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Assessment of Dietary Powdered Avocado Pear (*Persea americana*) leaves on Growth Performance and Survival of African Catfish (*Clarias gariepinus*)

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1. ABSTRACT

The growth performance and survival of *Clarias gariepinus* was assessed using five different diets. The diets were: Do (control) with 0% level of *Persea americana* powdered leaves and others with varying levels of the powdered leaves inclusion were D1 (3%), D2 (6%), D3 (9%) and D4 (12%). The summary of the eight weeks experiment showed that there were no significant difference in the length gain and condition factor of *C. gariepinus* fed the various experimented diets compared to the control. There were difference ($P<0.05$) in all other assessed growth parameters and survival. The weight gain, specific growth rate and the percentage weight gain, were higher ($P<0.05$) in the control compared to the treated diets, and the values reduced with increase in percentage leaves inclusion in their diets. The food conversion ratio was significantly lower in the control compared to the rest (D1 – D4) which increased as the percentage leaf inclusion increases. The survival rate was the same in fish (Do – D3) but lower ($P<0.05$) at 12% inclusion (D4). The growth performance of the fish in diets (D1 – D4) reduced slightly as the period of feeding increased. The results of this experiment indicated that the *P. americana* powdered leaves is a good dietary supplement to *C. gariepinus* at the used inclusion levels and the duration of the experiment, since the condition factor which is a measure of the health and growth of the fish is significantly the same across the experimented diets and the control.

Keywords: Persea americana, survival, growth, condition factor and *C. gariepinus*.

2. INTRODUCTION

Aquaculture products like fish and its by product are no doubt the invitable source of protein worldwide for human consumption irrespective of age, race class or sex (Abolude and Abdullahi, 2005; FAO, 2016). Fish and fish products from aquaculture surpasses that of the marine capture fisheries with over ten million tonnes (FAO, 2014). Aquaculture products also contains essentials such as lipids, vitamins, minerals, fatty acids etc and if consumed appropriately eliminates and control fatal diseases such as cancers, eye defects, cardiovascular disorders among others (Ukwe *et al.*, 2018a; Kirpal, 2003). Because of the high demand for fish, pollution as a result of industrial contamination and agricultural waste in our aquatic environments there is serious decline in the natural catch (Maske and Satyanarayan, 2012). In a bid to meet up the demand for aquacultural products, the practice of aquaculture have open up several employment opportunities such as construction,

production, processing, commerce both at local and international levels etc (Ukwe *et al* 2018a).

The type of feed and its constituents is a great determinant to productivity in aquaculture as it determines growth and survival rate of fish (Ukwe *et al.*, 2018b, Shalaby *et al.*, 2006; Lee *et al.*, 2012). Ukwe *et al.*, (2017) observed that when Artemia and Acartia were administered to larva of *Clarias gariepinus*, they affected the growth performance of the fish at different rates. Palatability of feed is another factor that affects growth as it affects the quantity of feed consumed (Ukwe *et al.*, 2018b).

Herbs have been reported to enhance flavor, which improves the eating behavior of fish, causes secretion of digestive fluids and increase feed intake (Lee and Geo, 2012; Adams, 2005). Some of the plants/plants product that have been reported to improve aquaculture production includes: moringa leaves (Puycha *et al.*, 2017), eleutherine leaves (Nugroho *et al.*, 2018), garlic bulb (Lee *et al.*, 2012), ginseng root (Amas, 2008) among others.

African catfish (*Clarias gariepinus*) is produced in Africa in both small and large scale, with Nigeria recorded as the largest producer and the third in the world as at 2007 (FAO, 2014). *Clarias gariepinus* is an economically important fish cultured in fresh waters (Adedeja and Okocha, 2011; Gabriel *et al.*, 2015). Some of the outstanding qualities of the *Clarias gariepinus* as a good fish for farming includes: good eggs production, diseases resistance, high survival rate, good flesh quality etc. (Kestemount, *et al.*, 2007; Jamabo and Dienye, 2017).

Avocado pear (*P. americana*) is found all over the world and its known for its medicinal and other important values (Purseglove, 1977), it belongs to the family: *lauraceae*, and genus; *Persea* (Uzukwu *et al.*, 2016). Phytochemicals such as saponins, tannins, oleic acid, terpenoids, flavonoids etc are found in the extracts of its leaves and back (Ogundare and Oladejo, 2014), and these phytochemicals have been reported to improve growth in fish (Bello 2014).

The purpose of this research work was to assess the importance of avocado pear leaves powder in the farming of *Clarias gariepinus.*

3. Materials and Methods

3.1 Study Location: The research work was done in African Regional Aquacultural Center (ARAC), Aluu in Ikwere Local Government Area of Rivers State, Nigeria.

3.2 *Clarias gariepinus*: Fish (*Clarias gariepinus)* of mean weight 90 – 95g and lenght 24 – 26cm were purchased from Idi-Onyana farms, along Abua – Ahoada road in Rivers State. They were acclimatized for a period of four weeks, using the methods of Gabriel *et al.*, (2011), and were fed 5% body weight per day.

3.3 Herbal Preparation: The avocado pear leaves were harvested in Aluu in Rivers State. They were carefully washed, dried, grounded to powdered form using electric blender, sieved and stored in an air tight entertainer for use (Alabi *et al.*, 2012; Lukcy and Jonathan, 2017).

3.4 Diets Preparation: About 38.35±0. 19cp diet (Do) was prepared using: Corn meal, wheat offal, soyabean meal, fish meal, garri, common salt, palm oil, fish premix, lysine, methionine and vitamin C and was used as control. Four other diets (D1 – D4) were prepared from this, with the addition of 3%, 6%, 9% and 12% powdered avocado pear leaves respectively (Nasir *et al.*, 2018).

3.5 Proximate Nutrient Composition of Experimented Diets

The nutrient composition of the experimented diets were done, in accordance with the Association of Official analytical Chemist (AOAC, 1990).

3.6 Experimental Procedure: Five hundred and twenty five fish 25.88±0.14cm length and 117.80±0.11g weight were used in this research work in triplicates across fifteen tanks of 200L capacity at thirty five fish per tank. Feeding commenced twenty four hours after stocking at 5% body weight per day. The measurement of weight and length was done every fourteen (14) days to determine the growth parameters. The experiment took eight weeks.

3.7 Determination of Growth Parameters

- **Length(cm):** This was determined using a millimeter calibrated ruler, and the length increase (**L**) was calculated using the formular:

$L = L_2 - L_1$ (Ukwe *et al.*, 2017) - - - (1)

Where L_1 = Initial length

L_2 = Final length

- **Weight(g):** This was determined using super Camry Peterson weighing balance: No: R-1509/02328 manufactured by Want Balance instrument Co. Ltd, China. The weight gain (**WG**) was calculated using the formular:

$WG = W_2 - W_1$ ((Ukwe *et al.*, 2017) - - - (2)

Where W_1 = Initial weight

W_2 = Final weight

Specific Growth Rage (SGR): It was determined using the formular:

$$SGR = \frac{InW1 - InWo}{t} x100$$ (Arimoro, 2007)---------- (3)

Where W1 = Final body weight

Wo = Initial body weight

t = Time (days)

In = Logarithms of number

Fulton Condition Factor (R): It was determined using the formular

$$K = \frac{W}{L^3} x100\%$$ (Panase and Mengumpjon, 2015)---------- (4)

Feed Conversion Ratio (FCR): It was determined using the formular

$$FCR = \frac{Dry\ weight\ of\ \ feed\ \ fed(g)}{Fish\ weight\ (g)} \quad \text{(Adeshina } et\ al.,\ 2017) \quad \text{----------} \quad (5)$$

Percentage Weight Gain (PWG): It was determined using the formular

$$PWG = \frac{Weight\ gain\ (g)}{Fish\ weight\ (g)} x100 \quad \text{(Ukwe } et\ al.,\ 2017) \quad \text{----------(6)}$$

Survival Rate (%): It was determined using the formular

$$= \frac{Fish\ stock - Mortality}{Inital\ number\ of\ \ fish\ stock} x100 \quad \text{(Ukwe } et\ al.,\ 2017) \quad \text{---------- - -} \quad (7)$$

4. Results

The proximate composition of the experimented diets are shown in Table 1. The moisture, lipids and Ash contents were similar (P>0.05) across the diets. The protein, carbohydrate and fibre contents were significantly different (P<0.05) across the diets. The summary of the growth parameters (Mean ± SE) within the eight weeks of the experiment is shown in Table 2. There were significant difference (P<0.05) between the control and the treated diets in all the growth parameters, except in length gain and condition factor. The comparative results between the weeks are shown in figures 1 – 7. There was steady increase in length in the fish fed the Do – D4 till week 6, when the rate of increase was high in the fish fed Do. The rate of weight gain increase from the beginning of the experiment to the end across the diets, with the fish fed Do have higher rate from the beginning of the experiment to the end. While the specific growth rate increase from week 2 to week 4 in at different rate till week 8, the fish fed D1 – D3 reduced at different rate in their SGR from week 2 to week 8.

Table 1: Proximate Composition of Supplemented Diets (Mean ±SD)

Parameters (%)	Diets 0	1	2	3	4
Moisture	11.48±0.38 [a]	11.42±03 [a]	11.24±1.18 [a]	11.87±0.21 [a]	11.62±0.53 [a]
Ash	11.54±0.9 [a]	12.30±0.13 [a]	12.91±0.01 [a]	12.34±0.22 [a]	12.40±0.27 [a]
Protein	38.35±0.19 [a]	36.76±0.40 [a]	35.37±0.01 [a]	34.26±0.12 [b]	33.03±0.05 [b]
Carbohydrate	17.51±0.12 [c]	18.73±0.77 [c]	19.30±0.58 [c]	19.14±1.62 [c]	22.78±0.88 [b]
Lipid	12.61±0.20 [a]	11.48±0.03 [a]	11.73±0.10 [a]	11.42±0.36 [a]	11.08±0.04 [a]
Fibre	7.99±0.87 [b]	8.82±0.53 [b]	9.05±1.03 [b]	10.91 ±0.23 [a]	12.14±0.59 [a]

Means within the same roe with different superscript are significantly different ($p<0.05$)

Table 2: Growth Response in *C. gariepinus* fed with Experimental Diets (Mean ±SE)

Parameters	Diets				
	0	1	2	3	4
Length increase (cm)	8.90±4.96 [a]	7.64±3.91 [a]	6.97±3.57 [a]	6.88±3.21 [a]	6.51±2.99 [a]
Weight Gain (g)	141.52±67.03 [a]	112.48±41.17 [b]	107.98±35.54 [c]	92.58±25.96 [d]	80.78±23.22 [d]
Survival (%)	100.00±0.00 [a]	100.00±0.00 [a]	98.33±4.03 [a]	97.81±5.64 [a]	94.47±7.33 [b]
Specific Growth Rate	0.99±0.11 [a]	0.89±0.19 [b]	0.89±0.23 [b]	0.81±0.24 [b]	0.82±0.41 [b]
Fulton Condition factor	0.62±0.10 [a]	0.63±0.15 [a]	0.64±0.12 [a]	0.60±0.10 [a]	0.60±0.10 [a]
Percentage Weight (%)	52.12±14.58 [a]	47.14±10.45 [b]	46.47±9.51 [b]	43.31±8.14 [b]	39.84±7.77 [c]
Feed Conversion Ratio	1.05±0.46 [b]	1.23±0.21 [a]	1.24±0.19 [a]	1.26±0.18 [a]	1.30±0.03 [a]

Means within the same roll with different superscript are significantly different ($p<0.05$)

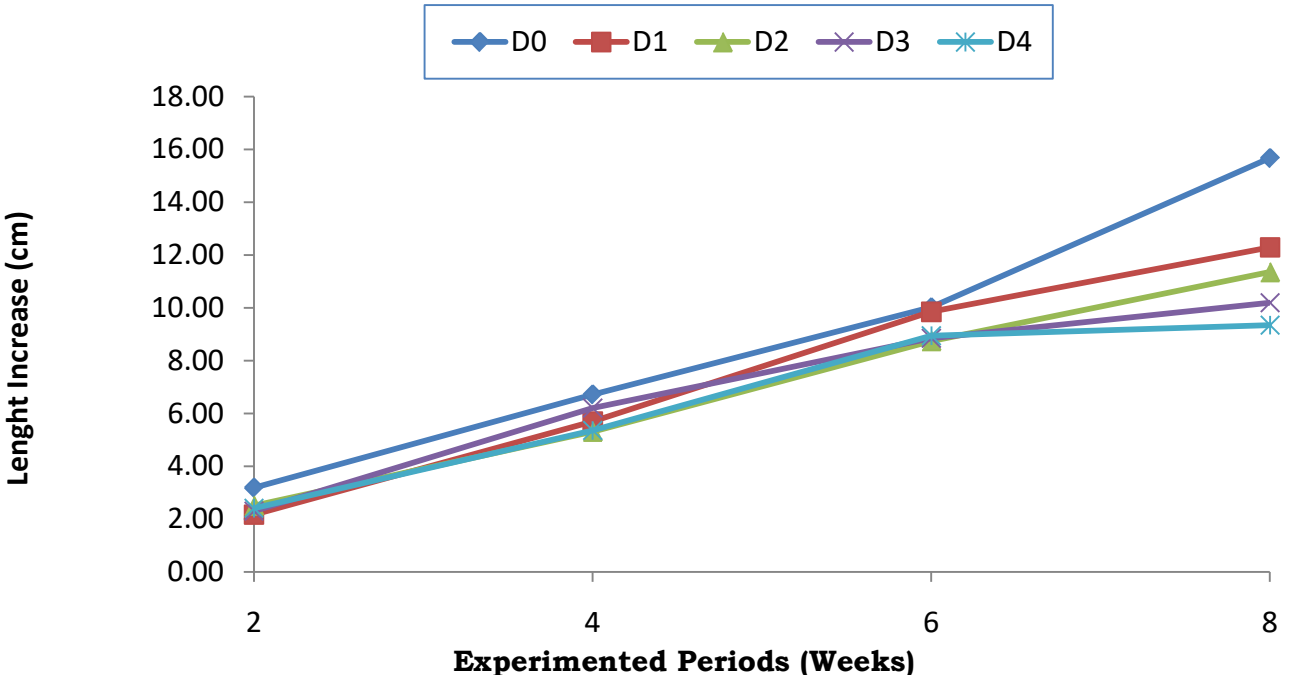

Figure 1: Length increase (cm) in *C.gariepinus* fed with experimented diets for eight weeks

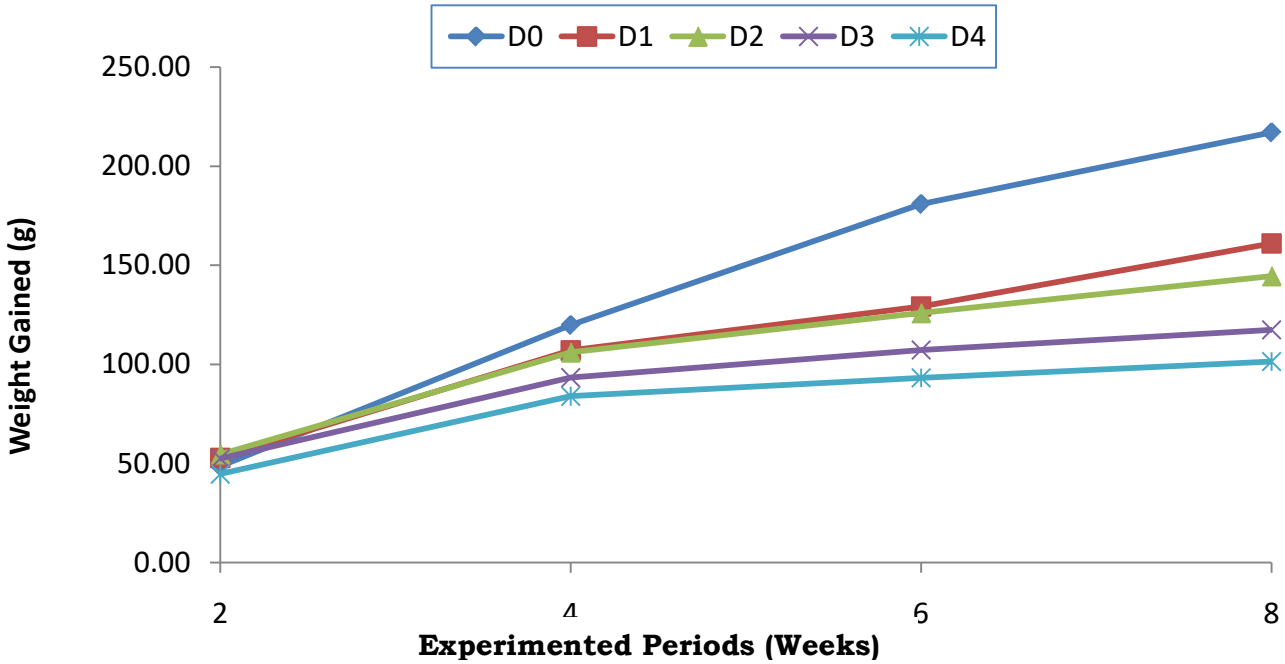

Figure 2: Weight gain (g) in *C.gariepinus* fed with Ex experimented diets and observed for eight weeks

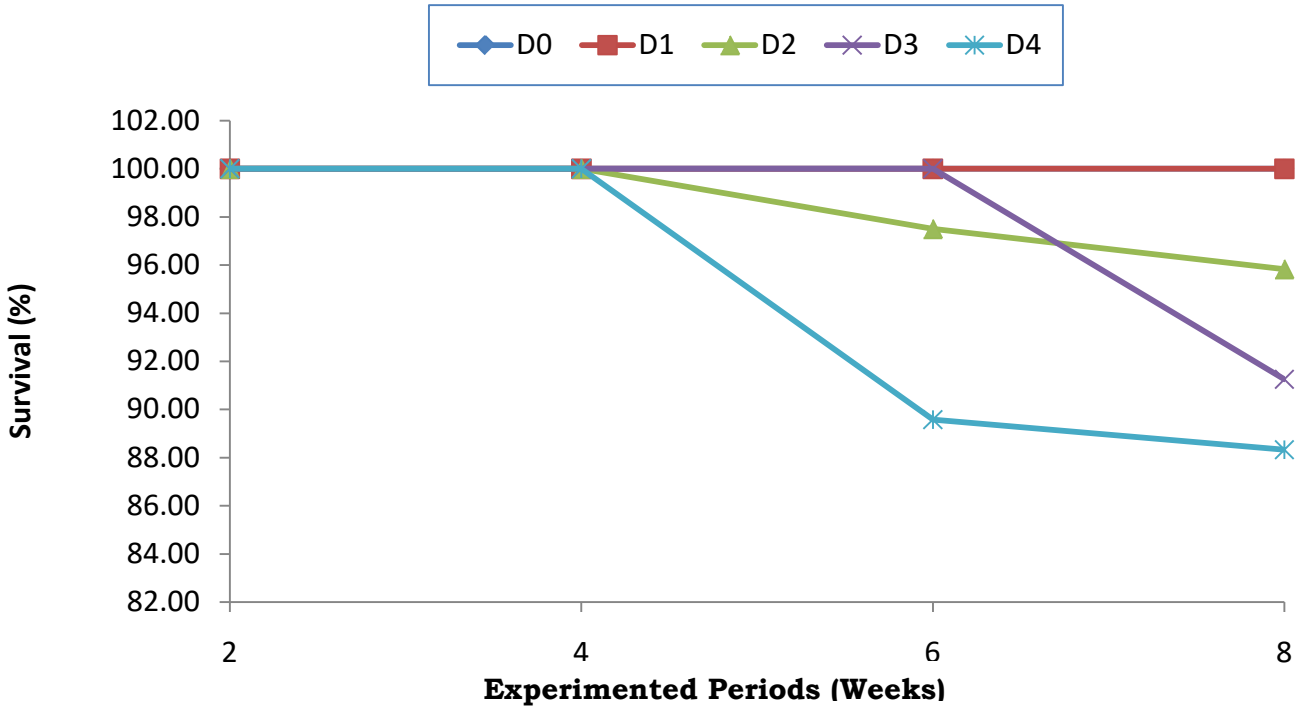

Figure 3: Survival in *C.gariepinus* fed with experimented diets for eight weeks

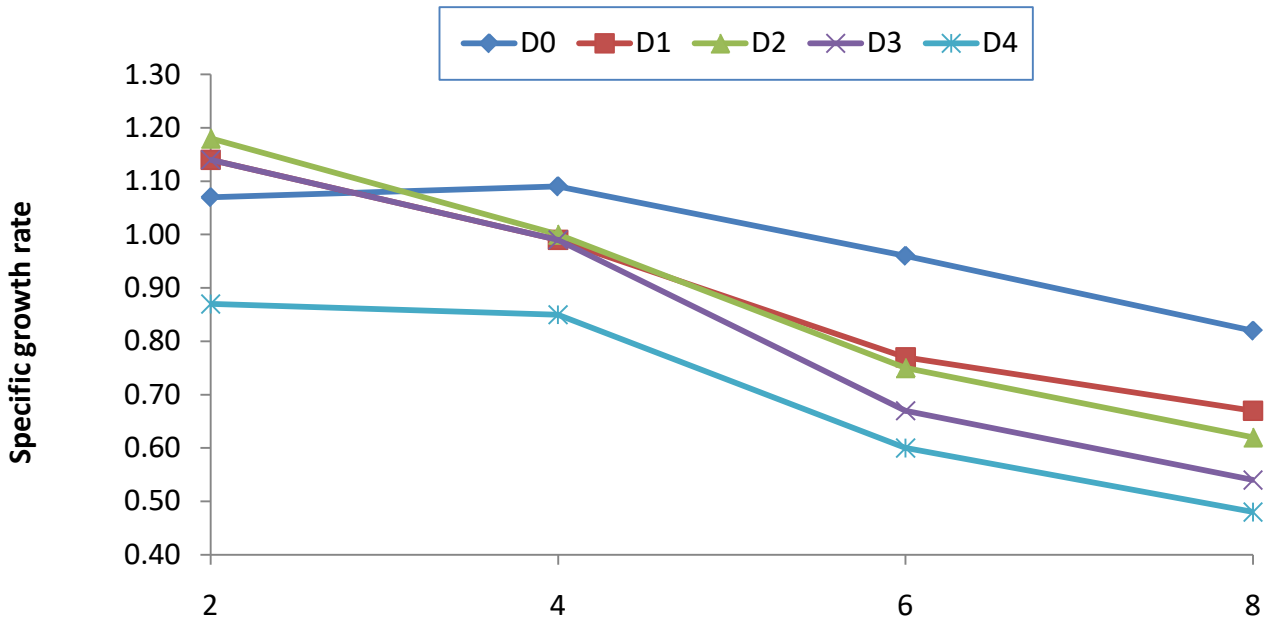

Figure 4: Special growth rate in C.gariepinus fed experimented diets for eight weeks

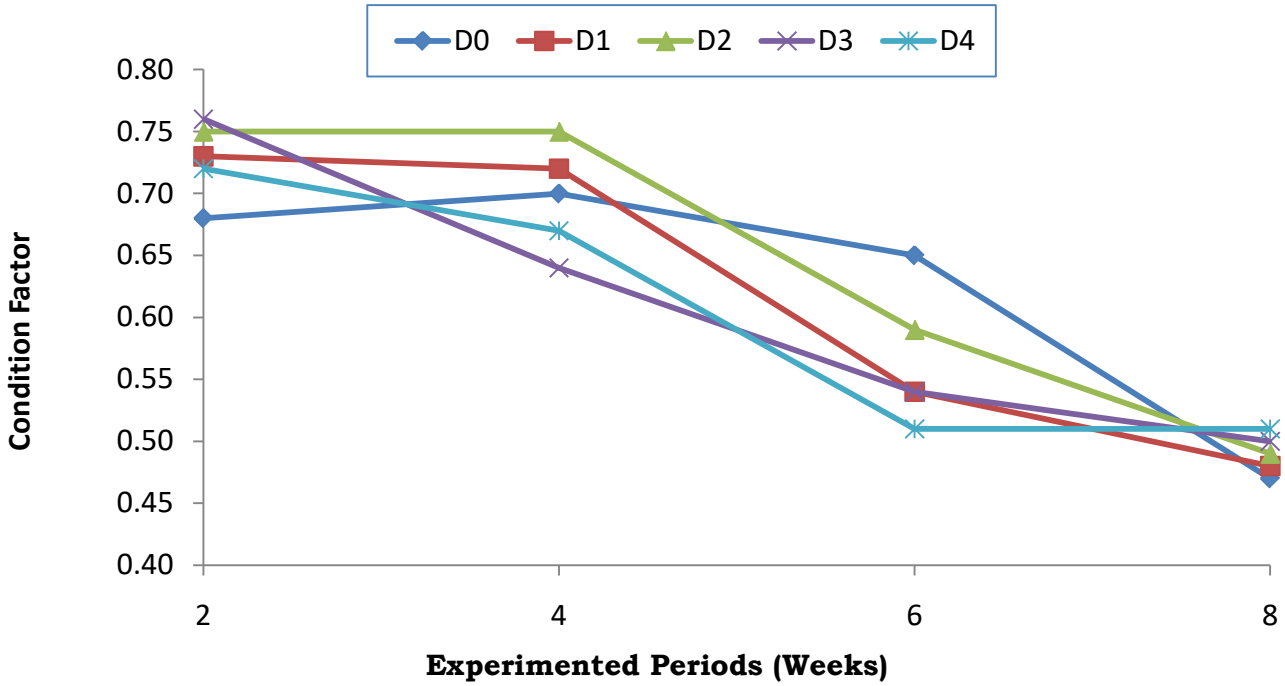

Figure 5: Condition factor in *C.gariepinus* fed Experimented diets for eight weeks

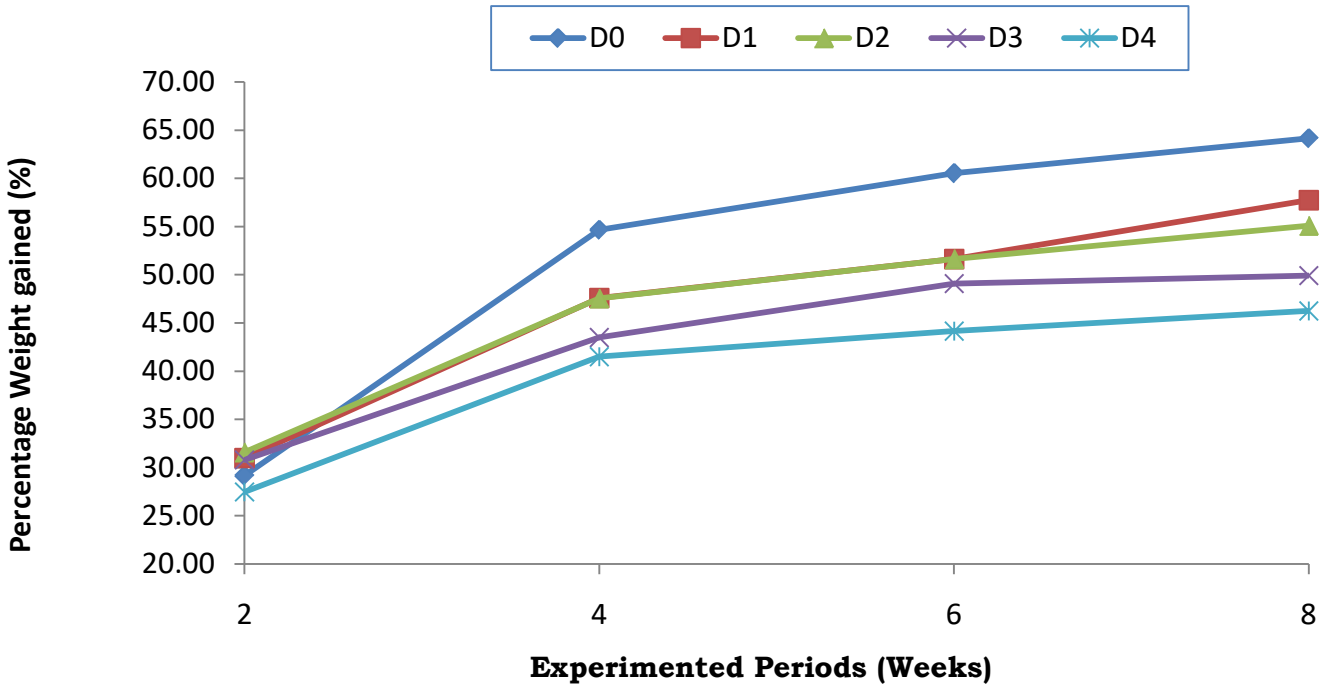

Figure 6: Percentage Weight gained (%) in *C.gariepinus* fed Experimented diets for eight weeks

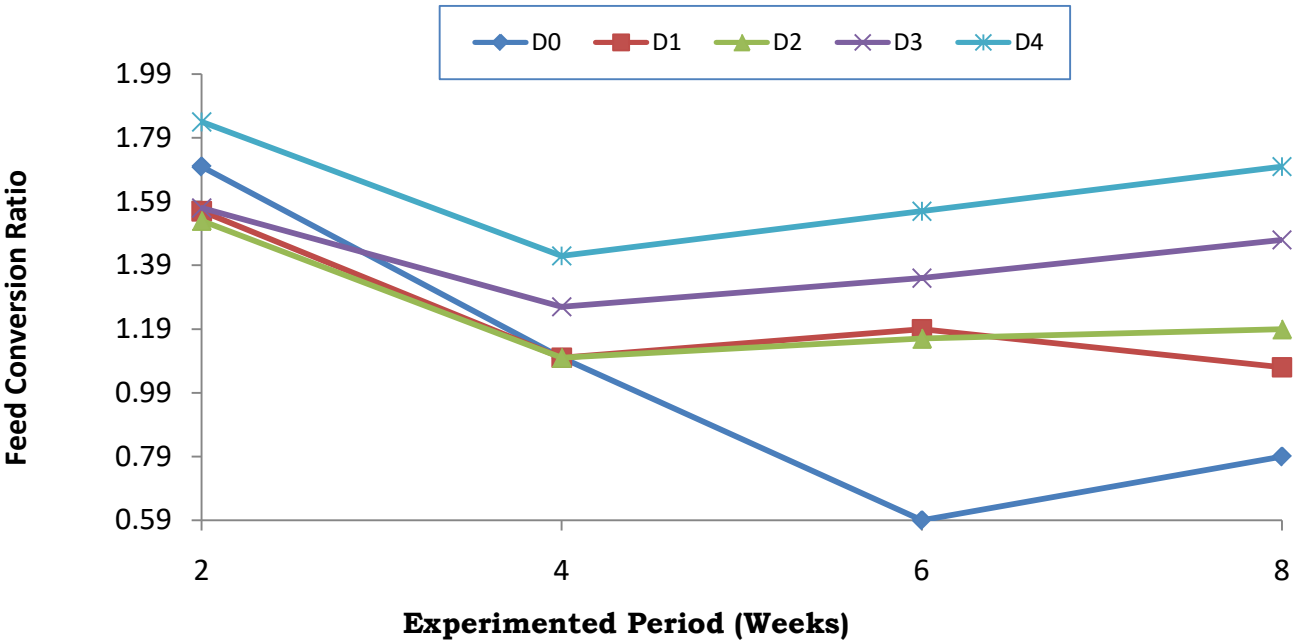

Figure 7: Feed Conversion Ratio in *C.gariepinus* fed Experimented diets for eight weeks

5. Discussion

The proximate composition of the experimented diets were within the range to favor fish farming (Li *et al.*, 2017). The fat and protein content of the various experimented diets were supportive to the growth of *C. gariepinus* (Tibbetts and Lall, 2013; Olaifa *et al.*, 2012). Moisture content is an important factor to consider in diets since it affects both floatation and shell life. The moisture content in the various experimental diets were within the recommended range (Condry, 2002).

The fish fed the control diet (Do) did better than the fish fed the treated diets (Do – D4) in growth parameters such as weight gain (WG), specific growth rate (SGR) and percentage weight gain (PWG) in this research work and they all reduced with increase in percentage herb inclusion in their diets. This could be as a result of so many factors. It could be that the included herb (avocado pear powdered leave) in the diets affected the palatability of the diets (Ukwe *et al.*, 2018b; Zaid *et al.*, 2020) and this affected the quantity of feed consumed. It could be that the fibre content of the treated diets increase the energy content of the diets, which can also reduce the quantity of feed consumed. Noblet and Goff (2001) reported that minimum dietary fibre is needed in the digestive track of animals, while Ukwe *et al.*, (2019) reported that diets with high energy content negatively affect growth despite protein content because the fish eats less to be satisfied and this affects the quantity of diet consumed, which in turn affect growth. It could also be that the percentage of the herbs were too high (Palanisamy *et al.*, 2011), and excess Tannin and Saponin which are major phytochemicals in avocado pear leaves (Ogundare and Oladejo, 2014) in diets negatively affects feed utilization in organisms (Dei *et al.*, 2007). Saponin binds with protein to form a complex and reduces its availabilities for use by the fish (Ogbe and Affiku, 2011). This results are in disagreement with the result of Panase *et al.*, (2018) who reported increase in these growth parameters

compared to the control, when hybrid catfish was fed diets supplemented with *Euphorbia extracts;* and the result of Olusola and Nwokike (2018) who reported increase in these growth parameters compared to the control when *C. gariepinus* was fed diets supplemented with *pawpaw* leaves extracts. But they are in agreement with the results of Zaid *et al.,* (2020) who reported improve growth in the control diets compared to the treated diets when herbal mixtures (Jedi, Gbewutu and Opa-eyin) were fed to *C. gariepinus,* and also the results of Gabriel *et al.,* (2019) when diets supplemented with *Aloe vera* polysacdiarides were given to *C. gariepinus* Specific growth rate and condition factor indicates the health status of fish (Ibrahim *et al,* 2010). The condition factor in the fish fed the various experimented diets were similar, that is to say the fish were in good health (Bello, 2014).

The feed conversion ratio (FCR) is an indication of the usefulness of the diets towards growth (Marimurth *et al.,* 2011) and low the FCR is an indication of good utilization (Puycha *et al.,* 2017). In this research work the FCR in the control was low ($P<0.05$) compared to the fish fed treated diets, and it increases with increased in percentage inclusion of the herb. This could be as a result of the fibre content of the treated diets (Ukwe *et al.,* 2019; Noblet and Goff, 2011), it could also be as a result of reduced palatability in the treated diets (Zaid *et al.,* 2020). This result is in agreement with the works of Gabriel *et al.,* (2019); and Turan (2019) who reported same when diets supplemented with *Aloe vera* and propolis were respectively administered to *C. gariepinus.* But they are in disagreement with the works of Bahrami *et al.,* (2015) who reported the reverse, when dietary *stachys lavandulitolia* extracts was administered to *Cyprinus carpio*.

The fish fed the control diet (Do) and 3% herbs inclusion diets (D1) had 100% survival rate within the period, but there were mortalities in fish fed 6% (D2), 9% (D3) and 12% (D4), with D4 fed fish been significantly lower. The above results could be as a result of experimental procedure (Amadi and Solomon, 2011), it could also be as a result of toxity arising from the prolong use of the avocado pear powdered leaves (Friday *et al.,* 2013; Oyeyemi and Oyeyemi, 2015).This result is similar to the result of Bello (2014) who reported 100% survival rate in control diet and fluctuating rates in treatments when *C. gariepinus* were fed diets supplemented with Onion bulbs and Walnut leaves. But the work is in disagreement with the works of Bahrami *et al.,* (2015) and Nugroho *et al.,* (2018) both reported 100% survival rate in all the treatment groups in their experiment to access the potency of different herbs supplemented diets on fish survival.

6. Conclusion

Though this is the first reported work on the effect of Avocado pear powdered leaves (*P. americana*) on the growth of *C. gariepinus,* the results have shown that the *P. americana* as dietary supplement is not harmful to the *C. gariepinus* as shown in the condition factor. It also supports the growth of the fish, but not as much as the results obtained in the control diet in weight related parameters, but the fish fed the treated diets had the same length increase and condition factor with the fish in the control. Because the performance in the growth parameters increased with reduction in the percentage herb inclusion in the diets, more works should be done with less percentage inclusion, for improve results.

Since the condition factor is a measure of length and weight of the fish, and it was significantly the same across the various experimented diets (Do – D4), the *P. americana* is recommended as good supplement in the culture of *C. gariepinus.*

The difference between this work and the ones sited could be as a result of mode of application of the herbs, condition of culture or stocking density in the various experiments.

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