Growth Performance, Carcass Yield and Organosomatic Indices of *Clariasgariepinus* Fed Propolis and Ag-zyme as Dietary Additives

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Abstract

In order to achieve self-sufficiency in fish production and supply in the subsequent years, cultured fish must be adequately fed diet to promote growth using additives.This study evaluated the effects of aqueous propolis extract and Ag-Zyme on growth performance, carcass yield and organosomatic indices of Clariasgariepinus. Eight isonitrogenous diets containing 40% Crude Protein: Control (0%), AGZ1 (0.35%), AGZ2 (0.7%), AGZ3 (1.4%), PRP1 (0.5%), PRP2 (1%), PRP3 (2%) and PRP4 (4%) were formulated. 15 fingerlings were stocked per treatments in triplicates and fed 5% body weight for 84days.Mean Weight Gain (MWG), Specific Growth Rate (SGR), Relative Growth Rate (RGR), Feed Conversion Ratio (FCR), carcass yield, percentage dress out, body weight yield and organosomatic indices were measured using standard methods. Data were analysed using descriptive statistics and Anova at $_{0.05}$). The result revealed that the MWG, SGR, RGR ranged from 37.21g to 70.00g; 0.57g to 0.83g;621.23g to 1250.00g respectively. The highest MWG was from fish fed PRP2 diet, closely followed by AGZ3 diet and the least from the control diet. The highest FCR (3.4) was from the control diet and the least from the fish fed PRP2 diet (2.52). Percentage (%) dress out and carcass yield showed no significant ($p>0.05$) difference across the treatments. Highest body weight yield was from PRP4 (101.43±3.89), closely followed by PRP2 diet (99.31±0.33) and the least was from AGZ3diet (74.22±8.01). Head yield showed significant ($p<0.05$) difference across the treatments. Hepatosomatic(HIS), Renosomatic(RSI), Visceralsomatic (VSI), Gillsomatic (GSI) and Fat deposit indices (FDI) showed significant ($p<0.05$) difference, while Cerebrosomatic (CBI) and Cardiosomatic(CSI) indices did not vary significantly among the diets. Propolis (PRP2) gave the best growth and could be recommended in practices, as dietary additive for optimal growth of Clariasgariepinus without necessarily compromising the health integrity of the fish. Alternatively, Agzyme (AGZ3) can also be used as alternative to propolis.

Key Words: Fish Nutrition, Growth Promotants, Enzyme Supplementation, Propolis Extract Fish Cultivation and Fish Medicine

INTRODUCTION

Aquaculture is estimated to produce more than 600 food fish and algal species in more than 190 countries (FAO, 2012a, b), and is increasingly assuming a dominant role in supply. Despite the popularity of farming in Nigeria, the fish farming industry can best be described as being at the infant stage when compared to the large market potential for

its production and marketing (Nwiro, 2012). A right step towards arresting the demand-supply deficit for fish is aquaculture. Recently, Nigeria Government put in place, an aquaculture transformation agenda, to increase annual fish production from the current production of 0.78 million tonnes to 3.0 million tonnes in order to achieve self-sufficiency in fish production and supply by the year 2015 (Tijani, 2011), through fish farm developmental programme, fish seeds and feed mill development, etc. However, fish feed account for at least 60% of the total cost of production (Gabriel *et al.,* 2007) and fish feed demand by fish farmers have not been met for effective growth of cultured fish species. Production of nutritionally balanced diets for fish is the main factor affecting intensive aquaculture because of its influence on growth, health and production cost. This situation calls for concerted efforts in nutritional research (Adewole, 2014) through the use of feed additives to promote growth, improve health and reduce production pressure that comes with reduced growth, susceptibility to diseases and can have devastating effect on the finances of fish farmers, if the situation is not properly handled.

However, the use of feed additives in the aquaculture industry has received considerable attention in recent years. The incorporation of naturally derived additives, like medicinal plants, probiotics, prebiotics and beehive products (Cuesta *et al.,* 2005; Chakrabarti *et al.,* 2012) stimulated the immune system of fish, enhanced their resistance to diseases, and promotes growth.

Propolis is a sticky gum, the colour of which varies from yellow-green to dark-brown depending on its source and age. It has very complex chemical compositions and analyses of its chemical compositions have identified at least 300 compounds (De Castro, 2001). It has been used in folk medicine since ancient times, due to its many biological and pharmacological properties mainly attributed to the phenolic components such as flavonoids. Its mechanisms of action have been widely investigated using different *in vitro* and *in vivo* models (Sforcin & Bankova, 2011). Recently, the effects of propolis as a growth promoter, immunostimulant and hepatoprotective agent (Deng *et al*., 2011) have been extensively demonstrated in poultry and fish. Supplementation of fish diet with enzyme can help to eliminate the effects of antinutritional factors and improve the utilization of dietary energy and amino acids, resulting in improved growth performance of fish (Soltan, 2009). This study aimed at investigating the effect of these additives; aqueouspropolis extract and organic enzyme (Ag-Zyme) on growth performances, carcass yield, and organosomatic indices of African Catfish (*C. gariepinus*) a leading candidate for aquaculture in Nigeria.

MATERIALS AND METHODS

The study was conducted in the Fish hatchery of the Department of Environmental Biology and Fisheries, Adekunle Ajasin University, Nigeria. Propolis was collected from a bee farmer in Ibadan, Oyo State, Nigeria. The propolis exract solutions were prepared based on adapted and modified method of (Nagai *et al.,* 2003). Ag-Zyme was bought at Agriculture Feed supplement store in Akure, Ondo State, Nigeria. Eight different diets were formulated and prepared with different feed ingredients using the Pearson‘s square method as shown in (Table1). All the Eight compounded diets were isonitrogenous at 40% Crude Protein (CP) level, with varying inclusions of the additives:0% (Control), AG-Zyme (AGZ1)(0.35%) –AG-Zyme (AGZ3) (1.4%) and Propolis (PRP1) (0.5%) -

Propolis (PRP4) (4%) respectively. The mixed ingredients were made into dough, pelleted intostrands, cuts into short pieces, sundried for 3 days and kept in a well tighten plastic container and stored in a refrigerator, until ready for used.

Table 1. Percentage composition of experimental diets

Ingredients	Control (0%)	AGZ1 (0.35%)	AGZ2 (0.7%)	AGZ3 (1.4%)	PRP1 (0.5%)	PRP2 (1%)	PRP3 (2%)	PRP4 (4%)
Fish meal	22.67	22.67	22.67	22.67	22.67	22.67	22.67	22.67
Soya bean	22.67	22.67	22.67	22.67	22.67	22.67	22.67	22.67
GNC	22.67	22.67	22.67	22.32	22.67	22.67	22.17	21.67
Yellow maize	11.72	11.37	11.37	11.37	11.22	11.22	11.22	10.72
Rice bran	11.72	11.72	11.37	11.37	11.72	11.22	11.22	10.72
Vit/Min Premix	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Vegetable oil	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Starch	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Bone Meal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CMC	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Cr_2O_3	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Propolis	-	-	-	-	0.50	1.00	2.00	4.00
Ag-Zyme	-	0.35	0.70	1.40	-	-	-	-
Total	100	100	100	100	100	100	100	100

Experimental procedures included Fish feeding, weighing, proximate analysis and data collection. 15 fingerlings of *Clariasgariepinus* of total weight of 261g and mean initial weight andtotal length of 17.40g and13.54cm respectively were randomly distributed into 24 rectangular plastic tanks (49x33.5x33.5) in triplicates, for a period of 84 days. The fish were acclimatized for 21days and were fed with commercial diet at 5% of their body weight twice daily. These tanks were washed twice in a week to remove uneaten food and faecal matters were removed with a hose every day to maintain good hygienic and healthy condition of the fish (Aderolu *et al*., 2009).

The growth parameters were measured according to standard method suggested by Aderolu *et al*. (2009) and the organosomatic indices after dissection according to Dogan and Can (2011).The body weight, carcass and head yields and percentage dress out were calculated according to Suleyman *et al.* (2010), while, the Condition Factor (K) was calculated according to the method of Anderson *et al.*(1998). Water quality parameters (Temperature, Dissolved oxygen and pH) were measured with Hanna water quality meters (Model number H19828) according to Boyd (1998). Data were subjected to one-way analysis of variance (ANOVA) at ($_{0.05}$), followed by Duncan's Multiple Range Test for the means at a significance level using Statistical Analysis System (SAS 2008).

RESULTS AND DISCUSSIONS

The proximate composition of the experimental diets fed *Clariasgariepinus* fingerlings for 84 days is presented in Table 2. The CP ranged from 40.79% to 41.84% with the highest value from AGZ3 diet, followed closely by AGZ1 diet and the least value was

from the control diet. There was increase in size of the fish fed the experimental diets which showed that the fish were healthy and manifested growth based on the utilization of the various diets. The initial total weights (261.00±0.00g) of the fish at the start of the experiment changed progressively to the final total weight that ranged from 782.00g to 1311.00g. The highest value was from PRP2 and closely followed by AGZ3 (1163.50±83.50g) and the least was from the Control fed group. The Mean Weight Gain (MWG), Specific Growth Rate (SGR) and Relative Growth Rate (RGR) followed the same trend as the final total weight gain were significantly ($p<0.05$) different within the treatments and also when compared with the control fed group. The final condition factor (K_2) ranged from 0.54 to 0.69, but were no significantly ($p<0.05$) different among the treatments with the highest numerical value from PRP1group. The survival rate ranged from 93.33% to 100.00% with the highest value jointly from the fish fed AGZ2; PRP1andPRP2 groups as presented in (Table 3).

The cerebrosomatic and cardiosomatic indices ranged :(0.38±0.01% to 0.46±0.04%; 0.09±0.01 to 0.12±0.02%) respectively and were not significantly different ($p>0.05$) within the treatments, but numerically higher values were gotten from the PRP3/AGZ1 and PRP1 groups. The hepatosomatic (HIS),visceralsomatic (VSI) and renaltosomatic (RSI) indices significantly ranged from (0.72±0.02 to 1.07±0.06%; 0.91±012% to 1.47±0.13%; and 0.29±0.02% to 0.46±0.03 %.) and highest values for both HIS and VSI were from the fish fed PRP1group and for VSI was from the AGZ1 group respectively as presented in (Table 4).The body weight yield and head yield of the fish varied significantly from (74.22±8.01 to 101.43±3.89 and 28.56±0.41 to31.41±0.76) and the highest values were from PRP4 and PRP2 groups respectively. The carcass yield and percentage dress out ranged from (66.41±1.39 to 69.43±1.14 and 91.02±0.17 to 92.15±0.97) and were not significantly ($p>0.05$) different among the treatments as presented in Table 5. The water temperatures varied from 24.77±0.07 to 25.30±0.35 with the highest value recorded from AGZ3 fed group, followed closely by AGZ1 and the least value was from PRP4 fed group (Table 4). The Dissolved Oxygen and the pH were not significantly ($p>0.05$) different among the treatments (Table 6).

Table 2. Proximate composition of the experimental diets

Parameters (%)	CONT 0.00%	AGZ1 0.35%	AGZ2 0.70%	AGZ3 1.4%	PRP1 0.5%	PRP2 1%	PRP3 2%	PRP4 4%
Crude protein	40.79	41.73	41.64	41.84	40.93	41.32	41.12	41.44
Crude fat	3.57	3.64	3.52	3.75	3.66	3.61	3.72	3.56
Crude fibre	3.41	3.33	3.30	3.37	3.17	3.22	3.17	3.28
Ash content	10.70	10.68	10.59	10.76	9.88	10.23	9.96	11.06
Moisture content	6.43	5.87	6.46	6.40	5.59	6.16	5.80	6.37
CHO	35.10	34.75	34.49	33.88	36.77	35.45	38.23	34.29

Table 3. Growth performance of Clariasgariepinusfed different levels of propolis extract and ag-zyme for 84 days

Growth Parameters	CONT (0.00%)	AGZ1 (0.35%)	AGZ2 (0.70%)	AGZ3 (1.4%)	PRP1 (0.5%)	PRP2 (1%)	PRP3 (2%)	PRP4 (4%)
Initial Weight(g)	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}	261.00±0.00^{a}
Final Weight(g)	782.00±34.00^{c}	1041±31.00^{b}	979.00±54.00^{bc}	1163.50±83.50^{a}	1141.50±34.50^{ab}	1311.00±42.00^{a}	1145.00±11.00^{ab}	1002.00±18.00^{bc}
Initial Length (cm)	13.68±0.05^{bc}	13.76±0.06^{ab}	13.92±0.07^{a}	13.78±0.08^{ab}	13.65±0.01^{bc}	13.70±0.04^{ac}	13.47±0.01^{c}	13.16±0.0006^{d}
Final Length (cm)	20.74±0.04^{b}	23.23±0.76^{ab}	23.61±0.52^{ab}	24.21±0.31^{a}	23.59±0.97^{ab}	24.30±0.32^{a}	24.85±0.02^{a}	23.97±0.08^{a}
Total Weight Gain (g)	521.00±21.00^{c}	780.00±31.00^{b}	718.00±32.00^{bc}	902.50±83.50^{ab}	880.50±34.50^{ab}	1050.00±33.00^{a}	884.00±11.00^{ab}	741.00±27.00^{bc}
Mean Weight Gain (g)	37.21±3.20^{c}	55.72±2.22^{ab}	47.87±2.02^{bc}	64.47±5.97^{ab}	58.70±2.30^{ab}	70.00±3.21^{a}	63.15±0.79^{ab}	52.93±3.21^{bc}
Mean Daily Weight Gain(g)	0.44±0.01^{c}	0.67±0.02^{a}	0.57±0.03^{a}	0.65±0.19^{a}	0.70±0.03^{a}	0.83±0.02^{a}	0.75±0.01^{a}	0.63±0.02^{a}
Weekly weight gain (g)	3.10^{a}	4.65±0.19^{a}	3.99±0.12^{a}	4.54±1.33^{a}	4.89±0.19^{a}	5.83±0.17^{a}	5.27±0.06^{a}	4.41±0.08^{a}
Specific Growth Rate(%/day)	0.57±0.01^{c}	0.72±0.02^{b}	0.68±0.02^{b}	0.77±0.04^{ab}	0.77±0.02^{ab}	0.83±0.00^{a}	0.77±0.01^{ab}	0.70±0.02^{b}
Relative Growth Rate	621.23±0.34^{c}	928.58±36.91^{b}	854.76±0.21^{bc}	1074.41±99.40^{a}	1048.47±40.82^{ab}	1250.00±0.54^{a}	1052.39±13.10^{ab}	882.14^{bc}
Feed Conversion Ratio	3.64^{a}±0.00	3.00±0.09^{ab}	2.97±0.06^{ab}	2.61±0.00^{b}	3.20±0.27^{ab}	2.52±0.02^{b}	2.94±0.01^{b}	3.02±0.00^{ab}
Total Feed Intake (g)	2565.08±61.96^{d}	2871.87±75.89^{cd}	3051.91±124.18^{bc}	3007.01±197^{c}	3351.32±70.67^{ab}	3337.79±136.02^{ab}	3434.20±8.78^{a}	2985.45±23.85^{c}
Mean Feed intake (g)	183.22±0.05^{d}	205.13±0.06^{cd}	203.46±0.10^{bc}	214.79±0.16^{bc}	223.42±0.05^{ab}	222.52±0.11^{ab}	245.30±0.01^{a}	213.25±0.02^{c}
Number Stocked	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}	15.00±0.00^{a}
Number Harvested	14.00^{b}	14.00±0.00^{b}	15.00^{a}	14.00±0.00^{b}	15.00±0.00^{a}	15.00^{a}	14.00±0.00^{b}	14.00^{b}
Survival Rate	93.33^{b}	93.33±0.00^{b}	100.00±0.00^{a}	93.33±0.00^{b}	100.00±0.00^{a}	100.00±0.00^{a}	93.33±0.00^{b}	93.33±0.00^{b}
Initial Condition Factor	0.68±0.00^{c}	0.67±0.00^{c}	0.64±0.00^{d}	0.67±0.01^{c}	0.68±0.01^{c}	0.67±0.00^{c}	0.72±0.01^{b}	0.76±0.00^{a}
Final Condition Factor	0.63±0.00^{a}	0.56±0.02^{a}	0.54±0.00^{a}	0.61±0.00^{a}	0.69±0.00^{a}	0.66±0.00^{a}	0.59±0.06^{a}	0.56±0.00^{a}
Difference	-0.05±0.01^{a}	-0.11±0.02^{ab}	-0.10±0.01^{ab}	-0.06±0.01^{ab}	0.01±0.01^{a}	0.01±0.01^{a}	-0.13±0.06^{ab}	-0.20^{b}

KEY: Value given in mean standard error of three replicates. **NOTE:** Figures in the same row having the same superscript are not significantly different (p>0.05).

Table 4. Organosomatic indices of Clariasgariepinus fed different levels of propolis extract and agzyme for 84 days

Organs Parameters	CONT 0.00%	AGZ1 0.35%	AGZ2 0.70%	AGZ3 1.4%	PRP1 0.5%	PRP2 1%	PRP3 2%	PRP4 4%
Cerebrosomatic Index	0.38±0.01^{a}	0.42±0.01^{a}	0.42±0.05^{a}	0.46±0.04^{a}	0.42±0.01^{a}	0.39±0.01^{a}	0.42±0.05^{a}	0.39±0.01^{a}
Hepasomatic Index	0.82±0.10^{ab}	1.04±0.06^{a}	0.93±0.06^{ab}	0.97±0.14^{ab}	1.07±0.06^{a}	0.90±0.04^{ab}	0.72±0.02^{b}	0.82±0.07^{ab}
Gill	2.97±0.38^{ab}	3.34±0.14^{a}	3.26±0.03^{ab}	3.03±0.14^{ab}	2.70±0.06^{b}	3.49±0.10^{a}	3.12±0.10^{ab}	3.37±0.19^{a}
Cardiosomatic Index	0.11±0.02^{a}	0.10±0.02^{a}	0.11±0.01^{a}	0.10±0.01^{a}	0.13±0.03^{a}	0.09±0.01^{a}	0.10±0.01^{a}	0.12±0.02^{a}
Renatosomatic Index	0.34±0.03^{bc}	0.46±0.03^{a}	0.46±0.01^{a}	0.34±0.02^{bc}	0.36±0.02^{b}	0.29±0.02^{c}	0.38±0.02^{b}	0.37±0.01^{b}
Visceraso matic index	0.91±0.12^{d}	0.97±0.09^{cd}	1.31±0.17^{ac}	1.33±0.22^{ac}	1.47±0.13^{a}	1.42±0.02^{a}	1.33±0.06^{ac}	1.01±0.03^{cd}
Fat Deposit Index	1.39±0.18^{a}	0.94±0.03^{b}	0.97±0.03^{ab}	1.03±0.05^{ab}	0.83±0.09^{b}	0.99±0.22^{ab}	0.98±0.08^{ab}	1.03±0.19^{ab}

KEY: Value given in mean standard error of three replicates. **NOTE:** Figures in the same row having the same superscript are not significantly different (p>0.05).

Table 5. Body carcass yield of Clariasgariepinusfed different levels of propolis extract and agzyme for84 days

Parameters	CONT(0.00%)	AGZ1 (0.35%)	AGZ2 (0.70%)	AGZ3 (1.4%)	PRP1 (0.5%)	PRP2 (1%)	PRP3 (2%)	PRP4 (4%)
Body Weight Yield	93.53±5.45^{aD}	91.95±5.18^{aD}	92.50±11.13^{aD}	74.22±8.01^{D}	86.14±2.55^{ab}	99.31±0.33^{a}	96.06±9.34^{ab}	101.43±3.89^{a}
Head Yield	31.06±0.37^{a}	29.54±0.52^{bc}	28.56±0.41^{c}	30.67±0.27^{aD}	29.28±0.21^{bc}	31.41±0.76^{a}	28.59±0.45^{c}	30.22±0.27^{ab}
Carcass Yield	66.44±1.14^{a}	68.31±1.19^{a}	69.43±1.14^{a}	66.73±1.35^{a}	68.46±1.21^{a}	66.41±1.39^{a}	68.98±1.18^{a}	67.70±1.04^{a}
Dress Out %	92.15±0.97^{a}	91.56±0.50^{a}	91.02±0.17^{a}	91.53±0.18^{a}	91.85±0.33^{a}	91.16±0.16^{a}	91.82±0.30^{a}	91.67±0.14^{a}

KEY: Value given in mean standard error of three replicates. **NOTE:** Figures in the same row having the same superscript are not significantly different (p>0.05).

Table 6. Physico-chemical parameters of water used for culturing Clariasgariepinusfed different levels of propolis and ag-zyme for 84 days

Water Parameters	CONT 0.00%	AGZ1 0.35%	AGZ2 0.70%	AGZ 3 1.4%	PRP1 0.5%	PRP2 1%	PRP3 2%	PRP4 4%
Temperature	24.94±0.08^{ab}	25.09 ±0.04^{ab}	25.00±0.10^{ab}	25.30 ±0.35^{a}	24.95±0.03^{ab}	24.93±0.05^{ab}	24.80±0.11^{b}	24.77±0.07^{b}
Dissolved Oxygen	5.64±0.31^{a}	5.75±0.07^{a}	5.74±0.13^{a}	5.62±0.01^{a}	5.52±0.02^{a}	5.45±0.02^{a}	5.42±0.04^{a}	5.44±0.00^{a}
P^{H}	6.60±0.04^{a}	6.78±0.35^{a}	6.44±0.04^{a}	6.35±0.01^{a}	6.27±0.02^{a}	6.25±0.00^{a}	6.32±0.06^{a}	6.60±0.35^{a}

KEY: Value given in mean standard error of three replicates. **NOTE:** Figures in the same row having the same superscript are not significantly different (p>0.05)

The proximate analysis result of the experimental diets revealed that they contained a mean of 41.35% CP. This is suitable for *C.gariepinus* growth and agrees with Olukunle (2009), who fed the same fish with varied inclusion levels of livestock vitamin grower's premix containing similar CP. In many studies conducted with propolis as additives, positive effects on feed utilization, body weight,percentage of dress meat and carcass yield have been reported (Bonomi, 2002; Bonomi, 2003).The result from this study is similar to the use of propolis that decreased Feed Conversion Ratio (FCR) and increased the growth performance (Abd –El- Rahman, 2009; Deng *et al*., 2011). Also, Abass (2012) reported dietary propolis and honey bee pollen significantly affect nutrient utilisation in the diet of Nile Tilapia, but did not affect $K_2$when compared to pollen and the control fed group.

The improved growth performance is based on the observation of Krell (1996) and Wang *et al*. (2003) that honeybee products of pollen and propolis are characterized by nutritionally valuable substances that can be used to improve aquaculture, such as its rich flavonoids, phenolics components and excellent source of vitamin, mineral and protein, which have been reported to promote growth in different animals. Thus, influencing the feed intake of *C. gariepinus* as observed in this study. Controversially, these findings are not in agreement with the result obtained by Velotto *et al.* (2010) and Acikoz *et al.* (2005) who, indicated that propolis extract to quail diets, male broilers and trout did not affect growth rate. However, the improved growth performance and survival of C. *gariepinus* fed Agzyme was similar to the recent reports of the effects of enzyme supplementation of several cultured fish species: Channel catfish (Jackson *et al.,* 1996), *Pangasiuspangasius* (Debnath *et al*., 2005) and Caspian salmon (Zamini *et al.*, 2014).

But it is worthy to note that dietary composition could affect the carcass yield and invariably the market values of the carcass , while the internal organs cold also be influenced by diet which in turn could affect nutrient absorption and utilization (Ndelekwute *et al.*, 2014). Carcass yield were almost constant at the end of the experiment and not significantly (P>0.05) different across the treatments fed group and the control fed group. This indicates that the carcass yield, percentage dress out and internal organs weight such as brain, heart were not affected by Propolis and Agzme

supplementation. This study is in line with the findings of Denli *et al.* (2005) who indicated that addition of propolis to quail diets did not affect carcass characteristics and Yaser, (2002) who argued that the inclusion of exogenous enzyme in the diet of broilers chicken did not have any significant effects on the carcass characteristics. However, these results differed from Ndelekwute *et al.* (2014; 2012) that reported improved carcass yields. However, the results of the body weight yield of *Clariasgariepinus* was similar to these authors that reported both dietary and drinking water containing organic acids produced heavier breast weight than the control.

Liver is known to enlarge in response to foreign bodies such as toxins or chemicals; this could be a reason for the heavier liver in the additive groups of AGZ1and PRP1 respectively in response to the presence of the organic enzyme and propolis. This is similar to the result presented by Ndelekwute *et al.* (2014) who reported enlarged liver in broiler chickens fed organic acids; however, there was decrease in the weight of the liver in this study as the propolis concentration increased to 4% (PRP4). There was also slight decrease in the weight of the kidney when the concentration of the propolis increased from 0.5% (PRP1) to 1% (PRP2). A similar report was made by Instirtoris *et al.*(2001) when he observed a decrease in the weight of the liver, adrenals and kidney of rat exposed to propoxur and heavy metal. However, the decrease in the liver and the kidney in this study could be as a result of proper detoxification by the kidney and the liver as observed in the PRP2 diet and ability of propolis to reduce the effect of toxins producing microorganism such as gram negative (pathogenic) bacteria. Toxins produced by these pathogens were reported to cause enlargement of the kidney (Choct, 2009). This result is in variance with Islam *et al*. (2008) who reported no significant effect of organic acids on the internal organs of broilers chickens, but agreed with the report of (Ndelekwute *et al.*, 2012) as regards the kidney, pancreas and liver.

The study of viscerosomatic and hepatosomatic indices have an important role in the metabolism of the fish, related to digestion and absorption, synthesis of and selection of digestive enzyme and carbohydrate metabolism (McLaughlin, 1983). The result of the viscerosomatic index in this study showed that the fish fed additives were significantly higher than the control. This result is similar to that of Ahmad *et al.* (2012) and Ighwela *et al.* (2014) who reported the VSI of Nile Tilapia *Oreochromisniloticus* that ranged from 1.49±0.45 – 1.66±0.31 after being fed with varying dietary maltose. The non-significant and significant influence of these additives among different organs from treatments is/are an indication of absence of toxins in both propolis and agzyme, since hypertrophy and hypotrophy of the organs have been associated with the presence of toxins (Aderemi, 2003). Furthermore, Broadbent *et al.* (1981) attributed this variance to the probability of differences in their live weight, since the surface area and the live weight determine the amount of the feathers and visceral organs. Esonu *et al*. (2008) reported that organ weights are index of nutrient retained by the birds while Butcher *et al*. (1983) reported that external and internal offal percentages tends to increase as slaughter weight of animal increases. It has been established that specific features of the catfish environment are of primary importance in determining the growth and survival of the fish species. All the cultured water values in this study fall within the range reported by Boyd (1979) as the best for tropical fishes.

CONCLUSIONS

This is the first time to knowledge of reporting the utilization of Agzme and propolison growth performance, carcass yield and organosomatic indices of African catfish. The findings from this indicate the presence of a potential effect of propolis and agzyme as shown by the improved rearing indices and uncompromising health of the fish. The results organosomatic indices are important indicator that can be used as valuable tool in assessment of new diets in nutritional science and sustainable aquaculture.

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