจริญเติบโต และอัตราการรอดตายของปลากดคัง

Effects of Moringa's leave supplementary diet on growth performances and survival rate of redtail mystus (*Hemibagrus wyckioides*)

Somphone Phommanivong and Sompong Doolchidachabaporn

Department of Fisheries, Faculty of Agriculture, Khon Kaen University, 40002

Corresponding author: somphone05@gmail.com

บทคัดย่อ

การใช้ใบมะรุม (*Moringa oleifera* Lam.) เสริมในอาหารต่อการเจริญเติบโต องค์ประกอบของเลือด และอัตราการรอดตายของปลากดคัง (*Hemibagrus wyckioides*) โดยเสริมใบมะรุมในอาหาร 0, 5, 10 และ 15 เปอร์เซ็นต์ ที่ระดับโปรตีน 35 เปอร์เซ็นต์ และพลังงาน 3,700 กิโลแคลอรีต่อกิโลกรัม โดยนำปลาน้ำหนักเริ่มต้นเฉลี่ย 2.82±0.03 กรัม/ตัว เลี้ยงเป็นเวลา 10 สัปดาห์ ผลการศึกษาพบว่า การเจริญเติบโตของปลากดคังที่ได้รับอาหารผสมใบมะรุมที่ระดับต่างๆ ไม่มีความแตกต่างกัน (P>0.05) น้ำหนักเพิ่มขึ้นสูงสุดของปลาที่ได้รับใบมะรุมผสมอาหาร 5% คือ 8.61±0.67 กรัม/ตัว ตามด้วยปลาที่กินอาหารผสมใบมะรุม 0, 10 และ 15% คือ 7.81±1.67, 7.68±1.34 และ 7.60±0.29 กรัม/ตัว ตามลำดับ อัตราการเจริญเติบโตจำเพาะเท่ากับ 1.87±0.23, 1.99±0.09, 1.86±0.18 และ 1.80±0.06 ตามลำดับ น้ำหนักเฉลี่ยต่อวันอยู่ที่ 0.10±0.02, 0.11±0.09, 0.10±0.02 และ 0.09 ±0.05 กรัม/ตัว ตามลำดับ ความยาวทั้งหมด 13.70±1.96, 14±1.82, 13.85±0.98 และ 13.37±1.25 ตามลำดับ นอกจากนี้อัตราการรอดตายของปลาไม่แตกต่างกัน (P>0.05) อยู่ในช่วง 93±5.77 - 97.5±1.91 % ค่าโลหิตวิทยา ดัชนีตับ (HSI) ดัชนีอวัยวะภายใน (VSI) และดัชนีลำไส้ (ISI) ไม่มีความแตกต่างกัน (P>0.05) ดังนั้นการเสริมใบมะรุมในอาหารที่ระดับ 15% พบว่า ไม่มีผลกระทบต่อการเจริญเติบโต อัตราการรอดตายและสุขภาพของปลากดคัง

คำสำคัญ: ปลากดคัง ใบมะรุม อัตราการเจริญเติบโต อัตราการรอด

Abstract

The utilization of moringa (*Moringa oleifera* Lam.) leaf additive diet on growth performance, hematological parameters, and survival rate in Red tail mystus (*Hemibagrus wyckioides*) was examined. Diets were prepared by supplementing with moringa leaf at 0, 5, 10, and 15%, all diets contained 35% crude protein and isocaloric diets of 3,700 kcal/kg. Fish with initial weight of 2.82± 0.03 g/fish were fed with experimental diets for 10 weeks. The result showed that growth

performance was not significant difference (p> 0.05) in all groups, the highest weight gain of fish nursed at 5% moringa leaf meal in diet was 8.61±0.67 g while the weight gains of fish fed with 0, 10 and 15 % moringa leaf meal in diet were 7.81±1.67, 7.68±1.34, and 7.60±0.29 (g), respectively. The specific growth rates were 1.87±0.23, 1.99±0.09, 1.86±0.18, and 1.80±0.06, respectively. Average daily gains were 0.10±0.02, 0.11±0.09, 0.10±0.02, and 0.09±0.05, respectively. Total lengths were 13.70±1.96, 14.00±1.82, 13.85±0.98, and 13.37±1.25, respectively. In addition, survival rate of fish was not significantly different (P>0.05), ranged from 93±5.77 to 97.5±1.91%. Furthermore, hematological parameters were not significantly different (P>0.05). Hepatosomatic index (HSI), vesicle somatic index (VSI), and intestinal somatic index (ISI) were similar in all groups. Therefore, supplementing 15% moringa leaf in diet showed no adverse effects on growth, survival rate, and health of redtail mystus.

Keywords: moringa, redtail mystus, growth performance, survival rate

Introduction

Aquaculture is one of the fastest growing sectors providing the human food around the world. To sustain such a high rate of aquaculture expansion, matching increase in fish feed production is imperative. On other hand, the high cost of fish feed and quality of feed its uncertain availability lead to the need to identify supplement protein sources for fish feeds. Recently, the analysis of nutritional value of wild plant materials attracted attention due to the fact that they contain significant amount of essential nutrients that can be used for both human consumption and in the formulation of animal feeds (Eromosele, 1993). In order to attain a more economically sustainable and environmentally friendly production, research interest has been directed towards the evaluation and use of unconventional protein sources, particularly from plant products such as seeds, leaves and other agricultural by products (Olvera *et al*., 1988). In last 10 years, extensive studies on agronomic aspects of moringa, that is widely distributed in the tropics and having a high fresh green matter production potential have been carried out (Foidl *et al*., 2001). *Moringa oleifera*, a number of the family Moringaceae, commonly referred to as “drumstick tree” is fast-growing plant with a great economic importance for the food and medical industry. The leaves are used as food supplements for humans and animals (Makkar and Becker, 1997). Leaves are also rich in starch, mineral, iron, vitamin A, B and C, calcium, and the essential amino acids, methionine and cysteine (Foidl *et al*., 2001). The protein content of fresh leaves does not vary substantially from place to

place (Gupta *et al*., 1989). Makkar and Becker (1996) reported that moringa leaves contain a negligible amount of tannins, but a high level of crude saponins (about 5 %), which may have antinutritional effects in animal. Recently, a preliminary study on moringa leaf meal in tilapia revealed that a 10% in diets did not cause any adverse effect on growth performance (Yuangsoi and Charoenwattanasak, 2011). Redtail mystus is an omnivorous freshwater fish of wide distribution in Mekong River basin, this species is the largest bagrid catfish in Asia and may reach 80 kg in the wild, and eats a wide variety of prepared, frozen and live foods, which make it an excellent candidate species for intensive aquaculture (Prasertwattana *et al*., 2005). The current study was designed to evaluate moringa leave meal in diets for growth performance and survival rate in a redtail mystus.

Materials and methods

1. Experimental design

The experimental design was 4×4 Completely Randomized Design; (CRD), 4 treatments and 4 replications. Each treatment was used diet containing 35% of crude protein by adding different levels of Moringa as following:

Treatment 1: Diet + 0% Moringa's leaves meal (control)

Treatment 2: Diet + 5% Moringa's leaves meal

Treatment 3: Diet + 10% Moringa's leaves meal

Treatment 4: Diet + 15 % Moringa's leaves meal

2. Experimental diets

Young fresh leaves of moringa were obtained from Khon Kaen. After separating the small stems, petioles and major midribs, the young leaflets were freeze-dried, ground and stored at -20 °C. Experimental diets of feed stuffs of these experiments are given in Table 1. The recipe of the dietary feed stuffs was similar to the work reported by Boonarsa (2008), which has been shown to be adequate for Green catfish. The vitamin and mineral mixtures were also similar to that of the Boonarsa (2008), except that it did not contain the same levels of dry moringa leave meal. Three diets were prepared to contain graded levels of dry moringa leave meal in diet (5, 10, and 15 %). The diets were prepared by mixing the dry ingredients with soybean oil and water by hands and then the wet dough was placed in a grinder, extruded to pass through a 2-mm mesh sieve, and

finally the moist pellets were dried in a room temperature, and then stored in the fridge at 10^0 C for further uses.

3. Proximate experimental diets

Experimental diets were analyzed according to AOAC (1990) procedures: dry matter (105 ºC to constant weight), ash (incinerated at 550 ºC to constant weight), crude protein (N×6.25) by the kjeldahl method.

Table 1. The ingredients used in feed ration for the composition of the basal diet

	Percentage of dry moringa leave meal in diet (%)			
Ingredient	Diet (0%)	Diet (5%)	Diet (10%)	Diet (15%)
Fish meal	45	45	45	45
Soybean meal	6	6	6	6
fulfat	21	16	11	6
Moringa	0	5	10	15
Rice bran	3	3	3	3
Soybean oil	20.79	20.79	20.79	20.79
Wheat powder	4.23	4.23	4.23	4.23
Vitamin mixture	0.20	0.20	0.20	0.20
Mineral mixture	0.76	0.76	0.76	0.76

Table 2. The proximate analysis of moringa leaves and experimental diets

	Proximate composition by analysis (% dry weight on basis)				
Composition	Moringa leaves	Diet (0%)	Diet (5%)	Diet (10%)	Diet (15%)
Moisture	7.9	10.33	10.12	10.75	10.26
Crude protein	25.6	34.8	35.07	35.06	35.19
Fat	6.6	18.1	17.35	17.78	16.8
Fiber	2.5	2.8	2.75	2.68	2.54
Ash	11.5	14.1	14.42	14.53	14.1
NFE	20.4	33.2	33.67	33.45	33.47
DE (Kcal/100 g)	187	367	363	366	366

4. Fish maintenance for experiment

The *H. wyckioides* fingerlings were obtained from a commercial farm in Nong khai province of Thailand. The experiment was carried out at the Department of Fisheries, Khon Kaen University and catfish were held in fiber tanks upon arrival. The fish were acclimatized in fiber tanks for 2 weeks and they were fed with the same diet. The trial was conducted in 16 glass-tanks. Each of them contained 50 liters of water. 50 fish with similar size and mean weight (MSE), 2.820±0.036 g were nursed in each tank. A static water system with continuous aeration was used. The fish were hand-fed to satiation for redtail catfish, 2 times per day at 8: 00 a.m and 17:00 p.m. Every three days, feces and excess feed were removed early in the morning to maintain water quality. Fish were batch-weighed tank by tank every 15 days and the feeding ration was adjusted. The feeding trial was carried out for 10 weeks. Water temperature was maintained at 25 – 28^0 C and mean pH values ranged from 7.01 – 8.07.

5. Evaluation of growth performance parameters

The collected data on live weight gained (WG), specific growth rate (SGR), feed conversion ratio (FCR), average daily gain (ADG), total length, survival rate, protein efficiency ratio, HIS, VSI and ISI were calculated.

$WG\ (g) = [(W_t - W_i)/W_i] \times 100$

SGR (% /day) = (Ln final wt - Ln initial wt)/days x100

FCR = total feed intake (g)/total wet weight gained (g)

ADG (g) = (Initial wt – final wt)/period of experiment

TL (cm) = Total length/ no of fish

Survival rate (%) = 100x (final fish number)/(initial fish number).

PER (%) = (g weight gained/g protein intake) x 100

HIS (%) = (Liver mass (g)/ body mass (g)) × 100

VSI (%) = (liver mass (g)/ total inner organ mass) × 100

ISI (%) = (Intestine mass (g)/ body mass (g)) × 100

6. Hematological profile

Blood samples were obtained from the caudal vein of 5 fish from each tank. 1 ml blood sample was collected in bottle containing 0.05 ml (EDTA) as anticoagulant. Blood samples for serum analysis were collected in bottles without any anticoagulant. Serum was separated by

centrifugation at 1500 rpm for 10 minutes, and kept frozen at -20 ºC. The total protein, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphate (ALP) activities were determined by using automated instrumentation (Veterinary Diagnosis Laboratory, Animal Hospital, Khon Kaen University). The hematological profiles were estimated by the method of Nelson and Morris (1989).

7. Statistical analysis

All of the collected data were subjected to one-way analysis of variance (ANOVA) and when the differences among the groups were identified, multiple comparisons of means were made with the use of Duncan's Multiple-Range Test (DMRT) through the use of a computer programme (SAS, 2003).

Results and discussions

1. Growth performance and feed utilization

Growth performance and feed utilization of moringa leaves meal in diets at 0, 5, 10 and 15% for nursing redtail mystus for 10 weeks are shown in Table 3.

Table 3. Growth performance and feed utilization of redtail mystus feed with experimental diets.

	Percentage of dry moringa leave meal in diet (%)				
parameters	0%	5%	10%	15%	p-value
IW (g)	2.83±0.03	2.82±0.03	2.82±0.03	2.83±0.03	0.972^{ns}
WG (g)	7.81±1.67	8.61±0.67	7.68±1.34	7.60±0.29	0.060^{ns}
SGR (%)	1.87±0.23	1.99±0.09	1.86±0.18	1.80±0.06	0.455^{ns}
ADG (g)	0.10±0.02	0.11±0.09	0.10±0.02	0.09±0.05	0.064^{ns}
FCR	2.09±0.16	2.02±0.12	2.15±0.25	2.20±0.09	0.067^{ns}
PER (%)	0.21±0.01	0.24±0.01	0.21±0.04	0.20±0.08	0.117^{ns}
TL (cm)	13.70±1.96	14.00±1.82	13.85±0.98	13.37±1.25	0.408^{ns}
SR (%)	97.5±1.91	93.0±5.77	95.5±1.01	97±2.581	0.274^{ns}
HSI%	1.13±0.12	1.05±0.12	1.18±0.09	1.28±0.28	0.2947^{ns}
ISI%	3.92±0.40	3.78±0.21	3.76±0.47	3.94±0.74	0.6072^{ns}
VSI%	3.92±0.40	3.78±0.21	3.96±0.47	3.81±0.74	0.6072^{ns}

The growth performance of redtail mystus, weight gain, specific growth rate, average daily weight gain, total length, survival rate, protein efficiency ratio and feed conversion ratio of fish fed with 5%, 10% and 15% of moringa leave meal additive diets were not significant (P> 0.05) when compared with control group (0%). Yuangsoi and Charoenwattanasak (2011) reported that utilization of moringa (*Moringa oleifera Lam*.) leaf on growth performance and protein digestibility in (*Oreochromis niloticus* L.) at 0, 5, 10 and 15% for 60 days. The average weight gain, specific growth rate, feed conversion ration and feed efficiency was not significant in all groups (p>0.05). Richter *et al*. (2003) reported that using moringa (*Moringa oleifera Lam*.) as an alternative protein source for Nile tilapia (*O. niloticus* L.) at 10%, 20% and 30% for 7 weeks and found that tilapia fed with 10% of moringa in diet provided the best growth performance, but the growth performances of Nile tilapia fed with moringa from 20 and 30% of moringa leave meal in diets were reduced. Afuang *et al.* (2003) reported that utilization of moringa leaf on growth performance and feed utilization in tilapia (*O. niloticus* L.) at 13, 27 and 40% and found that the growth performance of Nile tilapia fed with 13% of moringa leave meal in diet was reduced.

2. Hepatosomatic index, vesicle somatic index and intestinal somatic index

The hepatosomatic index (HSI), vesicle somatic index (VSI), intestinal somatic index (ISI) of redtail mystus fed with 5, 10, and 15 % of moringa leave meal additive diets were determined at the end of the experiment. HSI, VSI, and ISI weight were not significant (P > 0.05). Hepatosomatic index (HSI) were 1.13±0.12, 1.05±0.12, 1.18±0.09 and 1.28±0.28% found in fish fed with 5, 10, and 15 % of moringa leave meal additive diets, respectively. While vesicle somatic index (VSI) was 3.92±0.40, 3.78±0.21, 3.96±0.47 and 3.81±0.74%, respectively, intestinal somatic index (ISI) was 3.92±0.40, 3.78±0.21, 3.76±0.47 and 3.94±0.74%, respectively. Afuang *et al.* (2003) reported that there were no significances (p>0.05) in hepatosomatic index and intestinal somatic index of fish fed with all experimental moringa leaves supplementary diets when compared to those fed with the control diet. Likely, Yuangsoi and Charoenwattanasak (2011) reported that utilization of moringa in diet at 0, 5, 10 and 15% and found that at the end of experiment the hepatosomatic index (HSI) was not significant difference P>0.05 in all groups of experiment compared with control.

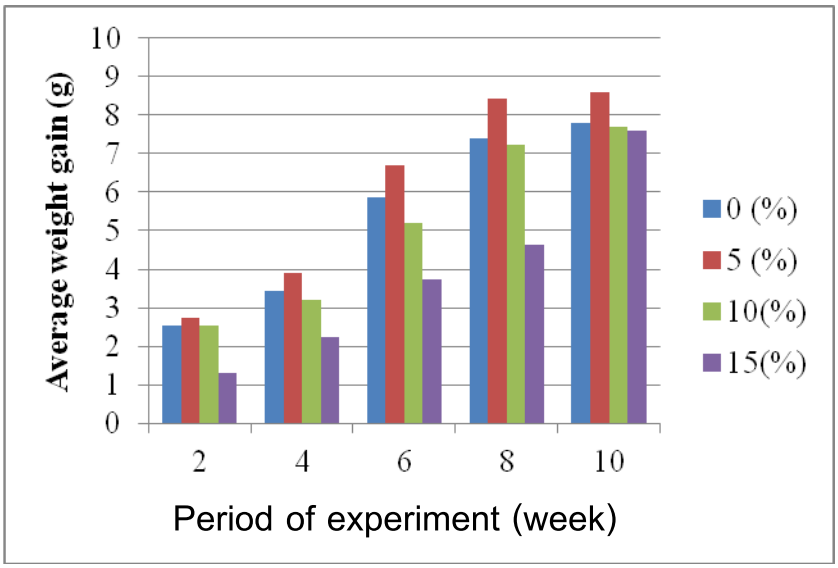

Figure 1. Growth performance of fish fed with experimental diets

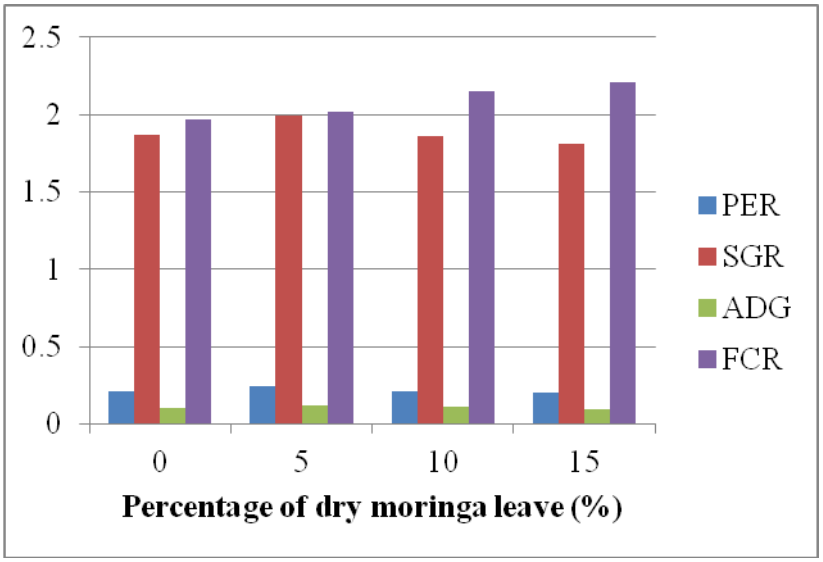

Figure 2. PER, SGR, ADG, and FCR of fish fed with experimental diets

3. Haematological parameters of fish with experimental diets

Haematological parameters of redtail mystus, average initial weight 2.82±0.03 g/fish, fed with moringa leaves meal in diets at 0, 5, 10 and 15% for 10 weeks are shown in Table 4.

Table 4. Hematological parameters of fish fed with experimental diets.

Parameters	Percentage of dry moringa leave meal in diet (%)				
	0	5	10	15	P-value
Hct (%)	12±1.32	13.33±5.79	14.33±2.02	15.66±3.78	0.669^{ns}
TP (g/dl)	6.01±0.60	6±0.60	6.02±0.80	6±0.60	0.054^{ns}
BT (mg/dl)	10.16±0.77	10.46±1.45	11.23±1.35	11.26±1.40	0.655^{ns}
AST (U/L)	301	303.66±5.59	302.66±1.21	303.66±1.30	0.058^{ns}
ALT (U/L)	234±14.79	237.66±1.01	236.66±1.09	235.33±7.04	0.110^{ns}
ALP (U/L)	152.66±18.5	149.66±1.78	150±2.83	153±7.54	0.448^{ns}

In this study, there were not significant differences ($p>0.05$) in haemotological parameters of redtail mystus fed with various levels of moringa leave in diets. Hematocrit was not significant differences ($p>0.05$) of fish fed with experimental diet ranged in 12±1.32 to 15.66±3.78 x 10^6, total protein ranged in 6±0.60 to 6.02±0.60 (g/dl) and BT (mg/dl) ranged 10.16±0.77 to 11.26±1.40 (mg/dl). Yuangsoi and Charoenwattanasak (2011) reported that hematological parameters of Nile tilapia fed with various levels of moringa leave meal in diets at 5, 10 and 15% were not significantly different ($p>0.05$) among all groups compared with control group.

Aspartate aminotransferase (AST), alkaline phosphate (ALP) and alanin aminotransferase (ALT) activities value of fish fed with various levels of moringa leave meal in diet showed that there were not significant ($p>0.05$). AST was 301, 303.66±5.59, 302.66±1.21 and 303.66±1.30 U/L, respectively, ALP was 152.66±18.5, 149.66±1.78, 150±2.83 and 153±7.54 U/L, respectively and ALT was 234±14.79, 237.66±1.01, 236.66±1.09, and 235.33±7.04 U/L, respectively. Therefore, attention has been focused on the changes in AST, ALT and ALP activities, which promotes gluconeogenesis from amino acid, as well as on the changes in aminotransferase activities in the liver.

Conclusions

The results of our preliminary study on nutritional quality of moringa leaves as partial feed for fish indicate that up to 15% inclusion of this material can be recommended for redtail mystus.

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