Original Research Article

Effect of Locally Formulated Watermelon and *Moringa* Syrup Booster on the Growth Performance of *Heterobranchus bidorsalis* Fingerlings

ABSTRACT

Aim: Evaluation of the effectiveness of formulated Watermelon (*Citrullus lanatus*) and *Moringa oleifera* booster on the growth performance of *Heterobranchus bidorsalis*.
Study design: This paper has Experimental design; data were subjected to statistical analysis using Duncan Multiple Range Statistics and interpretation was done using SPSS Version 22.
Place and duration of study: The experiment was conducted in the laboratory at the Department of Applied and Environmental Biology, Rivers State University, Nigeria for a period of 12 weeks (3 months), between November, 2016 – March, 2017.
Methodology: Total of 240 *Heterobranchus bidorsalis* fingerlings with an initial mean weight (1.61±0.23g) and length (5.13±0.26cm) were acclimated for one week. After acclimation, the fishes were fed twice daily (9am and 6pm) with 10% of their body weight after coating 2ml/1kg of the commercial feed with their individual growth booster syrup and allowed to air-dry for about 20 minutes. *Heterobranchus bidorsalis* fingerlings were scooped for the measurements exercise at one week interval after which they were returned to their various tanks.
Results: The result of this study recorded the experimental diets with optimum growth and survivability. From the result, it was deduced that, Commercial feed coated with watermelon syrup booster recorded the best performance in the growth variables of mean weight (26.36 ±3.19g), mean length (13.61±1.35cm), mean weight gain (24.64±3.00g), mean length gain (8.38±1.35cm), relative weight gain (25.36±3.19) while Commercial feed coated with commercial syrup booster (CbCf) recorded the best performance in growth variables of Daily Growth Rate (15.15±0.55) and Specific Growth Rate (2.69±0.03%) against *Moring* growth booster and commercial feed (control). However, there was less mortality as the fishes in different treatment tanks survived above 90%.
Conclusion: It could be summarized that Commercial feed coated with watermelon syrup booster (WbCf) had the best growth performance against the control groups although their values were not significantly impacted (p>0.05) when compared with other experimental diets.

Keywords: Commercial feed coated with commercial syrup booster (CbCf), Commercial feed only (Cf), Commercial feed coated with watermelon syrup booster (WbCf), Commercial feed coated with *Moringa* syrup booster (MbCf), *Heterobranchus bidorsalis*.

1. INTRODUCTION

Aquaculture is a practice used all over the world, especially in some African Countries; millions of people practice aquaculture and have used it immensely in ancient times as their means of livelihood [6]. Fish rearing/ Aquaculture practices needs less labor input compared to other agricultural practices and the expected profit margin when properly maintained is usually on the high side. For a small scale fish farmer who wishes to culture *Heterobranchus*

bidorsalis, the fluctuating level of ingredients contained in commercial feed becomes a barrier. This necessitates an innovative approach in utilizing an available formulated extract from watermelon and *Moringa* growth booster to enhance the nutrients contained in the feed [7]. Watermelon and moringa contains vital nutrients which includes vitamins, minerals, essential amino acid, phytochemicals such as carotenoids of which includes lycopene, Beta carotene, lutein. Lycopene and Beta carotene are strong antioxidant that can help to protect the cell against oxidative damage and therefore reduce risk of degenerative diseases caused by free radicals [14, 5]

Growth boosters are effective growth promoters, formulated to supplement balance feed and digestion in the target organism. Growth boosters are classified as Acidifiers, probiotics, synbiotics, phytogenics, feed enzymes and immune stimulants. Watermelon and *Moringa* syrup booster are categorized under phytogenics [10, 16].

Phytogenics are gotten from herbs, spices, aromatic plant etc. They are agents of microbes, fungi, virus, oxidation etc, aid in digestion as such, increase the palatability of feed and activate endogenous digestive enzymes, they are said to play major roles on the gut microflora [16]. Given the level of production of both crops by local farmers especially in Nigeria, bolstered by the enhanced awareness of the nutritional value of both plant products, there is the opportunity to incorporate this product into preparation of high energy level fish booster for enhanced productivity of catfish.

According to [7], *Heterobranchus bidorsalis,* which belongs to the *Clariidea* family, can be reared on formulated and less expensive feed. The *Clariidea* can withstand unfavorable and harsh environmental condition; they thrive in low oxygen and pH environment [8]. The inadequacy of nutritive fish feed ingredients has been a major constraint to the survival of fish culture in the competitive global food production system [2], as such, fish nutrition experts world over have considered the need to review a natural growth promoter especially from plant source to boost growth performance in fish farming [4]. On this note, plant products comprising *Moringa oleifera* leave as well as Watermelon (*Citrullus lanatus*) were been considered.

Moringa oleifera which belongs to the *Moringaceae* family is said to have originated from southern foothills of the Himalayas in northwestern India. It is generally planted in tropical and subtropical areas where its young seed pods and leaves are eaten as vegetables. Various parts of *Moringa oleifera* contain some important minerals, essential amino acids, such as methionine, cystine, tryptophan [3], it is also a good sources of energy, protein, vitamins, carotene, and phenolics. *Moringa* is said to have peculiar functions which is essential to human, animal, aquatic lives etc. Considering the benefits (nutritional and medicinal) of *Moringa oleifera*, it has been promoted as a “healthful” food, traditionally used to fight some popular ailments. Watermelon (*Citrullus lanatus*) is becoming an everyday fruit like apples, bananas and oranges because of its usefulness and antioxidant properties. Watermelon was also considered because its rind and seed are not usually consumed with the whole fruit, the pulp is the major parts been consumed especially in Nigeria. This fact adds to the increase of

solid food waste responsibility. To prevent agricultural health related hazards, some measures like the utilization of watermelon rind and seed as a growth booster were considered.

2. MATERIALS AND METHOD/ EXPERIMENTAL DETAILS/ METHODOLOGY

This research was carried out in the laboratory at the Department of Applied and Environmental Biology, Rivers State University located at Longitude 4.799^{o} N and Latitude 6.983^{o} S, Rivers State, Nigeria.

2.1 Materials

Heterobranchus bidorsalis fingerlings, Commercial feed (skretting of different variables, 1mm, 1.8mm and 2.5mm) table 1, *Moringa oleifera* leaves, watermelon seed, rind and pulp, commercial booster (leegrow Tab.2), triple beam balance (OHAUS), scoop net, masking tape, meter rule (cm) and twelve plastic tanks (30litre each).

2.2 *Moringa oleifera* syrup booster formulation

Fresh *Moringa oleifera* leaves used for this study were harvested from the Departmental garden at Rivers State University, Rivers state Nigeria while other raw materials were purchased from Ugo Resource and Health Farm Limited in Delta State Nigeria. The leaves were sorted out, washed thoroughly, spread on a tray with evenly spaced openings. The leaves were air-dried under shade at the laboratory for 3 days. After drying, the leaves were thoroughly blended in a fine powdery form. 20% of the blended *Moringa* leaf was mixed with 20% distilled water, 50% sucrose base and enzyme (binder), 10% of vitamin and mineral premix. The proximate content of the aqueous extract was analyzed for Moisture, Ash, Protein, Fats and Carbohydrates (see Table 2).

2.3 Watermelon syrup booster formulation

Watermelon fruits were bought and brought to the Research Laboratory at the Department of Applied and Environmental Biology, Rivers State University, Rivers State Nigeria. It was properly washed and sliced, seeds were picked out, rind was carefully scraped and chopped, and pulp obtained. 60% of Watermelon (pulp, rind and seed) was thoroughly blended and mixed with 30% sucrose base and feed enzyme (binder) and 10% of vitamin and mineral premix were used in watermelon growth booster formulation. The proximate content of the formulated Booster were analyzed as (see Table 2).

2.4 Collection of Fish

Total of two hundred and fourty (240) *Heterocbranchus bidorsalis* fingerlings (mean weight, 1.65 ± 0.23g; mean length 5.13 ± 0.26cm) were obtained from National Institute of Marine and Oceanographic Research, Sapele branch in Delta State Nigeria (NIOMOR). The fishes were transported in a transparent aquarium to the experimental laboratory, Rivers State University, Rivers State, Nigeria. The fishes were put into a transparent aquarium and taken to the laboratory. *Heterobranchus bidorsalis* fingerlings were evenly distributed into twelve plastic tanks (30litres each) at a stocking density of 20 fingerlings per tank. They were acclimated for one week during which they were placed on a maintenance diet with a commercial feed (skretting) once daily at 3% of their body weight. Water lettuce was introduced in the setup to enhance acclimation.

2.5 Experimental Procedures

After acclimation, twelve plastic tanks (30litre each) were randomly arranged and labeled into 4 Treatments (T. 1, 2, 3 and 4) with two replicates (R1, 2) and (R1, 2).

T1- Commercial booster with commercial feed **(CbCf) -** positive control.

T2- Commercial feed only (**Cf**) - Negative control.

T3- Watermelom booster with commercial feed **(WbCf)**

T4- *Moringa oleifera* booster with commercial feed **(MbCf)**

Fingerlings were weighed and measured to determine its initial mean weight and length. The fishes were fed twice daily (9am and 6pm) with 10% of their body weight after coating 2ml/1kg of the commercial feed with their individual growth booster syrup and allowed to air-dry for about 20 minutes.

Water was siphoned from each treatment tank daily and refilled from the tap maintaining its original water volume (25 liter). Weekly mean weight of the fishes in each labeled plastic tank were taken (to the nearest 0.01g) with OHAUS Triple Beam Balance (2610 g), weekly mean length from individual standard lengths of the fishes in each labeled plastic tank were also recorded (to the nearest 0.1cm) with a meter rule.

Heterobranchus bidorsalis fingerlings were scooped for the measurements exercise at one week interval after which they were returned to their various tanks. Growth performance was determined and were recorded followed by the observation period of three months (Nov 2016-Feb 2017).

2.6 Monitoring of Physico-chemical Parameters

Temperature and pH values were measured daily using glass thermometer and pH kit respectively. Other physico-chemical parameters were obtained using Extech instrument (DO 700) from Institute of Pollution Studies (IPS) RSU and the values obtained were recorded in Table 3.

2.7 Growth parameters

Growth performance, condition factor and survivability were calculated as follows;

(a) Initial Mean Weight = (g / fish)

(b) Final Mean Weight = (g / fish)

(c) Initial Mean Length = (cm / fish)

(d) Final Mean Length = (cm / fish)

(e) Mean Weight Gain (g) = W1-W0 (Where W1=Final Weight, W0=Initial Weight)

(f) Mean Length Gain (cm) = L1-L0 (Where L1=Final Length, L0=Initial Length)

(g) Daily Growth Rate (g) = $\frac{\text{Mean Weight Gain (g)}}{\text{Initial Body Weight (g)}}$

(h) Relative Weight Gain (g) = $\frac{\text{W1-W0 (g)}}{\text{W0 (g)}}$ (Where W1=Final Weight, W0=Initial Weight)

(i) Specific Growth Rate = $\frac{\text{Ln(W1) -Ln(W0)}}{\text{T}} * 100$

(Where Ln= Log e Final Weight- Log e Initial Weight, T= Culture period)

2.8 Statistical Analysis

Data generated were subjected to one way analysis of variance (ANOVA) with Duncan's Multiple Range Descriptive Test (Duncan, 1995). The result computation was done using Statistical Package for Social Science (SPSS) version 22. Differences among mean were separated with Turkey HSD (Honest Significant Difference) at $p<0.05$.

3. RESULTS AND DISCUSSION

Table 1: Commercial feed of different size 1mm, 1.8mm and 2.5mm (Company: skretting, proximate composition

Nutrients	Compositions (%)		
	1.1mm	**1.8mm**	**2.5mm**
Crude protein	52	45	45
Crude fibre	0.9	2.6	2.6
Crude ash	15	14	14
Fats	9.5	7.5	7.5

Table 2 showed the proximate analysis of *Moringa*, watermelon and commercial syrup booster. This result showed that the moisture content in *Moringa* was significantly higher (*P*=.05) than that of the control (commercial syrup booster) and watermelon syrup booster. Comparing proximate composition variables of Ash and crude protein content of the growth boosters, the control (commercial syrup booster) showed a significantly higher (*P*=.05) result against *Moringa* and watermelon booster. Fats content of commercial syrup booster is significantly lower (*P*=.05) than that of *Moringa* and watermelon syrup growth booster. Carbohydrate is significantly higher (*P*=.05) in commercial syrup booster followed by watermelon and *Moringa* has the least.

Table 2: Proximate Analysis of *Moringa*, Watermelon and Commercial Syrup Booster

Variables	**Samples (3) /compositions (%)**		
	***Moringa* Syrup Booster**	**Watermelon Syrup Booster**	**Commercial Syrup Booster**
Moisture	47.81 ± 0.77^{a}	36.55 ± 0.64^{b}	20.37 ± 0.57^{c}
Ash	0.14 ± 0.13^{bc}	0.09 ± 0.04^{bc}	0.59 ± 0.00^{a}

Protein	0.19±0.12^{bc}	0.18±0.11^{bc}	0.59±0.00^{a}
Fats	0.61±0.13^{ab}	0.53±0.06^{ab}	0.07±0.03^{c}
Carbohydrates	51.24±0.64^{c}	62.66±0.24^{b}	77.31±0.47^{a}

*Mean ±SD of moringa, watermelon and commercial syrup booster in the same column with different superscript are significantly different (*P*=0.05)

Table 3 Showed Physicochemical Parameters of water sample obtained using Extech instrument (DO 700) from Institute of Pollution Studies (IPS) RSU and the values obtained were recorded.

Table 3: Physicochemical Parameters of Water Sample

Parameters	**Value mean**
Temperature (^{o}C)	27.5
PH	6.5
Dissolved Oxygen (mg/l)	5.97
Conductivity(µS/cm)	116
Salinity (%)	0.05
BOD (mg/l)	3.45
Turbidity (NTU)	1.06
Total Dissolved Solid (mg/l)	60

Figure 1 showed mean weight of *Heterobranchus bidorsalis* fed different experimental. Commercial feed coated with watermelon syrup booster (WbCf) recorded the highest mean weight followed by commercial feed coated with commercial syrup booster (CbCf) positive control. Commercial feed (Cf) negative control also recorded gradual increase in mean weight. Commercial feed coated with *Moringa* syrup booster (WbCf) had the least mean weight. There was gradual increase in mean weight in all the experimental diet from week 1 to 8, week 9 to 12 recorded a significantly higher (*P*=.05) weight increase.

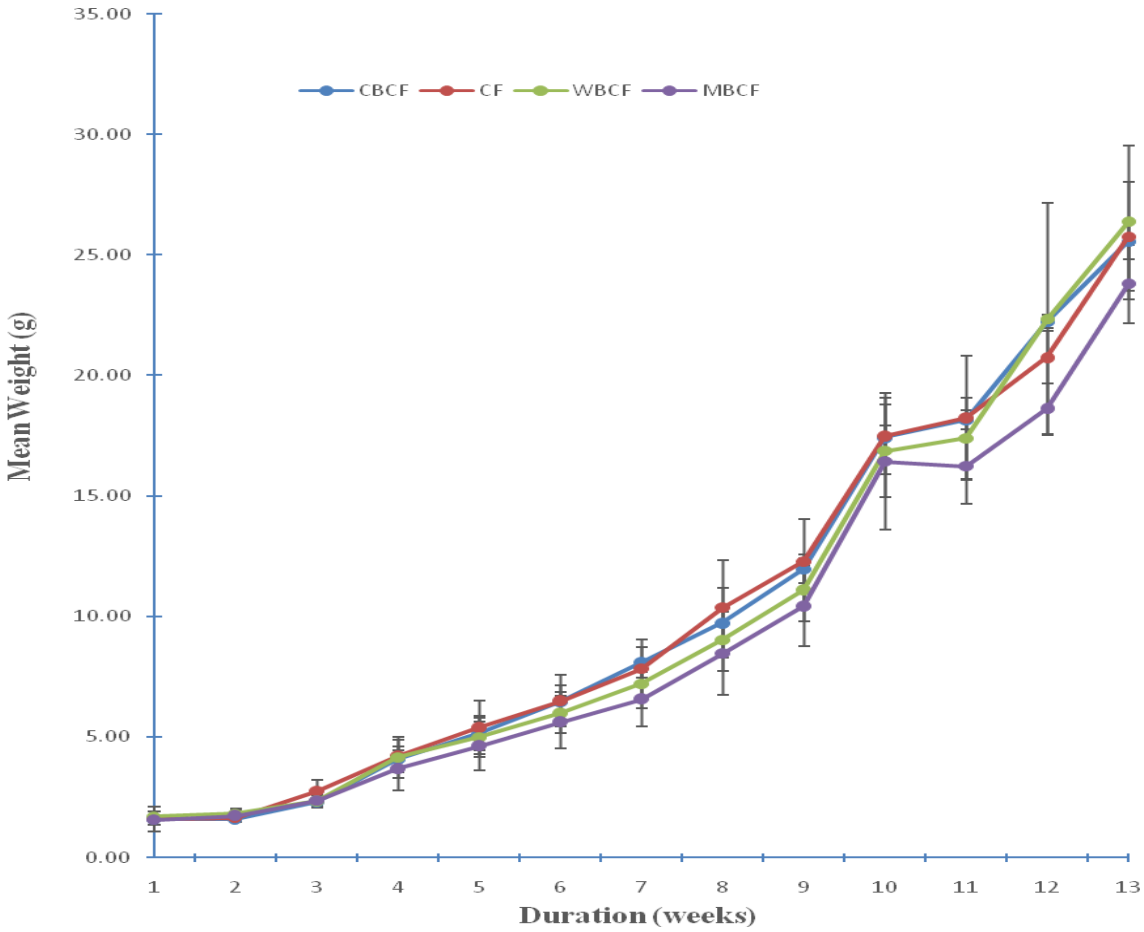

Fig. 1: Mean weight of *Heterobranchus bidorsalis* fed experimental diets.

Key:
- CbCf Commercial feed coated with commercial syrup booster
- Cf Commercial feed only
- WbCf Commercial feed coated with watermelon syrup booster
- MbCf Commercial feed coated with *moringa* syrup booster

Figure 2 showed mean length of *Heterobranchus bidorsalis* fed different experimental diet: Commercial feed coated with commercial syrup booster (CbCf), commercial feed (Cf), commercial feed coated with watermelon syrup booster (WbCf) and commercial feed coated with *Moringa* syrup booster (MbCf). Experimental diet WbCf had the highest mean length followed by (Cf) negative control, CbCf. MbCf recorded the least mean length. The increase in length was not significantly different (P=.05) from week 1 (start value) to the 12th week.

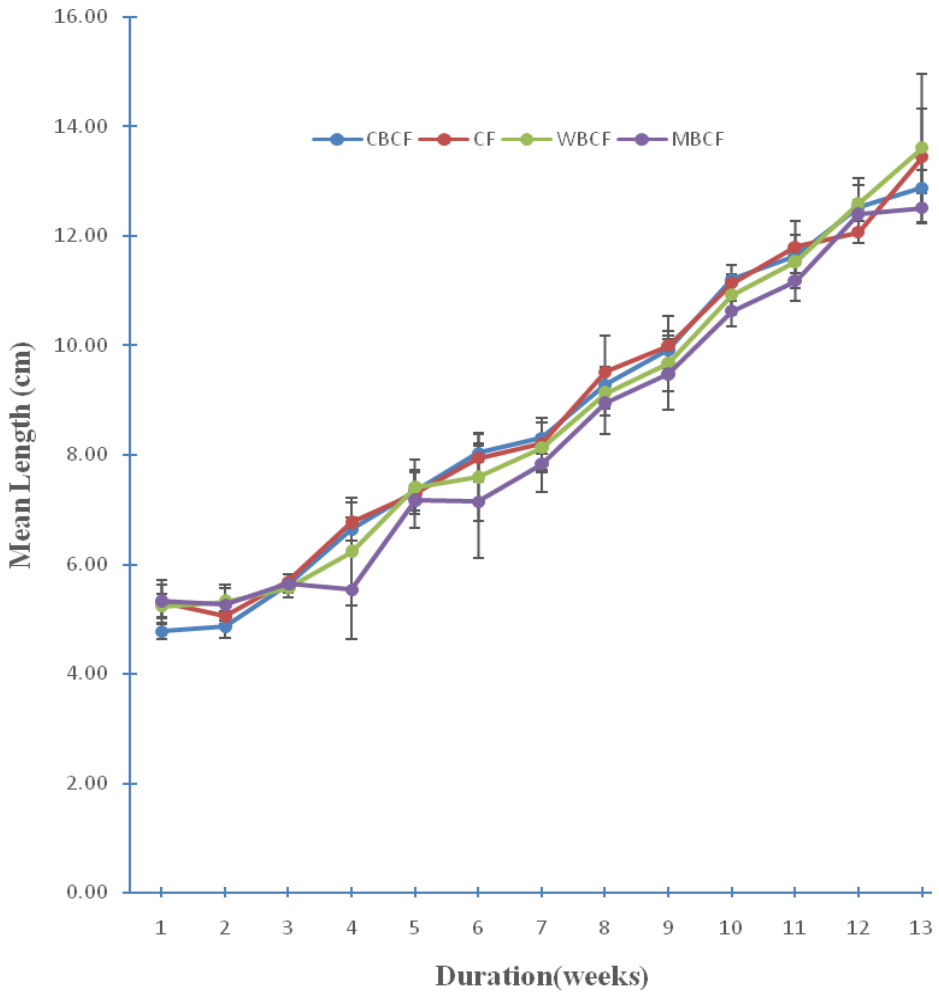

Fig. 2: Mean Length of *Heterobranchus bidorsalis* experimental diets at different durations

Figure 3 showed Mean weight gain of *Heterobranchus bidorsalis* fed different experimental diets. From this figure, Commercial feed coated with watermelon syrup booster (WbCf) recorded the highest mean weight gain, followed by commercial feed only (negative control). Commercial feed coated with commercial syrup booster (CbCf) and *Moringa* syrup booster (MbCf) had the least mean weight gain. The increase in mean weight gain of all the experimental diets from week 1-8 was not significantly impacted (P=.05). There was significant different (P=.05) from week 8-12 as such, a sharp increase in weight gain was recorded.

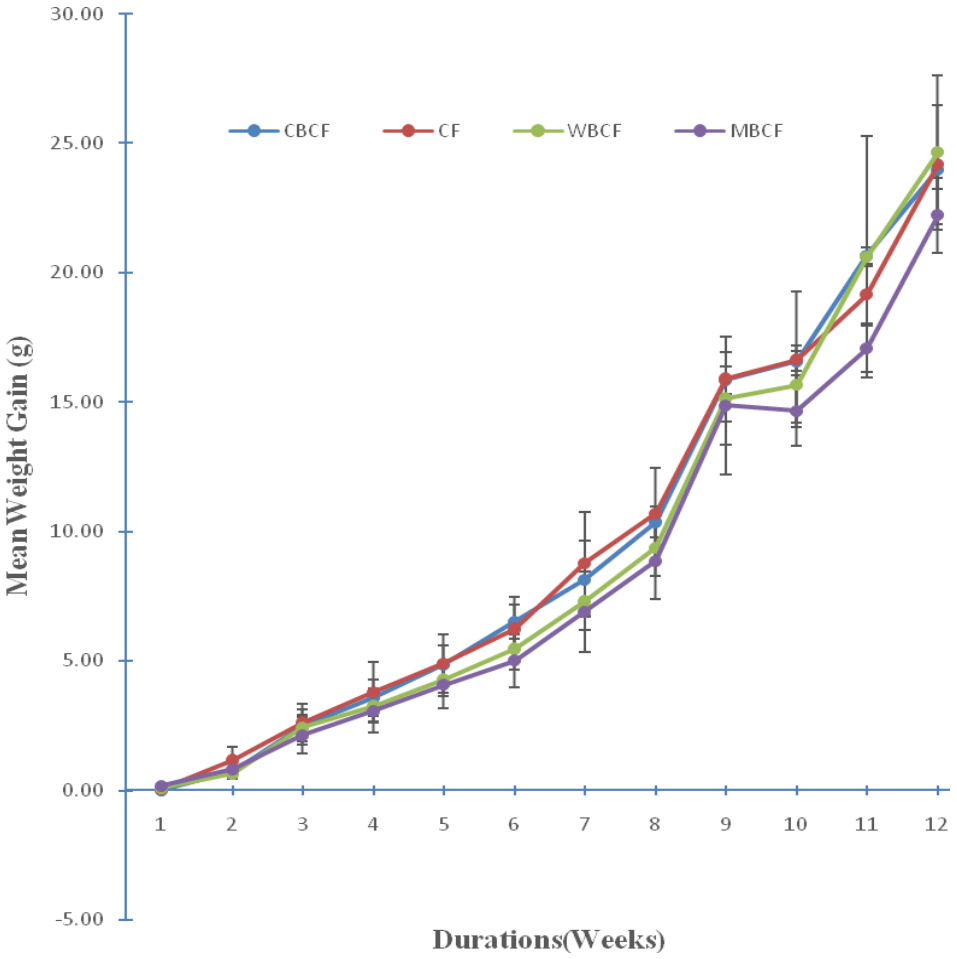

Fig. 3: Mean weight Gain of *Heterobranchusbidorsalis* fed with experimental diets at different durations.

Figure 4 showed mean length gain of *Heterobranchus bidorsalis* fed different experimental diets. Commercial feed coated with watermelon syrup booster (WbCf) recorded the highest mean length gain, (see Fig.4), followed by commercial feed only (negative control). Commercial feed coated with commercial syrup booster (CbCf) and *Moringa* syrup booster (CbCf and MbCf) had the least mean weight gain (Fig.4)

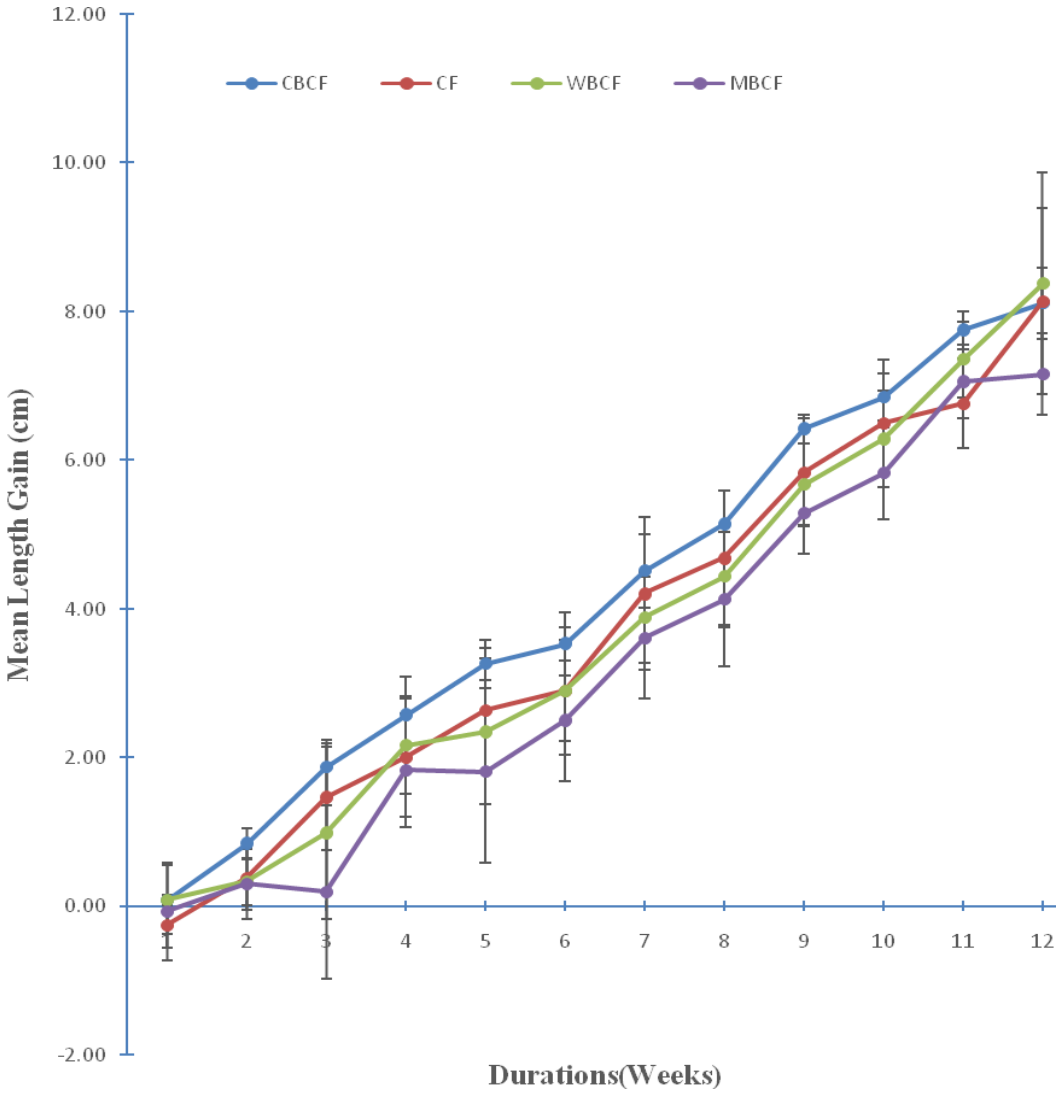

Fig. 4: Mean Length Gain of *Heterobranchus bidorsalis* fed with experimental diets at different durations

Figure 5 showed the Daily growth rate of *Heterobranchus bidorsalis* fed different experimental diets. Here, the control: commercial feed coated with commercial syrup booster (CbCf) and commercial feed only (Cf) had the best daily growth performance while commercial feed coated with watermelon and *moringa* syrup booster had the least daily growth rate performance (Fig.5) Also, a gradual increase in daily growth rate of all the experimental diets from week 1-7 were recorded. On the 8th week, there was sharp increase in daily growth rate which affected from week 9 to the end of the experimental duration.

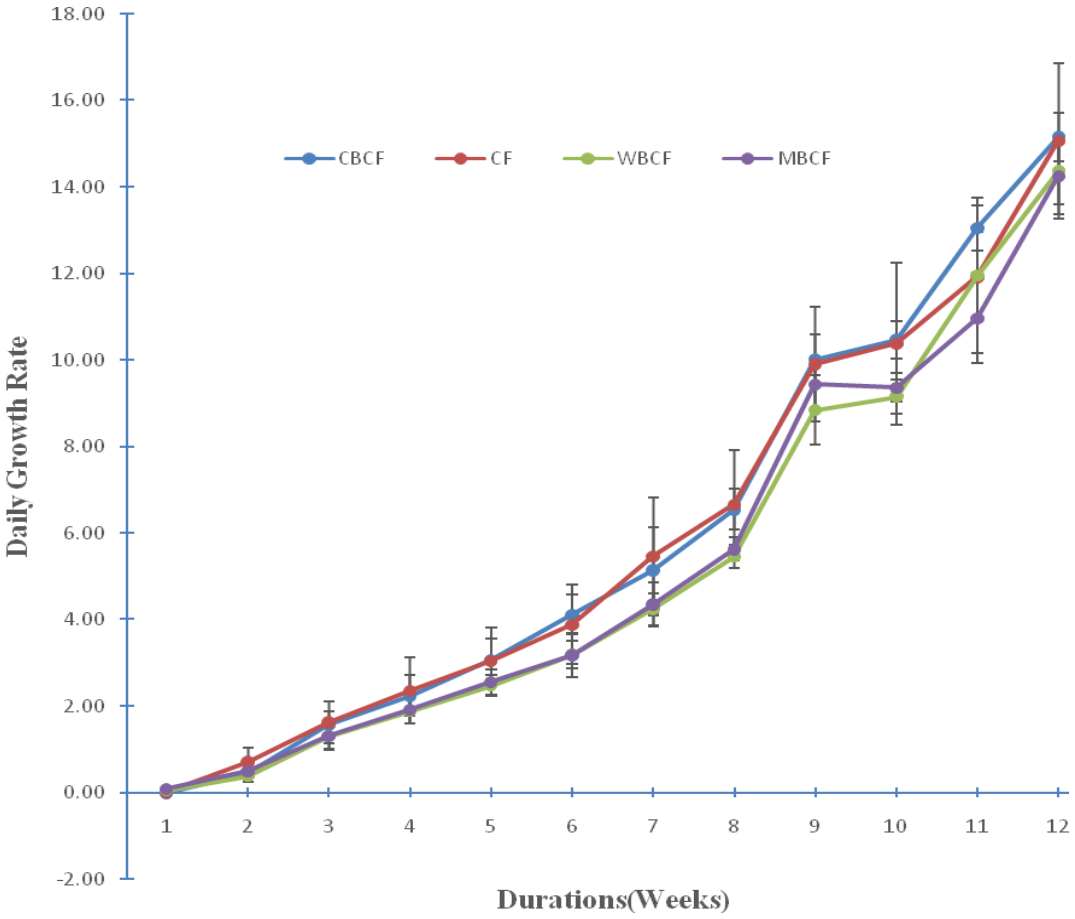

Fig. 5: Daily Growth Rate of *Heterobranchus bidorsalis* fed with experimental diets at different durations

Figure 6 showed Relative weight gain of *Heterobranchus bidorsalis* fed different experimental diets. This figure showed rapid Relative weight gain of all the experimental diets from week 8-12. Experimental diet commercial feed coated with watermelon syrup booster (WbCf) recorded the highest Relative weight gain against the control groups (CbCf and Cf). Commercial feed coated with *Moringa oleifera* syrup booster (MbCf) had the least Relative weight gain.

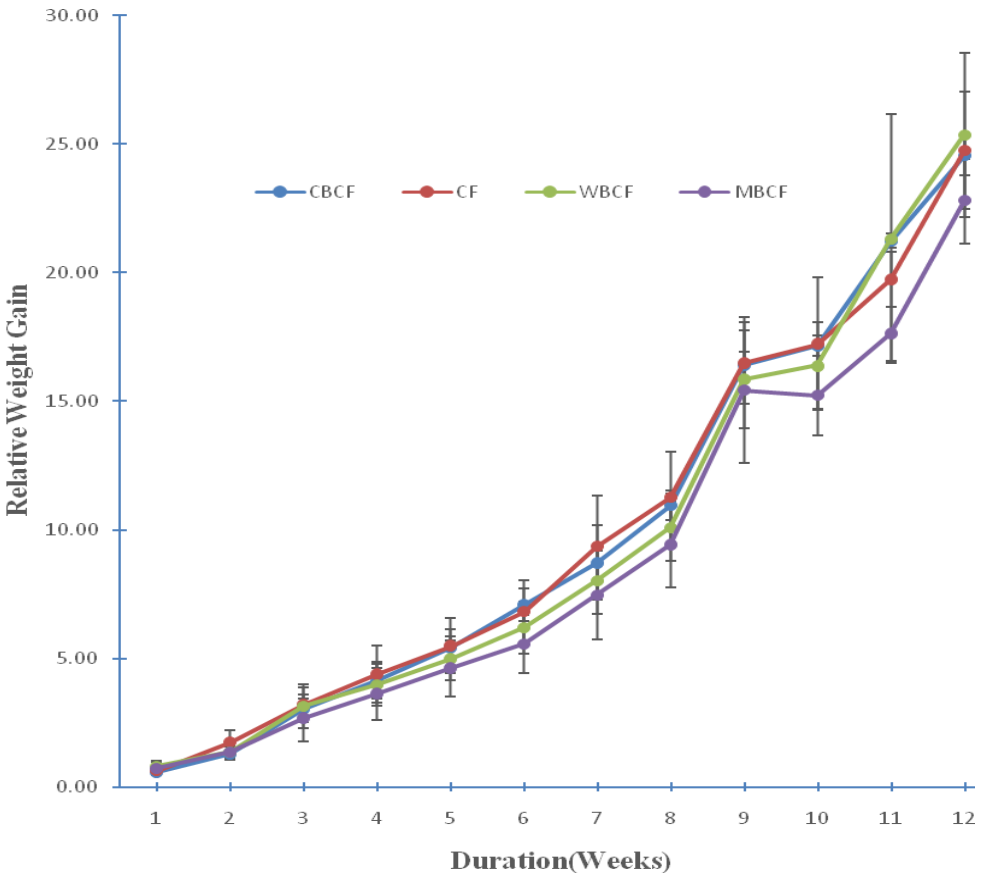

Fig. 6: Relative Weight Gain of *Heterobranchus bidorsalis* fed with experimental diets at different durations

Figure 7 showed specific growth rate of *Heterobranchus bidorsalis* fed different experimental diets. The control: commercial feed coated with commercial syrup booster (CbCf) and commercial feed only (Cf) recorded the highest specific growth rate against commercial feed coated with watermelon syrup booster. *Moringa* syrup booster had the least specific growth rate. Specific growth rate was also negatively affected in week 1. Week 2-12 recorded increase in specific growth rate although the values were not significantly different (*P*=.05) from each other.

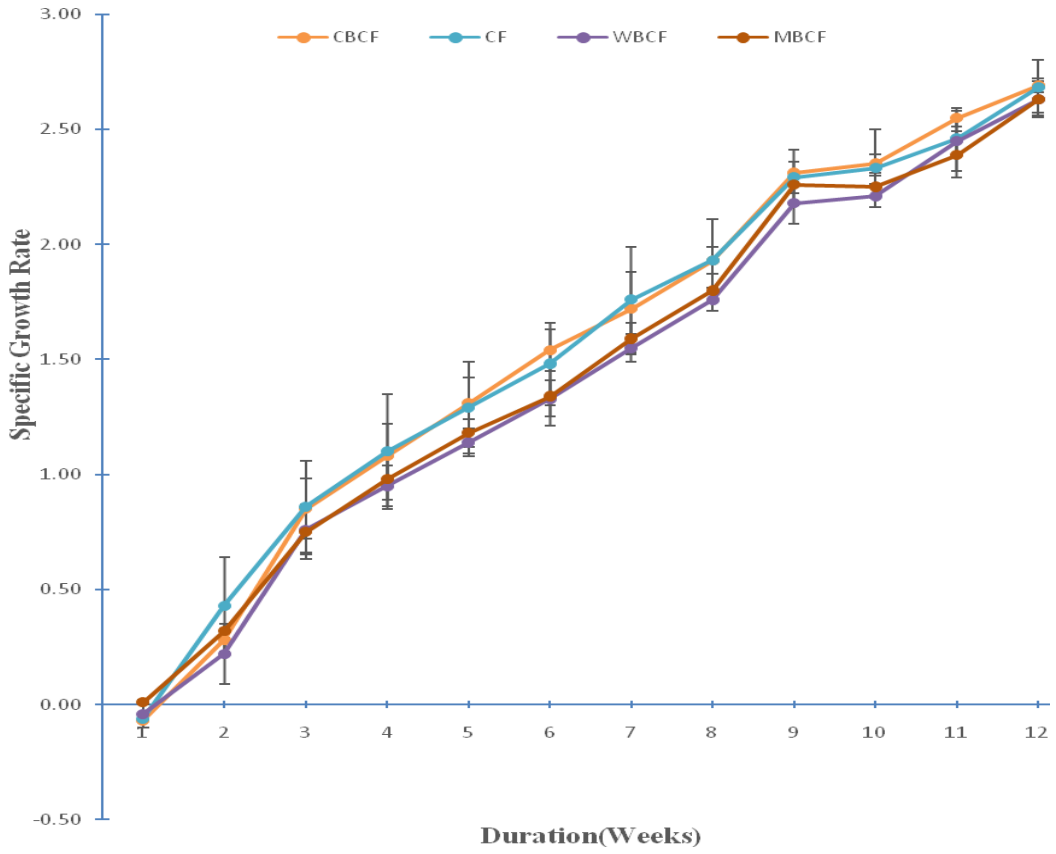

Fig. 7: Specific Growth Rate of *Hetrobranchus bidorsalis* fed with experimental dietsat different durations

Figure 8 showed the survivability of *Heterobranchus bidorsalis* fed different experimental diets. Commercial feed only (Cf) had 100% survivability from week 1-5, commercial feed coated with *moringa* and watermelon syrup booster (MbCf and CbCf) also had 100% survivability only in week 1. Generally, *Heterobranchus bidorsalis* fed all experimental diets survived above 90%.

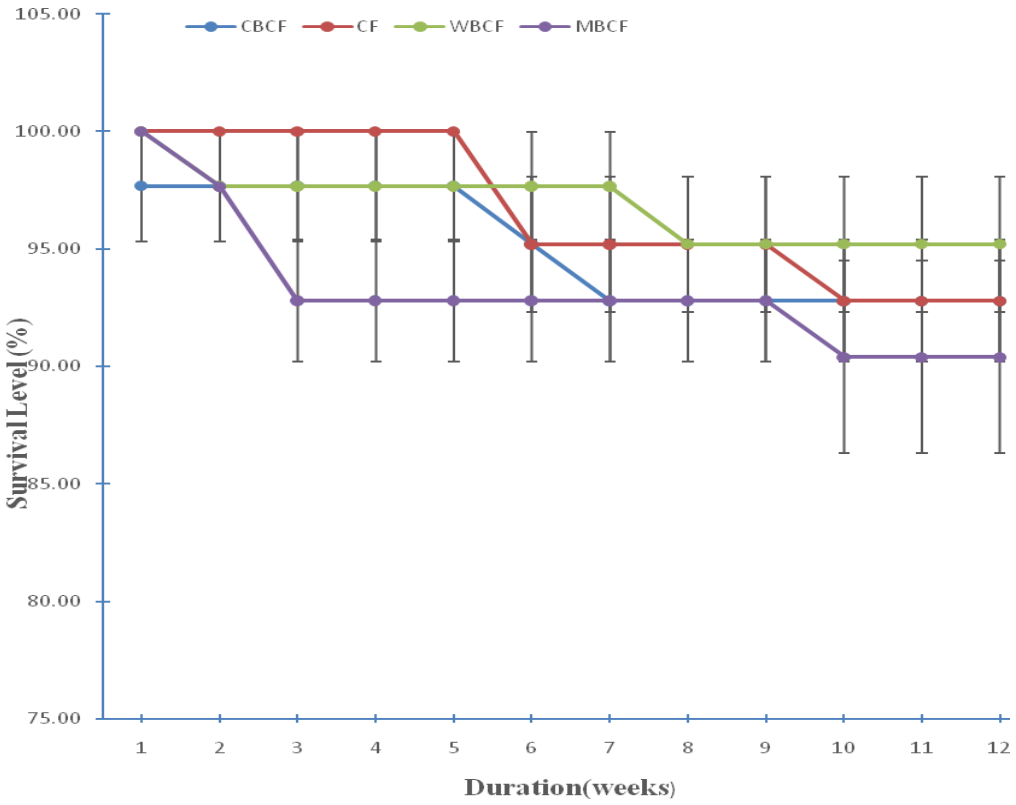

Fig. 8: Survivability of *Heterobranchus bidorsalis* fed with experimental diets at different duration

Table 4 showed the overall growth and nutrient utilization variables of *Heterobranchus bidorsalis* fed with all experimental diets. The growth pattern observed from growth variables under the experimental diet of commercial feed coated with commercial syrup booster (CbCf) showed no significant different (*P*=.05) result. WbCf recorded the highest numerical values in growth (*P*=.05) from other experimental diets

Table 4: Cummulative variables of *Heterobranchus bidorsalis* fed all experimental diets after the trial period (mean±SD)

VARIABLES	CbCf	Cf	WbCf	MbCf
Initial Mean Weight	1.58 ± 0.04^{b}	1.60 ± 0.51^{b}	1.71 ± 0.20^{a}	1.56 ± 0.19^{b}
Initial Mean Length	4.77 ± 0.15^{c}	5.30 ± 0.40^{a}	5.13 ± 0.22^{b}	5.33 ± 0.30^{a}
Final Mean Weight (g)	25.56 ± 0.76^{a}	25.76 ± 2.27^{a}	26.36 ± 3.19^{a}	23.79 ± 1.64^{b}
Final Mean Length (cm)	12.88 ± 0.33^{b}	13.44 ± 0.89^{ab}	13.61 ± 1.35^{a}	12.50 ± 0.28^{c}
Mean Weight Gain (g)	23.98 ± 0.75^{a}	24.16 ± 2.31^{a}	24.64 ± 3.00^{a}	22.22 ± 1.45^{b}
Mean Length Gain (cm)	8.11 ± 0.48^{a}	8.14 ± 1.25^{b}	8.38 ± 1.49^{a}	7.16 ± 0.55^{c}

Daily Growth Rate	15.15±0.55[a]	15.07±1.8[a]	14.37±0.76[b]	14.25±0.87[b]
Relative Weight Gain (%)	24.56±0.76[a]	24.76±2.27[a]	25.36±3.19[a]	22.79±1.64[b]
Specific Growth Rate (%)	2.69±0.03[a]	2.68±0.12[a]	2.63±0.06[b]	2.63±0.08[b]
Survivability (%)	92.80±2.58[a]	92.80±2.58[a]	95.20±2.88[a]	90.40±4.08[a]

*Mean ±SD in the same row with different superscript are significantly different (P<0.05)

Key: CbCf Commercial feed coated with commercial syrup booster
Cf Commercial feed only
WbCf Commercial feed coated with watermelon syrup booster
MbCf Commercial feed coated with *moringa* syrup booster

The use of formulated syrup booster from watermelon and *Moringa* coated with commercial feed has revealed that, *Heterobranchus bidorsalis* fed with the experimental diet CbCf, Cf recorded no significant difference (*P*=.05) in growth variables. Experimental diets of commercial feed coated with watermelon syrup booster WbCf had the highest Final Mean Weight (26.36±3.19g) and Length (13.61±1.35cm) when compared with other experimental diets: CbCf (25.26 ± 0.76g, 12.88 ± 0.33cm), Cf (25.76 ± 2.77g, 13.44 ± 0.89cm). MbCf had the lowest value (23.79 ± 1.64g, 12.05 ± 0.28cm) in final mean weight and length. The calculated Digestible Energy level of the three booster used were (256.10 kcal /kg) for WbCf, *Moringa* Growth Booster (211.17 kcal/kg) and (312.23 kcal/kg) for CbCf. In contrast to the present findings, high percentage in carbohydrates (62.66 and 51.24%) from proximate analysis of the growth boosters (watermelon and *Moringa oleifera*) (Table 2) is not comparable with the result obtained from United State Department of Agriculture, National Nutrient Data base USDA (2016) [15] on *Moringa oleifera* and watermelon (8.28 and 7.55g) but justifies Carbohydrates as an important non-protein energy source for fish and should be included in the diet at an appropriate level to maximize the use of dietary protein for growth and to facilitate movement of nutrient at the Gastro Intestinal Tract (GIT) which supports nutrient absorption [10].

Commercial feed coated with watermelon syrup booster showed poor performance on Daily Growth Rate (DGR) (14.37±0.76) while commercial feed coated with commercial syrup booster CbCf had the highest value on variables of DGR (15.15±0.55%), Specific Growth Rate (2.69±0.03%), but the values were not significantly different at P>0.05 when compared to other experimental diets. The poor growth performance from the experimental diets commercial feed coated with *Moringa* syrup booster MbCF is similar with that of [2], who reported that, at more than 10% concentration of *Moringa oleifera* inclusion in feed meal, the bitter taste of saponin and phenol becomes obvious, as such, causing low feed intake which invariably affects growth response.

This crude protein level in CbCf is contrary to the report of [4]. They recorded higher crude protein level in feed additives (Aqua pro) for African catfish. With this results, it can be said that watermelon syrup booster recorded the highest value in most of the growth variables although comparing with other experimental diets, the values were not significantly impacted (*P*=.05).

CONCLUSION

From the overall observations, this research has revealed Watermelon growth booster be a promising fish feed supplement having shown the highest growth performance. According to [4], a lot of literatures exist on other growth booster (Aqua booster, Aqua pro, Leegrow) unlike that of *Citrullus lanatus* and *Moringa oleifera* as a fish growth booster. As such, fish farmers should look inward on the utilization of watermelon growth syrup booster for effective growth performance of catfish, also for the more accessible cost and within a policy of green circular economy that aims at food waste recover.

Ethical Approval:

As per international standard or university standard ethical approval has been collected and preserved by the authors.

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