



Impact of Azomite Supplemented Diets on the Growth and Body Composition of Catfish (*Pangasius hypophthalmus*)

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ABSTRACT

The study was conducted to evaluate the impact of azomite, a natural mineral of volcanic ash, on the growth performance and body composition of catfish (*Pangasius hypophthalmus*) for 90 days. Experimental fish (n=25) was stocked in six fibreglass aquariums (18L capacity) at 25 fish/aquaria. Azomite was added in the basal diet containing crude protein (CP 38.3%) with three graded levels 0% control, 0.5% T₁ and 1.0% T₂ and the fish was fed at 4% of wet body weight. After 90 days of study period, the increase in weight gain was obtained as 4.3g, 5.9g and 6.7 g in control, T₁ and T₂, respectively. The treatments with azomite supplementation showed significantly higher growth than control group (P ≤ 0.05). The feed conversion ratio (FCR) was found significantly (P ≤ 0.05) better (1.9) in T₂ than (2.4) control and (2.2) T₁. Proximate analysis showed that the fish fed azomite supplemented diet has a significant difference (P ≤ 0.05) in fat, moisture, protein and ash contents while non-significant differences observed in fibre and phosphorus contents as compared to the control group. In conclusion the *Pangasius* fry showed best growth performance without any significant increase in biochemical nutrients profile with 1.0% inclusion of azomite in the diet.

INTRODUCTION

Catfish *Pangasius hypophthalmus* is Asian Catfish which is mainly produced in Vietnam and Thailand. It is considered major fish spp. in the Mekong River fishery and is the largest and most valued inland fisheries in the world. The *Pangasius* are prolific spawners and produce large numbers of larvae which are harvested easily from the flowing river. The establishment of capture-based aquaculture for this specie was begun in Vietnam and to some extent in Thailand and Cambodia (Nguyen, 2009). Thai *Pangasius hypophthalmus* becomes an auspicious species due to its omnivorous nature, rapid growth and good market. To achieve optimal growth potential *Pangasius* requires high protein diet (> 40%) (Ali *et al.*, 2001). The operating cost mainly feed for cat fish is very high which accounts for more than 50% of the total production cost

that is one of the major hindrance in its culture (Sehagal and Toor, 1991; De Silva and Davy, 1992). The nutritionists are working to reduce feed cost down so that suitable feeding strategies are made to improve the husbandry techniques by improving fish feed utilization. The studies revealed that an increase of feeding frequency has positive effect on the growth and production performance of catfish pangasiid and silver carp culture (Khan *et al.*, 2009).

Azomite is considered a very useful natural mineral product found from Utha in USA and also abundantly used in Asia. It is a certified organic trace mineral booster and is used as supplement in livestock and aquatic animal feeds globally for over a decade. It is also used in the feed of poultry, shrimps, and tilapia as trace mineral mix for several years and declares to improve the feed quality, increase weight gain, feed conversion and likability. It has been reported that azomite supplemented diet improves growth, intestinal digestive enzymes activity, nutrient digestibility and serum non-specific immune function in tilapia (*Oreochromis niloticus aureus*) (Liu *et al.*, 2009), grass carp (*Ctenopharyngodon idellus*) (Liu *et al.*, 2011),

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Authors' Contribution

SSB, NK and UA planned the work. K.JI, HA, SD and NK wrote the article. SB, SM, MN and SA studied growth, proximate and physicochemical parameters. SB, DHM and MSA analysed the data statistically.

Key words

Catfish (*Pangasius hypophthalmus*), Azomite, Growth, Body composition.

white shrimp (*Litopenaeus vannamei*) (Tan *et al.*, 2014), koi carp (*Ciprinus carpio*) (Jaleel *et al.*, 2015). The trace minerals are necessary to incorporate in fish diets because they participate in biochemical processes required for normal fish growth and development (Hooge, 2008). Keeping in view the importance of azomite inclusion in experimental as well as commercial diets in animal and poultry feeds and its effects on the growth and survivability; the present study was therefore planned to test the impact of various levels of azomite concentration on the growth performance and body composition of catfish (*Pangasius hypophthalmus*) fry.

MATERIALS AND METHODS

Experimental setup

The experimental fish *Pangasius hypophthalmus* was imported from Thailand and kept in fiberglass aquariums in fish hatchery at Fisheries Research and Training Facilities, Department of Fisheries and Aquaculture, UVAS, Ravi Campus, Pattoki. The fish was fed with powdered diet having 38.3% crude protein three times a day at 2% fish body weight. After four weeks of acclimatization and quarantine measures, the experimental fish was distributed into three treatment groups (levels 0% control, 0.5% T₁ and 1.0% T₂) each having two replicates. *Pangasius hypophthalmus* having an average weight of 0.98 g was stocked at 25 fish/aquaria and the fish was fed at 4% of wet body weight. The morphometric characters *viz.* fish wet body weight (g) and total body length (mm) of each fish was measured and recorded at the time of stocking. Aerators were installed in each aquarium for oxygenation of water. The aquaria water was change 10% daily and completely on third day. The uneaten feed and feces were siphoned on daily basis.

Table I.- Feed formulation and feed ingredients.

Ingredients and CP composition	Percent inclusion	Crude protein (5)
Fish meal (50%)	30	15.0
Corn glutton (60%)	22	13.2
Rice polish (12%)	7	0.84
Soybean meal (43%)	10	4.3
Wheat bran (16.5%)	30	4.95
Vitamins premix and oil	1	0
Azomite	0%, 0.5%, 1%	
Total	100	38.3%

Feed formulation and feeding protocol

Three types of experimental feeds control, T₁ and T₂ were prepared using following feed ingredients: fish

meal, maize glutton, rice polish, soybean meal, wheat bran, minerals mix, vitamins, cooking oil and azomite as a supplement in different ratios (0.5% and 1.0%) in feed designated as T₁ and T₂, respectively (Table I). The proximate composition of experimental feeds are given in Table II. Pelleted feeds were prepared on local pelleting machine which were then sun dried and broken down in to small crumbles and fed to fish at 4% of its wet body weight twice a day up to six days a week. Feed was adjusted after fortnightly sampling of fish and its growth increment.

Fish growth parameters

To measure the morphometric records, all the fish were caught on fortnightly basis using small nylon mesh hand net and glass beaker to avoid stress. After taking morphometric measurements fish was released back to their respective aquaria. Mortality of fish was also recorded if found. Growth parameters like net weight gain, feed conversion ratio (FCR) and specific growth rate (SGR) were also calculated for each tank.

$$\text{Net WG} = \text{Final BW (g)} - \text{Initial BW (g)}$$

$$\% \text{WG} = \frac{\text{Final BW (g)} - \text{Initial BW (g)}}{\text{Initial BW (g)}} \times 100$$

$$\text{FCR} = \frac{\text{Feed given}}{\text{WG}}$$

$$\text{SGR}\% = \frac{\ln(W1) - \ln(W2)}{T} \times 100$$

Where, WG is weight gain, BW is body weight, W1 is initial weight, W2 is final weight and T is the number of days in the feeding trial.

Table II.- Proximate composition of fish feed.

Parameters	Control (0.0%)	T ₁ (0.5%)	T ₂ (1.0%)
Moisture (%)	7.3	8.0	7.9
Crude protein (%)	38.3	38.3	38.3
Crude fat (%)	8.7	8.5	8.4
Crude fiber (%)	0.85	0.7	0.7
Ash (%)	15.5	14.3	14.3

Proximate analysis

On termination of feeding trials, 7-8 fishes from each aquarium were taken for whole body proximate analysis. The fish sample and the formulated feed were subjected to proximate analysis to determine the dry matter, ash, crude protein, crude lipids and gross energy following (AOAC, 2003; Mehbood *et al.*, 2017) in the Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Ravi Campus, Pattoki and Buffalo Research Institute (BRI), Pattoki using Near Infrared Spectrophotometry (NIR) method.

Physico-chemical parameters

Water quality parameters such as, dissolved oxygen (DO), pH, water temperature, total dissolved solids (TDS) and salinity were monitored and recorded on daily basis by using DO meter (YSI 55 Incorporated, Yellow Springs, Ohio, 4387, USA), pH meter (LT-Lutron pH-207 Taiwan) and TDS meter, respectively (APHA, 1998).

Statistical analysis

Data obtained was statistically analyzed using SAS 9.1 version through one-way ANOVA (Analysis of Variance Techniques). Means were compared by using Duncan's Multiple Range test.

Table III.- Fortnightly average growth of fish using various levels of azomite in artificial feed.

Parameter	Control (0%)	T1 (0.5%)	T2 (1.0%)
Initial wt. (g)	0.7 ^c ±0.002 ^c	0.9±0.001 ^b	0.8±0.008 ^a
Final wt. (g)	4.3±0.002 ^c	5.9±0.025 ^b	6.7±0.019 ^a
Net wt.gain (g)	3.6±0.028 ^c	5.0±0.34 ^b	5.9±0.23 ^a
Wt. gain (%)	514.28±1.9 ^c	555.55±3.89 ^b	737.5±6.03 ^a
Initial length (mm)	53.3±0.14 ^a	53.4 ± 0.57 ^a	53.1±0.07 ^a
Final length (mm)	69.4±0.14 ^c	82.4±0.07 ^b	85.3±0.07 ^a
Length gain (mm)	16.1±0.28 ^c	28.9±0.49 ^b	32.1±0 ^a
Initial biomass	18.6±0.07 ^c	21.9±0.04 ^a	20.7 ±0.21 ^b
Final biomass	90.7±0.04 ^c	135.1±0.59 ^b	155.2±0.44 ^a
FCR	2.4±0.01 ^a	2.2±0 ^b	1.9±0.007 ^c
SGR%	1.1±0.01 ^a	1.1±0.01 ^a	1.2±0.01 ^b

*Figures having different super scripts are significantly different.

RESULTS

Growth

The growth parameters of fish under all the treatments are presented in Table III. Statistical analysis using one-way ANOVA revealed significant differences ($P \leq 0.05$) among the initial weight, final weight, net weight gain, and percent weight gain of fish in all the three treatment groups. The fish in T₂ exhibited significantly ($P \leq 0.05$) higher growth indices compared to T₁ and control, respectively (Table IV). Length increment also revealed same significant difference with higher increase in T₂ followed by T₁ and control, respectively (Table IV). Results regarding final biomass exhibited significantly higher increase in T₂ followed by T₁ and control. FCR and SGR% reveals significantly better values in T₂, T₁ and then control, respectively. SGR% in control and T₁ showed non-significant differences compared to T₂.

Proximate composition

The detail of proximate composition of *Pangasius*

hypophthalmus fingerlings is given in Table IV. The fish was also analyzed for its proximate composition at the start and post-trial as well. The dry matter, ash content, crude protein and crude fat contents showed significant differences ($P \leq 0.05$) with control group but fiber content in the fish sample revealed non-significant differences.

Table IV.- Proximate composition pre and post-trial of *Pangasius hypophthalmus*.

Parameters	Pre-treatment	Control (0.0%)	T ₁ (0.05%)	T ₂ (1.0%)
Dry matter (%)	7.69±0.37 ^b	9.55±0.35 ^a	8.35 ± 0.21 ^b	8.15 ± 0.21 ^b
Crude protein (%)	58.15 ± 0.49 ^c	63.4 ± 0.14 ^a	60.2 ± 0.28 ^b	63.5 ± 0.28 ^a
Crude lipids (%)	8.2 ± 0.14 ^a	8.55 ± 0.21 ^a	7.7 ± 0.28 ^b	8.35 ± 0.35 ^a
Ash (%)	17.4 ± 0.14 ^c	18.55 ± 0.35 ^a	18.35 ± 0.35 ^a	17.65 ± 0.07 ^c
Crude fiber (%)	0.78 ± 0.09 ^a	0.95 ± 0.07 ^a	0.78 ± 0.04 ^a	0.75 ± 0.08 ^a

*Figures having different super scripts are significantly different.

Table V.- Physico-chemical parameters of aquariums water in different treatments.

Parameters	Control (0.0%)	T ₁ (0.05%)	T ₂ (1.0%)
DO (mg/l)	4.96±0.06 ^a	4.52 ±0.39 ^a	4.79 ±0.33 ^a
TDS (mg/l)	1252±3.92 ^a	1262 ±3.94 ^a	1273±3.64 ^a
Salinity (ppt)	1.08±0.007 ^a	1.12±0.01 ^a	1.14±0.03 ^a
Temp. (°C)	25.84±0.09 ^a	25.91±0.31 ^a	25.76 ±0.16 ^a
pH	7.18±0.04 ^c	7.50±0.26 ^a	7.36±0.01 ^b

Physico-chemical parameters

The physico-chemical parameters temperature, dissolved oxygen (DO), total dissolved solids (TDS), and salinity shows a non-significant difference in each treatment but pH shows a significant difference ($P \leq 0.05$) in each treatment and was in acceptable range throughout the study period (Table V).

DISCUSSION

The importance of trace minerals as essential ingredients in diets, although in small quantities, is also evident in fish. The results of current study based on the impact of adding different ratios of azomite *i.e.*, control (0%), T₁ (0.5%) and T₂ (1%) in the diet containing 38.3% crude protein on the growth, survival and body composition of *Pangasius hypophthalmus* fry. The statistical analysis of growth parameters revealed a significantly higher final

weight, net weight gain and percent weight gain in T₂ followed by T₁ and then control. The significantly higher fish biomass and FCR values were also observed in T₂ than T₁ and control group. Our results are comparable with the findings of Liu *et al.* (2009) who reported that addition of 0.25%, 0.50% and 0.75% azomite in the diet of *Oreochromis niloticus* increased significant growth and better FCR. Watanabe *et al.* (1997) described the role of trace elements in biological systems in several animals where macro and micro or trace minerals played an important role in the growth, survival, cellular and physiological levels of animals. Investigations of mineral contents in fish are comparatively difficult and complicated because both dietary mineral intake and waterborne mineral uptake have to be considered while calculating the mineral budgets. Liu *et al.* (2011) evaluated various levels of azomite on the growth and body composition of grass carp (*Ctenopharyngodon idella*) and found significant difference in growth and FCR with the addition of 0.2% azomite compared to control and non-significant changes in fish body composition. Tan *et al.* (2014) also supported our results who fed azomite at 2.0 and 4.0 g kg⁻¹ in basal feed of shrimp and found significant higher growth compared to control group with 0g inclusion of azomite in the diet. Liu *et al.* (2011) reported that carps fed with azomite treatment showed higher growth and lower FCR than the control group with 0% azomite. Tan *et al.* (2014) also reported that the weight gain of shrimp increased by 14.0% (P≤0.05), while feed conversion ratio decreased by 0.11 and 0.09 (P≤0.05) in shrimp given feed containing 2.0 and 4.0 g kg⁻¹ azomite.

Regarding proximate composition the results revealed non-significant differences among treated and control groups and is in line with the findings of Liu *et al.* (2009) who did not found any significant change in fish body composition.

The physico-chemical parameters were found within acceptable range accept temperature which showed fluctuations that might be due to winter season and addition of freshwater which was exchanged 10% on daily basis in the culture system. The growth and survival of fish is affected directly or indirectly by temperature (El-Sayed *et al.*, 1996). Increase in temperature increases fish growth while decrease in temperature decreases growth (Hannibal *et al.*, 2011; Shah *et al.*, 2014). Other water quality parameters were recorded throughout the study period and were within the acceptable ranges for Pangas growth.

CONCLUSION

In conclusion supplementation of azomite at 1.0% in Pangasius fry diet can significantly increase growth

without any significant alteration in the fish biochemical nutrient profile when fed with high protein 38.3% CP feed.

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Statement of conflict of interest

Authors have declared no conflict of interest.

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