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Growth Performance of *Clarias gariepinus* Fed Dietary Milk Fat

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Abstract: A feeding trial was conducted on the utilization of milk fat as lipid energy source by *Clarias gariepinus* fingerlings (0.85±0.03 g). The fishes were fed with 0, 5, 10, 15, 20% milk fat based diets respectively for 8 weeks. The results obtained showed significant differences ($p<0.05$) for diets containing graded levels of milk fat in terms of weight gain, feed efficiency ratio and specific growth rate when compared with the control diet (0% milk fat). Among the milk fat based diets, containing that had 20% inclusion level of milk fat gave the highest specific growth rate and lowest feed conversion ratio. Carcass analysis showed that there was a significant difference ($p<0.05$) between the control diet and milk fat based diets. Therefore, the results indicated efficient utilization of milk fat as protein sparing which would promote sustainable aquaculture in view of the high cost fish oil.

Key words: Milk fat, *Clarias gariepinus*, fish oil, protein sparing

INTRODUCTION

Milk fat is a very important commodity to the dairy industries. Its image as a natural product and its organoleptic attributes, nutritional values and functional properties make it suitable for numerous food applications (Boudreau and Arul, 1993; Rajah, 1994). Possessing a unique fatty acid profile, milk fats has the most complex chemical composition of all natural fats. This fatty acid composition is highly variable and is influenced by factors such as lactation stage, season, breeds of cow, feed source and region (Deffense, 1993; German and Dillard, 1998). Dietary lipids play an important role in commercial diets of fish as concentrated source of energy and essential fatty acids for growth and development of fish (Pie *et al*., 2004). The use of dietary lipids can spare dietary protein through a process called protein sparing action (Gaylord and Gatlin, 2000). Higher energy levels generally come from increased dietary lipids as lipid is an energy dense nutrient and readily metabolized by fish (NRC, 1993). However, higher dietary lipid content in the diet of fish could result in oxidative stress and invariably pathological conditions (Sakai *et al*., 1998). Thus, the experiment was to determine the growth response of *Clarias gariepinus* fed with milk fat feed.

MATERIALS AND METHODS

The experiment was conducted at the Water Resources, Aquaculture and Fisheries Technology Laboratories of Federal University of Technology, Minna. The experiments consisted of five treatments in triplicate. A water flow-through device was maintained in the experimental unit to enable freshwater enter each bowl and excess and polluted water leave the system. Twenty fingerlings of *Clarias gariepinus* fingerlings (weight of 0.85g±0.02) were randomly stocked in 15 circular plastic bowls. Five iso-nitogenous diets were formulated at 40% crude protein with graded levels of milk fat (0, 5, 10, 15, 20%) Table 1. The fingerlings were fed twice daily at 3 and 5% body weight. The fishes were individually weighed at the commencement of the trial and bulk weighed fortnightly with the aid of electronic sensitive balance Citizen 200.. The water quality parameters like pH, Dissolved oxygen, Temperature and Conductivity were monitored weekly by the standard methods as described by Boyd (1990). The carcass analysis were conducted at both the initial and end of the feeding trials for the evaluation of growth performance according to AOAC (2000).

RESULTS

From the result shown in Table 2, the Mean Weight Gain (MWG) did not indicate significant difference ($p>0.05$) between Diet I and IV but there were significant differences ($p<0.05$) among diets II, III and V respectively. However, diet V gave the highest MWG (1.91), while diet III exhibited the lowest MWG (0.92). For Specific Growth Rate (SGR), diet V was significantly different ($p<0.05$) from diets I, II, III and IV. Diet V had the highest SGR value (1.91), while diet III (1.02) had the lowest SGR. Moreover, there was no significant difference ($p>0.05$) between diets I and III and diets II and IV respectively. The Feed Conversion Ratio (FCR) values were significantly different ($p<0.05$) among diets II, IV, V but between diets I and III the difference was insignificant ($p>0.05$). Diet IV had the highest FCR (3.20)

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Table 1: Composition of the experimental diets

Feed stuffs %	Diet I	Diet II	Diet III	Diet IV	Diet V
Soy bean meal	29.59	28.03	26.47	24.91	23.56
Fish meal	29.59	28.03	26.47	24.91	23.56
Maize	35.83	33.95	32.06	30.18	28.29
Milk fat	0.00	5.00	10.00	15.00	20.00
Vit/Mineral premix	5.00	5.00	5.00	5.00	5.00
Total	100.00	100.00	100.00	100.00	100.00
Proximate composition (%)					
Crude protein	41.30	41.00	39.50	39.50	40.30
Crude lipid	16.00	18.00	19.00	34.00	36.00
Ash	2.00	10.50	7.50	10.50	9.00
Moisture	7.80	7.40	11.20	7.80	8.40

Table 2: Growth parameters of *Clarias gariepinus* fed milk fat and control diet for 8 weeks

Growth parameter	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	SD
MIW (g)	0.87 ± 0.02^{a}	0.85 ± 0.04^{b}	0.85 ± 0.02^{b}	0.85 ± 0.03^{b}	0.85 ± 0.00^{b}	±0.03
MFW (g)	2.10 ± 0.59^{bc}	2.29 ± 0.91^{b}	1.78 ± 0.61^{c}	1.97 ± 0.03^{bc}	2.94 ± 0.72^{a}	±0.66
MWG (g)	1.22 ± 0.62^{bc}	1.35 ± 1.06^{b}	0.92 ± 0.65^{c}	1.08 ± 0.31^{bc}	1.91 ± 0.59^{a}	±0.69
FCR	2.37 ± 0.74^{c}	2.07 ± 0.24^{b}	2.98 ± 1.67^{c}	3.20 ± 3.19^{a}	1.57 ± 0.40^{d}	±1.66
SGR	1.21 ± 0.51^{c}	1.37 ± 1.11^{b}	1.20 ± 0.10^{c}	1.41 ± 0.34^{b}	1.91 ± 0.32^{a}	±0.74
PER	0.14 ± 0.21^{a}	0.03 ± 0.02^{c}	0.02 ± 0.02^{c}	0.03 ± 0.01^{bc}	0.05 ± 0.00^{b}	±0.09
ANPU%	3.12 ± 0.061^{d}	8.17 ± 0.06^{c}	9.27 ± 0.06^{b}	10.48 ± 0.06^{a}	3.05 ± 0.00^{d}	

Mean data on the same row carrying letter with different superscript are significantly different from each other ($p<0.05$)

Table 3: Body composition of *Clarias gariepinus* fed milkfat based diets

Proximate composition (%)	Initial	Diet I	Diet II	Diet III	Diet IV	Diet V	SD±
Crude protein	$25.37^{d}\pm0.06$	$26.68^{c}\pm0.01$	$28.75^{b}\pm0.01$	$29.05^{a}\pm0.01$	$29.63^{a}\pm0.01$	$26.63^{c}\pm0.01$	0.03
Crude lipid	$27.97^{a}\pm0.06$	$19.97^{d}\pm0.06$	$27.97^{a}\pm0.06$	$19.97^{d}\pm0.06$	$21.97^{c}\pm0.06$	$26.97^{b}\pm0.06$	0.06
Ash	$10.97^{d}\pm0.06$	$37.50^{bc}\pm0.01$	$39.27^{bc}\pm0.06$	$42.87^{b}\pm0.06$	$55.27^{a}\pm0.06$	$32.40^{c}\pm0.01$	0.08
Moisture	$00.66^{d}\pm0.01$	$08.97^{b}\pm0.06$	$05.97^{c}\pm0.06$	$14.77^{a}\pm0.06$	$10.97^{ab}\pm0.06$	$12.57^{ab}\pm0.06$	0.05

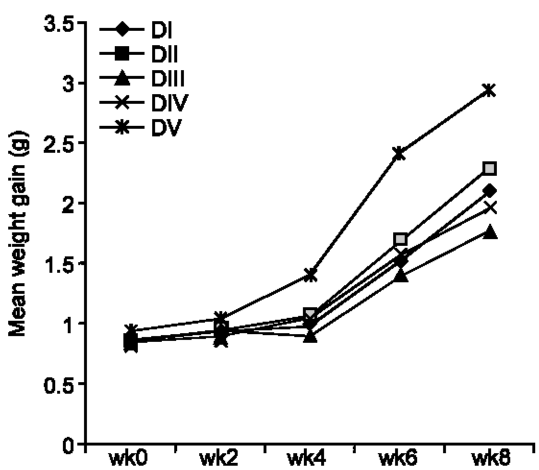

Fig. 1: Growth response of *Claris gariepinus* fed milkfat based diets for 56 days

while diet V gave the lowest FRC value. The Protein Efficiency Ratio (PER), showed significant differences ($p<0.05$) among the treatments. Diet I had the highest protein efficiency ratio, followed by diet V, the least was diet III. For Apparent Net Protein Utilization (ANPU) there were significant differences among the treatments. Diet IV (10.48) had the highest % ANPU. While diet V (3.05) had the lowest % ANPU.

The growth response (Fig. 1) indicated best growth performance by diet V, while diet III exhibited the least performance.

DISCUSSION

From the results, there was a better growth performance of *Clarias gariepinus* fed milk fat at the highest inclusion level of 20% compared with other diets including the control. Pie *et al.* (2004) established that dietary lipid played essential role in the growth and development of fish. The fish on the experimental diets showed satisfactory diet acceptance even at high (20% milk fat) inclusion levels. These indicate that there was neither palatability problem nor feed intake depression. NRC (1993) reported that at high dietary lipid level, growth rate may be reduced due to reduced ability to digest and absorb high lipid, reduction in feed and or fatty acid imbalance in feed. The present study showed that increase in dietary lipid level was not associated with decline in feeding rate. The ability of *Clarias gariepinus* to utilize high level of milk fat indicate its efficiency at utilizing fatty acid of saturated sources(C16) which is contained in the milk fat (Jensen *et al.*, 1991; Banks, 1991; German and Dillard, 1998). Improved feed conversion and protein efficiency ratio with increasing high lipid level in both milk fat diet tested, is in agreement with other studies (Pie *et al.*, 2004). Who reported for other lipid sources in other species.

Conclusion: In conclusion, it was observed that milk fat can be utilized and converted for muscle development and growth of *Clarias gariepinus*. Milk fat percentage inclusion up to 20% was considered optimum for good feed conversion and growth in terms of weight gain.

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