HONEY COMB POTENTIALITIES AS GROWTH PROMOTER AND PRESERVATOR IN *CLARIAS GARIEPINUS* DIETS

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Abstract

Honey comb was involved as floating additive in fish diets at 0, 4 and 8% levels in 30% crude protein for *Clarias gariepinus* juveniles of mean weight 30.30 ±0.05g for 56 days in aquaria each measuring 60 x 30 x 30cm. Within six weeks all stages of grain weevils *Oritzaphillus mecartus* were associated with the zero honey comb diets, while those with honey comb remained as kept. Feed and fish values were better in honey comb diets. The growth, food utilization indices; feed and fish values were significantly (P<O.05) higher in honey comb diets. Bee keeping for income and honey comb usage in fish diets were suggested to farmers.

Keywords: Honey comb, growth, preservation, diets, *Clarias gariepinus* juveniles, cost.

Introduction

The recent rush for imported floating fish feeds among Nigerian fish farmers has brought about the search for local technological approach to fish feed flotation without extrusion. Locally produced floating fish feed would save our foreign exchange and increase job opportunities within the country.

In the early studies, beeswax was extracted, from honey comb and used as floating additive in *C. gariepinus* and Tilapia diets. Positive results were obtained in Water stability, Nutrients retention and Flotation (Falayi, *et, al.*, 2005a). Further investigation revealed whole honey comb excelled as better floater than the wax extracted. Honey comb is a by-product from honey factory and it contained natural wax, exudates secreted by bees and served an protective coatings or receptacles which glued all trapped dead insects brought into the hive by mother bees to feed their young's. During harvest all insects inclusive of the young and killed bees are harvest in the comb; and this made honey comb moderately rich in animal proteins and amino acids (Dada *et al*, 1998). Apart from the above, honey products contain some antioxidants which help to prolong the life span of food and products by preventing oxidation, rancidity and insects attack (Falayi, *et, al.*, 2005, Greener and Fernema, 1989, Krochta and Johnston, 1997). The present study is aimed at feeding the diets composed of honey comb to groups of *C. gariepinus* juveniles and evaluating the growth of fish and honey comb storage potentialities in feed.

Material And Methods

Honey comb was obtained from honey producer in and around the Kainji Lake basin, Nigeria, and pressed by solar and hot water treatments to reduce the honey content following the methods of Dada *et al.* (1988). The process also helps to remove the impurities. The honey comb was milled with the embedded insects and kept as floating additive. Wheat Flour Starch binder was produced following the methods of Falayi *et al.*, (2003 and 2005). Whole Wheat meal (WWM) and Cassava flour meal (CFM), formed the main carbohydrate feedstuffs and were obtained by the methods of Falayi *et al.*, (2004). Groundnut Cake (GNC) and extruded Soybean meal (ESBM) were produced as in Eyo (2003) and Eyo *et, al.*, (2003a) respectively. Clupeids fish meal and Bovine blood meal were produced as in Falayi *et al.* (2006). Vitamins and micro mineral premix were obtained from agrochemical store in New-Bussa while bone meal was processed as described in Falayi *et, al.*, (2006). Vegetable oil and salt were purchased from New Bussa central market.

Diet formulation and Preparation

Three iso-nitrogenous diets were formulated with honey comb incorporated at 0, 4 and 8 %, and the binding agent fixed at 10%. Clupeids fish meal and blood meal were fixed at 15 and 5 %, respectively, while bone meal, vegetable oil, premix, amino acid supplements and salt were added as shown in Table 1. The main carbohydrate and protein feedstuffs were formulated by the methods of Halver, (1976 in ratio 2:1 and respectively, to obtain is nitrogenous 30% crude protein diets for *Clarias gariepinus* juveniles (Ayinla and Akande, 1988). All large particle ingredients were first milled separately with hammer milling machine and sieved to fine particulates before weighed into plastic buckets according to the values in the formulation Table. Cassava flour meal (CFM) was cooked separately at the ratio of 100 dry weights to 400 mls water at 100°C for 10 minutes to produce gelatinized starch. The starch was allowed to cool for 5 minutes. The floater was weighed and added to the starch and remixed until it is completely dissolved or melted in the starch. The mixtures of honey comb and starch was poured into a plastic bucket containing other dry- mixed ingredients. Thorough hand kneading was carried out to obtain homogenized paste. Vegetable oil was the last ingredient added and before the final general remixing). The soft and well mixed paste (dough) was placed in a Project Development Agency (PRODA) made pelletizer, and rolled out into a waiting tray via 4mm die holes in different lengths. The pellet strand were then cut into 2cm each and molded into ball shape, placed in a galvanized tray lined with oil film, (to prevent the diet stickiness on the tray) covered with the lid and put in electric oven set at 105°C for 3 hours; cooled in a desiccator's. Samples were sent in sealed bottles for proximate analysis following the AOAC, (1990) methods. Some samples were tested for Water stability, Nutrients retention and Flotation in Falayi *et al.* (2005).

Bulk of the diets were put in polyethylene sacks, stapled with pins and placed inside cupboard in the Nutrition laboratory (NIFFR) New Bussa for 6 weeks when waiting for the catfish fingerlings to mature to juveniles needed in the feeding trials. The room temperature and relative humidity were obtained with thermometer and air hygrometer, respectively. Within the periods of storage, mean daily temperature and relative humidity for the six weeks revealed mean temperature 25.5°c and mean relatively humidity 90%.

Feeding Trial

Replicate feed samples were fed to groups of *Clarias gariepinus* juveniles mean weight 30.30± 0.05g in aquaria each measuring 60 x 30 x 30cm, filled to ¾ of holding capacity with mixture of bore hole and rain waters. Aeration was done by electric aerators and air stones. The diets were fed at 5% of the fish biomass for 56 days; with half of the daily consumption fed in the morning 0700hr and the other half fed at 1800hrs. Part(1/2) of water in all tanks were siphoned and replaced every 3 days and all tank waters were drained, cleansed and replaced at the 8th day after water quality parameters (DO, pH and water Temperature) of the experimented waters were observed following the methods of APHA, (1990). Data on the proximate, growth, and cost parameters were analyzed using one way ANOVA and the differences in means tested for significant differences using Duncan multiple range F-Test (Duncan, 1955).

Results

Table 1 revealed the proximate analysis of the three (3) diets, honey comb, Carcass Composition of *Clarias gariepinus* before and after the diets consumption. The moisture content of all samples ranged from 3.55-7.00% with more values in the diets than honey comb and the fish carcasses. The honey comb moisture content was similar to those of the carcasses. Crude proteins ranged from 20.00-58.00% with higher values in carcasses than honey comb and diets. Crude lipids ranged from 10.00-43.00% with highest value in honey comb (43.00%), higher values were obtained in the fish carcasses and least in diets. Crude fiber ranged from 2.00 to 4.50% with highest value in fish carcass before fed the experimental diets, while lower values were obtained in carcasses after the feeding trial and the least value (2.00%) in honey comb. Ash contents ranged from 3.50 to 15.80% with highest values in fish carcasses, followed by diets and the least (3.50%) in honey comb. The NFE ranged from 3.80 39.55% with highest values in diets, followed by honey comb and least values in carcasses. The result of the growth and food utilization is revealed on Table 2. Final weights and weight gains ranged between 75.50 to 92.50g and 45.2 to 62.2g, respectively, with the highest values in Diet 2 with 8% honey comb and least in Diet 3 without honey comb. Feed intake, FCE, PER and SGR (%) were highest in 8% honeycomb at 260.0g, 35.58g, 2.10g and 1.99%, respectively, and least in that order at 255.0g, 29.61g, 1.47g and 1.63% in control. In all parameters above, Diet1 with 4% honey comb ranked 2nd position. The result on the feed preservation for six weeks before feeding finally commenced revealed all stages of a certain weevil (associated with cereal and grain products) in Diet3 without honey comb. The weevil was named as *Oritzaphillus mecartus*. Diets1 and 11 with honeycomb were without insects and remained as kept for the six weeks. Table 3 gave the cost of diets and fish produced. Highest value (N640.00) of fish was obtained from the least cost (N121.8) diet (Diet 2). An evidence of best cost benefit fish/diets. The water quality of experimental tanks revealed mean temperature 25°C, mean DO 5.51mg/l and mean pH 7.5. They were within the recommendations for warm water fishes (Boyd, 1990).

Discussion

The highest lipids content in honey comb confirmed the works of Dada *et, al.*, (1988), Hafez and Abd-Alfattah, (1998) and Falayi, *et, al.*, (2005), that beeswax was abundant in the exudates secreted by bees which served as protective coatings or receptacles. The highest values of crude protein and Ash contents in fish carcasses than diets and honey comb confirmed the abundant nutrients in fish carcasses than diets which composed mainly nutrients from plant sources, while the highest NFE in diets and honey comb over the carcasses confirmed higher starch nutrient in plant sources. The perfect condition of the honey comb diets over that with weevils and without honey comb could be traced to the fact that when honey product is diluted, glucose oxidize enzyme which is inactivated at moisture content 14 19% becomes activated, resulting in the breakdown of dextrose into hydrogen peroxide and glycolic acid. Hydrogen peroxide permits, or slows down the growth of bacteria and thus protects diluted honey product from attacks by microbes (Ushkalova and Murykanick, 1978,) Hafez and Abd-Alfattah, 1998). Other reasons could be traced to the presence of proplise a natural antioxidant in honey products; which contained flavour, flavourness and flavones which are collected by bees from the resins and secretions of buds in deciduous tree and herbs around the apiary. Bees used proplise to tighten he hive's polishing of the comb cell walls and proplization of small animals and dead insects found on the bottom of the hive, so their corpse do not decay. The efficiency of proplise as natural antioxidant which replaces the synthetic Buthylated Hydroxy Toluene (BHT) were reported individuals by that it enables frozen fish to keep it quality 2 - 3 times longer and Ushkalova and Murykanick, (1978) in stabilizing the oleic and pork melted fat and by during frozen and storage of meat. Proplise also prevented rancidity of sunflower oil in oven for 6 months at level 0.02gm/l 100ml (200p pm) compared to Buthylated Hydroxy Toluene (BHT) at 0.03g/l 100ml (300ppm) level. The highest growth and food utilization indices recorded in the honey comb diets are prove that there is no toxic substance in honey comb, and high digestibility and acceptability, *Clarias gariepinus*. Honey comb has abundant natural wax and fatty acids, high protein and amino acids (Hafzez and Abd-Alfattah, 1998). There are edible polymer and polysaccharide films in beeswax (whey protein isolate (WPI) and brownies, which served moderately as moisture and oxygen barriers. The films formed a coating on feed inhibit migration of moisture, oxygen, carbon-dioxide, aromas and lipids etc; and improve mechanical integrity of feed (Greener and Fennema, 1989; Krochta and Moulder-Johnston, 1997). These phenomena have assisted high buoyancy and flotation in honey comb diets (reported in another paper) and subsequently, prolonged eating of the diets, by the fish (with minimum lost of nutrients to leaching) and higher nutrients uptake which led to higher growth and food utilization compared with the 0% honey comb that sank and disintegrated earlier in water.

Table 1: Diets formulation with varied levels of Honey comb and the analyses.

Ingredients	DT.1 4% HC	DT.2 8% HC	DT.3 0% HC					
Fish meal	15	15	15					
WWM	25.84	24.48	27.2					
CFM	12.92	12.24	13.6					
GNC	9.97	9.00	10.96					
ESBM	9.97	9.00	10.96					
H. comb	4.00	8.00	0.00					
WFS(Binder)	10.00	10.00	10.00					
Blood meal	5.00	5.00	5.00					
Veg. Oil	3.00	3.00	3.00					
Premix	2.00	2.00	2.00					
Blood meal	1.00	1.00	1.00					
Methionine-DL	0.50	0.50	0.50					
Lysine-L	0.50	0.50	0.50					
Salt	0.30	0.30	0.30					
Proximate Analysis:					**Carcasses**			
				Honey comb	**Initial**	**4%**	**8%**	**0%**
Moisture %	7.00^{a}	6.80^{a}	6.59^{a}	4.00^{b}	3.55^{b}	4.00^{b}	3.70^{b}	3.70^{b}
C. Protein (%)	30.45^{b}	30.20^{b}	30.71^{b}	20.00^{c}	55.41^{d}	58.0^{d}	59.5^{d}	57.0^{d}
C.Lipid (%)	12.42^{c}	14.00^{c}	10.00^{c}	43.00^{b}	10.25^{c}	14.5^{c}	16.30^{c}	13.0^{c}
C. Fiber	3.92^{k}	3.88^{k}	3.65^{k}	2.00^{k}	4.50^{k}	3.90^{k}	3.00^{k}	3.70^{k}
Ash (%)	8.08^{j}	8.05^{j}	9.50^{j}	3.50^{k}	15.35^{L}	15.50^{L}	15.70^{L}	15.80^{L}
NFE (%)	38.13^{a}	37.07^{a}	39.55^{a}	27.50^{b}	10.94^{c}	4.10^{d}	3.8^{d}	6.8^{a}
DM (%)	90.55c	87.90c	91.60c	-	-	-	-	-

NFE= 100 (% Moisture + % C. Protein + % C. Lipid+ C. Fiber + % Ash content).
Values in rows with same parenthesis are not significantly ($P<0.05$) different.

Table 2: Growth performance and food utilization of *Clarias gariepinus* juveniles fed diets floated with Honey Comb at different levels.

Growth Indices	Diet 1 (4%)	Diet 2 (8%)	Diet 3 (0%)
Mean no. of fish	5	5	5
Initial mean Wt. (g)	30.35^{a}	30.30^{a}	30.30^{a}
Final mean Wt. (g)	84.05^{b}	92.50^{b}	75.50^{c}
Mean Wt. gain (g)	53.70^{c}	62.2^{c}	45.2^{a}
Mean Daily Wt. gain (g)	0.96^{k}	1.11^{k}	0.81^{c}
Mean % Wt. gain	176.94^{l}	2.10^{b}	1.47^{c}
FCE	0.098^{k}	1.07^{k}	0.88^{k}
PER	1.76^{b}	2.10^{b}	1.47^{c}
SGR (%)	1.82^{c}	1.99^{c}	1.63^{d}

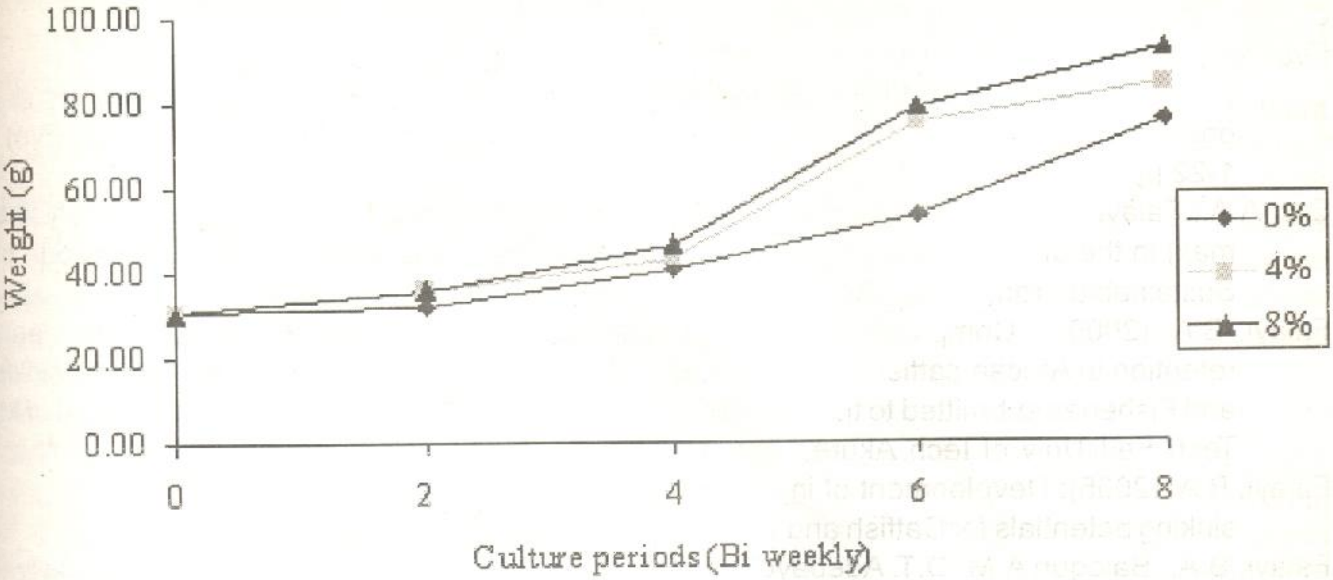

Figure 1: Bi weekly growth rate of *Clarias gariepinus* juveniles fed varied levels of honey comb diets

Table 3: Cost Benefit analysis of feed/fish

Parameters	4% HC	8% HC	0% HC
Cost per 100g feed	12.53	12.18	12.84
Cost per 1g feed	12.53	121.8	128.4
Mean feed intake (g)	85.67	86.67	85.5
Mean fish produced (g)	84.05	92.50	75.50
1 gram feed fish (g)	0.98	1.07	0.88
1 kg feed fish (g)	980	1.070	880
Market 100 1kg fish (₦)	600	600	600
Cost of 1kg feed fish(₦)	588	640	528
Profit or Difference from the least cost fish (₦)	68	122	-68

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