Original Research Article

NUTRITIONAL QUALITY DIFFERENTIAL, GROWTH AND ECONOMICS EFFICIENCY OF SOME SELECTED COMMERCIAL FLOATING FISH FEEDS IN SAKI WEST OYO STATE NIGERIA

Abstract

Nothing is more important than quality nutrition and adequate feeding of fish in captivity. Undernourished fish in terms of nutrient deficiency, cannot maintain its health for proportionate growth regardless the intense of feeding and quality of the environment.

A 49 day-feeding trial was carried out to investigate nutritional quality differential, growth and economics efficiency of some sampled commercially extruded floating feeds, based on frequency of usage among fish farmers in the study area. The sample feeds were sourced from respective distributors covering the zone of study. The feeds were designated as Fd_1, Fd_2, Fd_3, Fd_4, Fd_5 and Fd_6 (control), with 3 replicates for each treatment. The examined growth performance, feed utilization and economic efficiency of feeds followed particular trend pattern and significantly different ($p<0.05$) across the sampled feeds (FW, MWG, SGR, TPI, PER and FCR). Finally, the control diet was least consumed, sustained positive allometry growth pattern and concomitant marginal profits; than feed 1 and 2 which had sharp drops in the growth pattern of fish after four(4) weeks.

Key Words: Allometry growth, Economic efficiency, fish farming, feed utilization, Differential, nutrition

Introduction

Aquaculture is one of the fastest animal based food producing sectors, particularly in developing countries. However, success in aquaculture depends on the ability of a farmer to cost effectively meet the nutritional demand of the cultured fish species. This is because feed type as well as feed quality may have consequences on both growth efficiency and feed utilization (Tsevis *et al.,* 2000). Good nutrition in animal production system is essential to economically produce a healthy and high quality product. In fish farming, nutrition is critical because feed represents 50-60% of the production costs, Jamiu and Ayinla (2003). The development of new species, specific diet support the aquaculture (fish farming) industry as it expands to satisfy increasing demand for affordable, safe and high quality fish.

As aquaculture production become more and more intensive in Nigeria, fish feed will be a significant factor in increasing the productivity and profitability of aquaculture (Akinrotimi*,* 2007). The need to intensify the culture of the fish, so as to meet the ever increasing demand for fish has made it essential to develop suitable diet either in supplementary form for ponds or as complete feed in tanks (Olakunle, 2000). The contribution of fisheries to the national economy is very significant in term of employment, income generation, poverty alleviation, food security, foreign exchange earnings and provision of raw materials for the animal feed industry (Alatise *et al*.,2014). Catfish (*Clarias* sp) are the major commercially species in Nigeria, for good market and culture (management) reasons (Anetekhai *et al.,* 2004).

Since 2000 there has been a rapid expansion in urban aquaculture and a significant development in high density catfish culture. As a result of this intensification in catfish culture, the aqua feed industry has grown and concerted effort has been focusing on research in fish nutrition and fish diet which start at Nigeria Institute for Oceanography and Marine Research (NIOMR). Laboratory size pellet mill and about 12 commercial aqua feed producers were established in Nigeria to complement companies that import high quality floating feed (Hect, 2007; Ayinla, 2007**).** As such, there is currently in the market assortment of both imported and locally manufactured pelleted floating catfish feed brands.

Feed trial studies have been carried out on *Clarias gariepinus* to evaluate their growth response to different readily available protein sources (Ayinla and Akande, 1988; Achionye- Nzeh *et al.,* 2002; Fagbenro and Arowosoge, 2002; Otubusin *et al.,* 2009; Amisah *et al.,* 2009; Sotolu, 2009 and Sotolu, 2010;). The submission of their findings were not conclusive and the variations in conclusion of these afore-listed authors is a source motivation to further expand the body of knowledge regarding the nutritional quality differential, growth and economics efficiency of some selected floating feeds.

Materials and Methods

Study Area / Experimental Site

35 practicing fish farmers in Saki – West L/Gvt. were sampled based on their preferred floating fish feeds abound in the market. The experiment was carried out in the Fisheries Laboratory of Oyo State College of Agriculture and Technology Igbo-ora, Oyo State, Nigeria.

Experimental Feeds (Sampled Feeds)

There are diverse of fish feeds which offer fish farmers' opportunity to choose out of the available floating fish feeds in the market. In this experiment, only five types of fish feeds were chosen based on frequency of usage by sampled fish farmers. They include, CF, AF, RF, VF, DF and CLF (Smoked fish waste meal) designated as $Fd_{1,}$ Fd_2, Fd_3, Fd_4, Fd_5 and

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Fd_6 (control). The control diet was formulated using smoked fish waste (smoked fish waste meal) while other feed stuffs were purchased.

Experimental Design

The experimental design was in triplicates of eighteen plastic bowls for a period of 7 weeks, (April to June, 2018). Level of water in each bowl (60cm x 30cm x 15cm) was maintained at 30 litres and the renewal of water was weekly (every seven days) at ratio 1:1 to avoid the shock as a result of the seemingly new environment when the whole water is changed.

Experimental procedure

One hundred and eighty (180) African catfish (*Clarias gariepinus*) juveniles of average weight 38.8g, was obtained from a reliable source. The fish were acclimatized for 2 days and were fed with control diet feed (Fd_6) at 5% of their body weight twice daily; morning and evening. The fish were starved for 24 hours in order to empty their stomach and prepared their appetite for the new feed trials. The feeding ration and diet per meal were prepared at 5% body weight and two time feeding regimes. Weekly adjustment of feeding ration and diet were carried out throughout the experiment.

Growth performance parameters of test organism juveniles fed different Feeds

Data on growth performance were collected weekly using the following nutrient utilization and growth parameters:

$$\text{Main Weight gain} = \text{Final weight} - \text{initial weight}$$

$$\text{Average weight} = \frac{\text{Total weight}}{\text{No of fish}}$$

$$\text{Specific growth rate} = \frac{\ln \text{final body weight} - \ln \text{initial body weight}}{\text{Time (days)}} \times 100$$

$$ADWG = MWG / \text{Period of the experiment}$$

$$\%WG = MWG / \text{Initial mean weight} \times 100$$

$$\text{Protein Gain} = \frac{\text{MTPI g}}{\text{Culture Time (days)}}$$

$$\text{Total Protein Intake (TOi)} = \text{Total feed consumed} \times \%\ CP \text{ in the feed}$$

$$PER = \frac{\text{Net weight gain (g)}}{\text{Amount of protein fed (g)}}$$

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed intake}}{\text{Total wet weight gain}}$$

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$$\text{Total fish production} = \frac{\text{Final weight g} \times \text{Survival rate}}{1000}$$

Statistical analysis of Data

One-way analysis of variance (ANOVA) was used to determine the effects of diets on growth and nutrient utilization indices using 16,0 version of SPSS (1999) statistical package. Significant differences between individual means were identified using the Duncan's multiple range test (Duncan, 1955). Mean differences were considered significant at $p < 0.05$.

Water quality Management

The water quality variables such as Temperature, Hydrogen- Ion Concentration (pH) were measured with a combined digital pen-type daily meter, while dissolved oxygen (mg/l) was measured using Winkler's method and conductivity by a digit conductivity meter (APHA/ AWWA/ WPCF, 1999).

RESULTS AND DISCUSSION

Differential nutritional quality, growth Response and economic efficiency

Table 1: Average Mean Values Proximate Composition in Experimental Feeds

PARAMETER	DT_1	DT_2	DT_3	DT_4	DT_5	DT6
Crude Protein	28.70	50.75	27.65	35.35	29.05	40.02
Ash	6.17	4.02	5.26	5.50	5.90	6.28
Crude Fibre	0.01	0.01	0.02	0.01	0.01	0.35
Lipid Either Extract	6.50	7.50	6.70	7.10	6.80	4.65
Moisture Dry Meter	91.99	92.67	92.39	91.70	92.15	93.76
NFE	58.62	37.72	60.37	52.04	58.24	48.7
Gross Energy	463.92	512.26	467.05	480.18	467.16	389.72
Digestible Energy ($kcalg^{-1}$)	361.27	370.39	362.34	363.38	360.60	348.18
Energy/Protein ratio	12.6	7.3	13.1	10.3	12.4	8.7

Nitrogen Free Extract (NFE) = 100-(Crude Protein+Crude lipid+crudefibre+total ash). Gross energy: Caloric value of protein 5.65, NFE 4.1 and lipid 9.45 kcal g^{-1}, Digestible energy: caloric value of protein 3.5, NFE 2.5 and lipid 8.1 kcal g^{-1}(Adedokun et al., 2017)

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Water quality parameters (WQP)

The mean water quality of the plastic trough system at weekly intervals during the study is presented in **Table 2.** Throughout the feeding trials, the water quality was keenly monitored. The observed water quality parameters were within the acceptable ranges of APHA/AWWA/WPCF (1999), Ajani and Akinwole (2001).

Table 2: Water quality parameters of the Experiment

Parameters	**Dietary Sampled Feeds**					
	Fd_1	**Fd_2**	**Fd_3**	**Fd_4**	**Fd_5**	**Fd_6**
Temperature	27.58	27.57	27.46	27.40	27.40	27.46
DO (mg/l)	6.20	5.40	5.20	5.40	5.10	4.80
P^H	6.40	6.80	6.70	6.60	6.60	6.60
Conductivity (μhom/cm^3	580	582	580	583	585	420

Table 3: Growth Response Efficiency of *Clarias gariepinus* Juveniles

Parameters	**DT1**	**DT2**	**DT3**	**DT4**	**DT5**	**DT6**
Total Feed	141.5	153.2	116.0	141.3	130.0	72.6
Final Weight	899.5	973.8	581.6	878.6	881	339.4
% Survival	80%	86.6%	66.6%	86.6%	86.6%	90
% Mortality	20%	13.3%	33.3%	13.3%	13.3%	10
Average Wt.	37.5	37.5	29.1	33.8	33.9	12.6
MWG	860.7	935	542.8	839.8	842.2	300.6
ADWG	17.6	19.1	11.1	17.1	17.2	6.1
% WG	2218.3	2409.8	1399	2164.4	2170.6	774.7
SGR	17.6	19.1	11.1	17.1	17.2	6.1
TP Intake (TP1)	40.6	77.8	32.1	50.0	37.8	29.1
PER	22.2	12.5	18.1	17.6	23.3	11.7
Total Fish Produced	21.6	25.3	11.6	22.8	22.9	9.2
Feed CR	0.16	0.16	0.20	0.16	0.14	0.22

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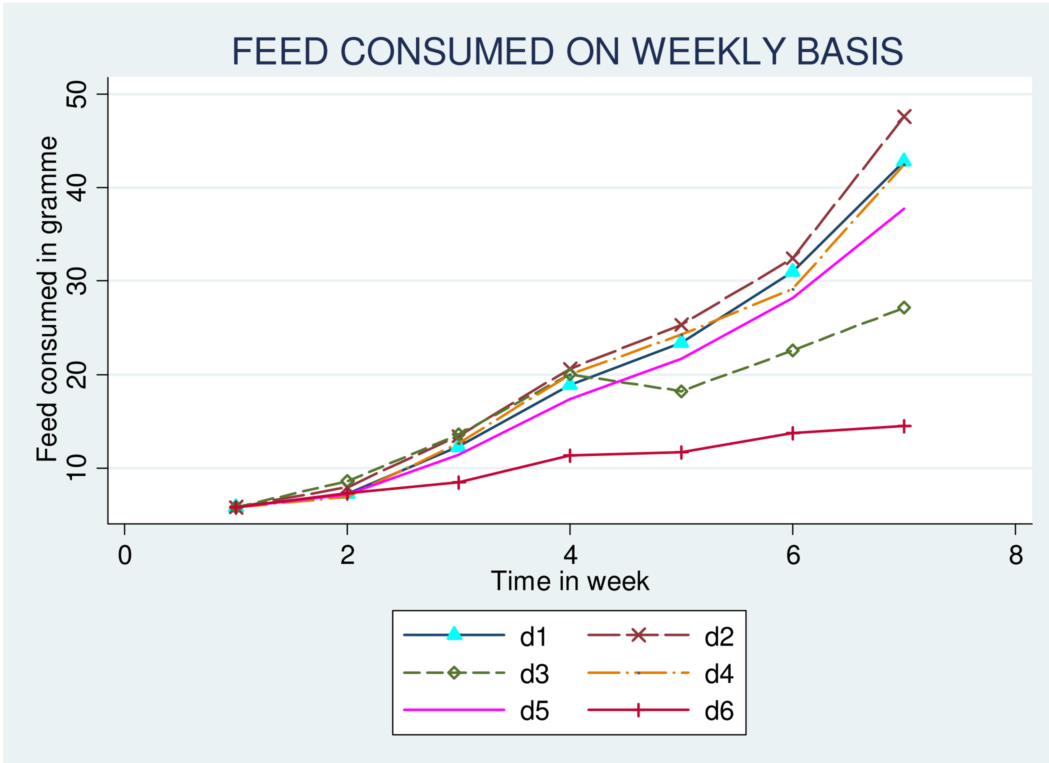

Figure 1a: Weekly Feeds sampled consumed

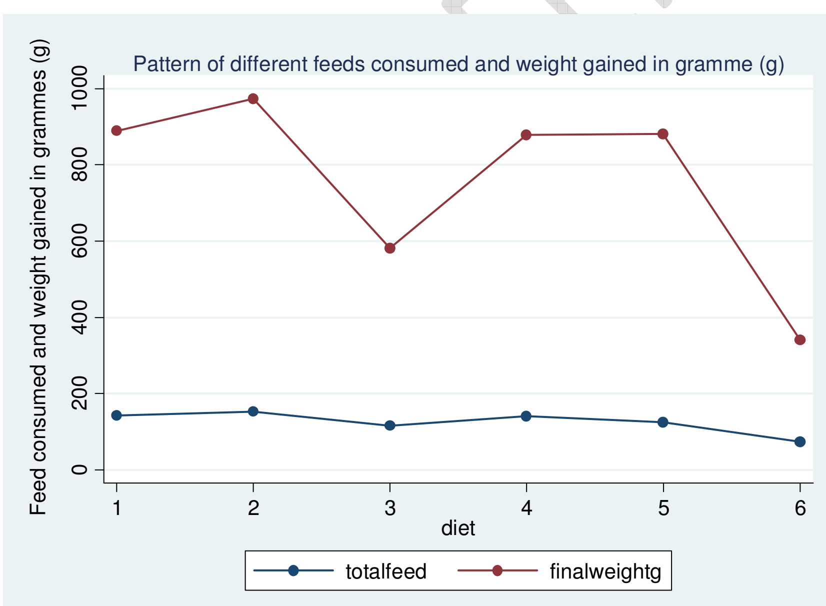

Figure 1b: Pattern of diff. feeds consumed and weight gained

The amounts of sampled feeds consumed were compared with weight gained by the fish. The graph shows wide variation in the sampled feed consumed (fig. 1a) but relative little variation in the body weight gained (fig. 1c) by the fish sampled. The wide range between quantity of feed consumed and weight gained ratio is shown in figure 1(b).

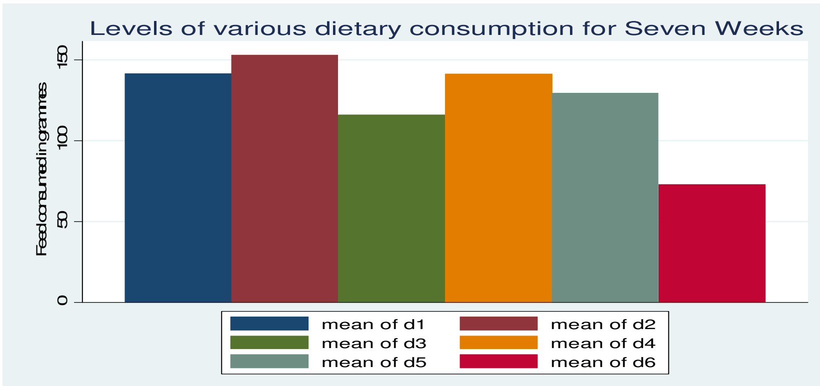

Figure 1c: Level of sampled feeds consumed

Acceptability and palatability of feed is a function of the processing methods.

The feed conversion ratio (FCR) depends on many factors such as feed palatability, fish breed and species, energy content, level of fibre inclusion, crude protein content, mineralization etc.

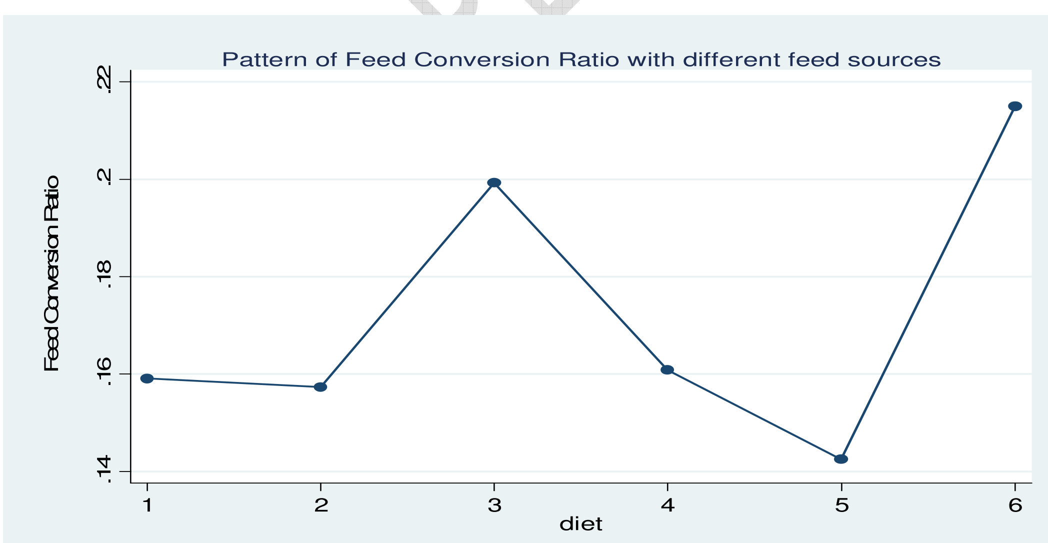

Figure 2a: Pattern of feed conversion ratio with diff. feeds sampled

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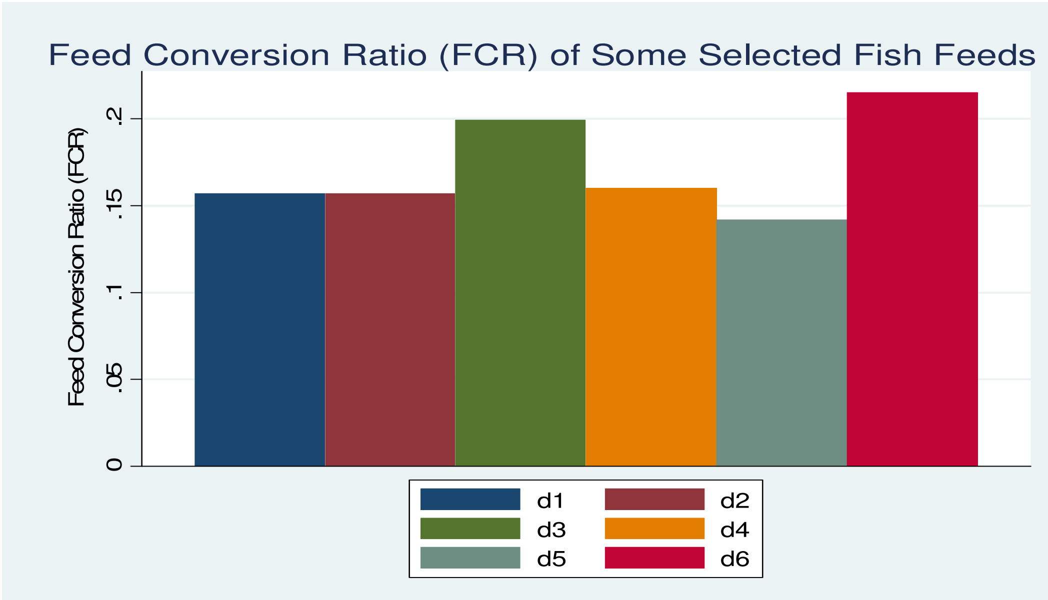

Figure 2b: Feed conversion ratio of sampled fish feeds

Figures 2a and 2b show the pattern of feed conversion ratio with different feeds sampled. The descriptive analysis revealed that diet 6 has highest feed conversion ratio (FCR) though less than 0.5 of total dry feed consumed divided by the wet weight of fish harvested. While diet 5 had the lowest feed conversion ratio. Theoretically, among other factors that affect ultilizaiton nutrient inlude digestiable protein content of the feed, enegy-protein ratio, mineral and vitamin. Moreover, it was observed that the fish consumed less quantity of diet 6 due to easy distrigration and sinking tendecy of the feed sample. But the little quantiy of diet 6 consumed was well ultilized.

Figure 3 shows the length -weight relationship of the test organism in the experiment. It was obvious tha fish had relatibvely unform and steady lengh-weight relationship in the first two weeks. After which there were sharp drops in the growth perttern of fish in floating types. The sinking type progressively sustained the positive allometry growth better than floating feeds. This may be attributed to the percentage crude protein content of each feed relative to the size of fish.

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Figure 3: Length-weight relatioships

The analyis was also carried out on the cost per tonne of different feeds sampled. Fig. 4 showed that diet 6 had the least cost per tonne while diet 5 had the highest cost. Relating the cost of individual diet with feed convesion ratio, it was discovered that diet 6 had the least cost and highest feed conversion ratio while diet 5 had the highest cost with least feed conversion ratio. It could be deduced that diet 6 is most ecomomical diet than other extruded floating types with concombitant marginal profits.

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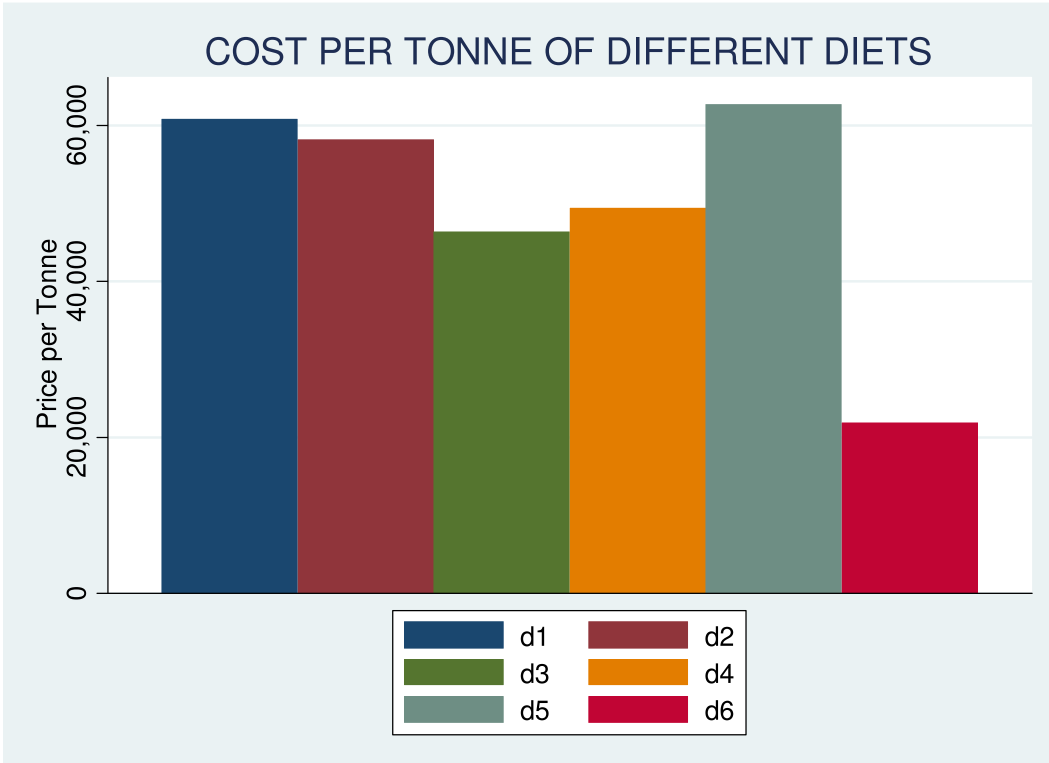

Figure 4: Cost per tonne of different feeds

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Conclusion

The results of this study had shown that there are falsifications in crude protein percentages. The actual crude protein percentage in each feed was established through proximate analysis, response of fish growth and feed utilization efficiency. Generally, floating feeds performed excellently well in terms of weight gained and length-weight relationships for the first two weeks as evidenced in the experiment. However, the body weight gained dropped sharply and did not commensurate with the total feeds consumed over time. The control diet (DT_6) was least consumed with steady body weight gained and positive weight length-weight relationship and had best feed conversion ratio.

Recommendation

According to the experiment conducted, it revealed that floating feeds specifically (DT1) and (DT2) are good and preferable to be used in early 2-4 weeks after which compounded feed is recommended for least feed consumption, steady body weight-gained and for high cost effectiveness.

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