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EFFECT OF DIETARY INCLUSION OF SWEET POTATO IPOMOEA BATATAS AND WATERMELON CITRULLUS LANATUS PEELS ON THE GROWTH PERFORMANCE OF TILAPIA OREOCHROMIS MOSSAMBICUS

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ABSTRACT

This study was carried out to examine the effect of dietary inclusion of dried sweet potato peels (DSPP) Ipomoea batatas and dried watermelon peels (DWP) Citrullus lanatus on the growth performance of tilapia Oreochromis mossambicus. Four feed samples were formulated; T1, T2, T3 and Control such that T1 was formulated by including DSPP in normal fish feed, T2 was formulated by including DWP, T3 was formulated by including both DSPP and DWP while Control is the normal fish feed. Seventy-two (72) mixed sex tilapia fish fingerlings of average weight 10.72± 0.43g were grouped into four with eighteen (18) fingerlings per group and further separated into three replicas of (6) fingering per replica fed with the four feed samples. The fishes were fed twice daily with feed of 5% their body weight and the growth indicators considered were standard length, total length, weight, change in weight, change in length, growth rate, and specific growth rate, measures at two weeks interval for fourteen weeks. The results revealed that; both DSPP and DWP are suitable as inclusion in formulating tilapia fish feed. The feed sample with DSPP (T1) performed better in weight-based growth indicators (DSPP 51.45g > DWP 45.15g). The feed sample with DWP (T2) performed better in length-based growth indicators (DWP 6.06 > DSPP 5.53) while the feed that contained both DWP and WSPP (T3) performed better than the feed sample with only DWP and WSPP (mixed DWP/WSSP 63.59 > only DWP 45.15g and only DSPP 51.45g), finally, the results revealed that there was significant difference between the growth performance of the Control feed and the three other feeds

KEYWORDS

Non-conventional, fish feed, sweet potato Ipomoea batatas, dried watermelon peels Citrullus lanatus.

samples ($p<0.05$) and the Control feed sample performed better than the other three feed samples in all the growth indicators considered. Therefore, it was concluded, among others, that DWP and WSPP are suitable as inclusion in formulating fish feed for tilapia fingerlings, it was recommended that fish farmers and commercial fish feed producers should consider formulating fish feed by including both DWP and WSP, thus, will improve the growth performance of the fish and also reduce the cost of fish feed.

Introduction

Fish constitutes a large growing source of protein food in almost every diet consumed by humans in the world today (FAO, 2021). Fish also constitutes about 40% of the total animal protein intake by the average Nigerian hence there is great demand for fish in the country. Nigeria requires about 2.66 million metric tons of fish annually to satisfy the dietary requirement of its citizens (150 million) (FAO, 2011). Regrettably, the total aggregate domestic fish supply from all source (capture and culture fisheries) is less than 0.7 million metric tons per annum. Nigeria has to import 0.7 million metric tons of fish valued at about 8500 million annually to augment the short fall. This massive importation of frozen fish in the country has ranked Nigeria the largest importer of frozen fish in Africa (FAO, 2021). Tilapia is a popular fish for aquaculture as it is very versatile and is tolerant of a variety of aquaculture environment, it can be farmed in brackish or salt water and also in pond or cage system. Tilapia has become the third most important fish in aquaculture after carp and salmon; worldwide production exceeded 1.5 million metric tons (1.5×10^6 tons) in 2002 and increases annually (Feessehaye and Yona, 2006). Due to their high protein content, rapid growth and palatability they are given major focus attentions. Tilapia fisheries originated in Africa and levant region in Asia. Tilapia are among the easiest and most profitable fish to farm due to their omnivorous diet, mode of reproduction (the fry does not pass through a planktonic phase), tolerance of high stocking density, and rapid growth.

Tilapia raised in inland tanks or channels are considered safe for the environment since their waste and disease is contained and not spread to the wild commercially grown tilapia are almost exclusively males. Being prolific breeders, female tilapia in the pond or tanks will result in large populations of small fish. Tilapia from aquaculture contains high ratios of omega-6 to omega-3 fatty acids Male tilapia fishes are preferred by fish farmers because they tend to grow faster than their female counterparts which spends more of their energy in the course of breeding. These activities the female tilapia get involved with is basically responsible for their stunted growth and to the advantage of the male tilapia which grows to a better table size than the females. Techniques are being researched by scientists to produce only male tilapia fish. Cultured tilapia fish can be really delicious in meals as well as a lucrative source of extra income.

Global population, and also the population of Nigeria, is increasing at an alarming rate, and this situation demands for urgent action and aggressive approach narrowed towards massive food production in order to feed the population and to resolve inadequate food supplies and the corresponding consequence of malnutrition. One of the current, viable and encouraging solutions to the problem of shortage in intake of animal protein, especially in developing countries like Nigeria, is a proper and intentional development of aquaculture (World Fish Center, 2007).

According to Sunday and Komi (2021), fish feed has been confirmed as the most expensive input factor in development and operation of aquaculture system. This high cost of feed is due to massive reliance on the limited and costly protein sources for feed formulation like fishmeal and shrimp meal (Lim *et al.,* 2011). Omoregie (2001) reported that the shortage and high-cost of fish feed severely constrained the development and operation of low-cost aquaculture systems suitable for small-scale farmers in the developing countries like Nigeria. It would therefore, be more economical to utilize plant protein in fish feed formulation than high cost animal protein materials.

According to Masudul *et* al., (2015) watermelon peel contains appreciable amount of dietary nutrition for fish feed, Watermelon contains vitamins, proteins, minerals, fat and carbohydrates (Hrubec *et al.,* 2010) while its peel, which is usually discarded as food waste, contains remarkable amount of most nutrients like phenolic antioxidants, flavonoids and lycopene (Collins *et al.,* 2007). Kays (2009) reported that sweet potato peel is devoid of most of the anti-nutrition agents as the sweet potato plant usually stores these chemicals in its tubers. hence, there is need to examine the potential of these two non-conventional ingredients (watermelon and sweet potato peels).as inclusion in fish feed formulation for Tilapia fingerlings in order to maximize fish yield and also reduce the rate of wastage of these peels.

This study is aimed at maximizing the use of watermelon (*Citrullus lanatus*) peels and sweet potatoes (*Ipomoea batatas)* peels as fish feed inclusion to enhance fish yield of Tilapia (*Oreochromis mossambicus)* fingerlings and reduce wastage of these fruits and vegetable, the specific objectives are

1. To examine the growth performance of Tilapia (*Oreochromis mossambicus)* fingerlings using sweet potatoes peels and watermelon peels as inclusions in fish feed production.
2. To determine the impact of the feed containing only dried sweet potatoes peels on the growth performance of tilapia fingerling
3. To analyze the effect of the feed containing only dried watermelon peels inclusion diet on the growth performance of tilapia fingerling.

This study will be important to key players in the aquiculture sector which includes commercial fish feed producing firms, small, medium and large-scale fish farmers as well as intending and potential fish farmers. The finding of this study will help them to understand the possibilities of using watermelon and sweet potatoes peel as part of the material for formulation of fish feed. The finding of this study will also be useful to scholars and researchers in plant science and animal science, especially those in aquaculture related field because it will serve as reference material which will guide them in studies that are related to this current study.

This study focuses on formulation of three separate fish feeds by addition of sweet potatoes peel, watermelon peel and combination of the sweet potatoes peel and watermelon peel and investigating the effect of these feed samples on growth performance of Tilapia fish fingerlings as compared to a normal feed sample that does not contain sweet potatoes peel and watermelon peel. Growth performance was obtained by measuring the difference between the final length and weight of the sampled tilapia fingerlings after specific period of feeding and the initial length and weight of the tilapia fingerlings before feeding divided by the time spent during the feeding period.

The empirical review was also carried out to ascertain the results and technique used by research to ascertain the possibilities of using sweet potatoes peel and water melon peel as feed for fish and other animal in term an addition or inclusion to already existing feed or replacement to some component of

already existing feed. Based on some empirical literatures reviewed, the ones that are closest to this current study were the work of Omoregie et al (2009) who carried out empirical examination on the growth-based performance of the Tilapia *Oreochromis niloticus* fed with feed of different levels of sweet potato peels in which the levels of sweet potato peel in the feed used in the experimental were 0, 5, 10, 15, 20 and 25%. The analysis of their results revealed that based on plasma glucose and plasma protein there was no deleterious impact recorded in the test fish due to the diet inclusion of the sweet potato peel and also that Tilapia fish could accept up to 15% level of inclusion of sweet potato peel. This finding was crucial because it has revealed that sweet potato peels is suitable as inclusion stuff in fish feeds which would help to reduce high cost associated with producing fish feed. The study is related to the current study because they both seek to ascertain the viability of using potatoes peels as inclusion in fish feed; however, this current study goes beyond this by including watermelon peel.

Also, Oladipupo & Salami (2020) carried out empirical study to examine nutritional viability of feeding catfish *Clarias gariepinus* with different levels of watermelon peel inclusion in their feed. In this study, different levels of watermelon considered were 0.0, 1.0, 1.5, 2.0 and 2.5g/kg denoted as (DI-D5) and their finding revealed that there were notable disparities in growth performances of all the groups. However, fishes in groups denoted D4 had highest growth-based performance compared to other group and control. It was noticed that there was drop in growth as watermelon peel content increased above 2.0g/kg. Thus, changing inclusion levels of watermelon peel in the feed enhanced their blood profile which was confirmed by significant disparity ($P<0.05$) in blood parameters tested. It was finally concluded that 2.0g/kg inclusion of watermelon peel in feed of catfish is ideal for improving their growth. This study is similar to current study because it examines viability of including watermelon peel in fish feed however the current study is focused on tilapia while this work is based on catfish. Therefore, this current study is focused on evaluating the impact of feed inclusion of both watermelon and sweet potatoes peel on growth performance of tilapia fingerlings.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out at the African Regional Aquaculture Center (ARAC) Aluu, Ikwerre Local government area, Port Harcourt Rivers State Nigeria.

2.2 Experimental Design

Seventy-two (72) mixed sexed fingerling tilapia fishes of initial weight of $10.72 \pm 0.43g$ were used. The fingerlings were acclimatized in a wide small concrete pond for three days before being transferred to their respective experimental ponds. The fish samples were distributed into four different treatment groups in three replicas and each replica contained 6 fingerlings placed in a woven net arrangement and placed in a large (10m by 15m by 7m) concrete pond capable of holding $1000m^3$volme of water. Thus, there were three fish ponds used in this experiment each fish pond contained four (4) woven net arrangement with six fishes in each woven net arrangement for each treatment group. Each fish pond was used for separate feed treatment group designated as C, T1, T2 and T3. C was the control experiment treatment group in which the fishes in woven net were fed with the normal fish feed. T1 was the experiment set up for treatment group in which the fishes in the woven net are fed with normal feed mixed with dried sweet potatoes peel, T2 was the treatment group in which the fishes in the woven

net are fed with normal fish feed mixed with dried watermelon peel and T3 was treatment group in which the fishes were fed with normal fish feed mixed with both dried watermelon and sweet potatoes peels. In total there are twelve (12) woven nets arrangement distributed evenly in three (3) large concrete ponds such that each pond is responsible each replica of the four (4) treatment group as explained thus see Plate 1



Plate 1: The woven net arrangement in the Fish Pond.

2.2.1 Duration:
The experiment started on the 3rd day of March and ended 26th May 2022 making it a total of 14 weeks, however, the data which includes the weight, standard length and total length of the fishes were taken before stocking them in the ponds and after which they were measured biweekly alongside the water parameters

2.2.2 Feed formulation and Feeding:
35% crude protein diet was formulated using the person square method which allowed the inclusion of other materials (watermelon peels and sweet potato peels) see Table 3.1. The experimental fishes were feed at 5% of their body weight daily morning and evening between the hours of 9am- 5pm during the course of this study respectively.35% crude protein diet was formulated using the pearson square method which allowed the inclusion of other materials (watermelon peels and sweet potato peels) see Table 1. NOTE: The control diets were produced using only the regular fish feed materials. Four different feeds were formulated and were labeled
Feed 1: C (normal feed without inclusion)
Feed 2: T1 (Sweet potato peels inclusion)
Feed 3: T2 (Water melon peel inclusion)
Feed 4: T3 (Both inclusion)

Table 1 The Feed Content of the Four feed samples used in the Experiment

	10 KG fish feed diet, 35%CP				
	CONTROL	**T1**	**T2**	**T3**	
		WMP	SPP	BOTH	TOTAL KG
WATERMELON PEEL	0.00000	1.609385	0.00000	1.122813	2.732197
SWEET POTATO PEEL	0.00000	0.00000	1.667077	1.122813	2.789889
WHEATBRAN	2.803333	1.609385	1.667077	1.122813	7.202607
GARRI	0.560667	0.268231	0.277846	0.224563	1.331306
SOYABEAN	3.068	3.0065	2.944	2.9535	11.972
FISHMEAL	3.068	3.0065	2.944	2.9535	11.972
PALM OIL	0.3	0.3	0.3	0.3	1.2
BONEMEAL	0.04	0.04	0.04	0.04	0.16
SALT	0.04	0.04	0.04	0.04	0.16
PREMIX	0.04	0.04	0.04	0.04	0.16
METHIONINE	0.04	0.04	0.04	0.04	0.16
VIT.C	0.04	0.04	0.04	0.04	0.16
Total	10	10	10	10	40

Where T1 = feed with Watermelon peel inclusion, T2 = feed with sweet potato peel inclusion, T3 = feed with both watermelon and sweet potatoes peel inclusion and C = feed without the peel.

2.3 Data collection

The first data collection was on the water quality of the pond. Five major parameters were considered on water quality and they include, Dissolved oxygen Content, Temperature, pH, Ammonia content and Nitrate content. The main data collection was focused on parameters that are required to evaluate the growth performance of the fishes in the experiment. The parameters required are: Initial weight, (W_1), Initial standard length, (SL_1), Initial total length, (TL_1), Final weight after each period, (W_2). Final standard length after each period, (SL_2), Final total length after each period. (TL_2)

2.3.1 Procedure used to measure the weight and length of the fishes

The fishes were carefully harvested from each pond into a bucket and moved to measurement table. Meter rule and weighing balance were used to measure the length and weight of the fishes respectively. After the measurement, they were returned to the ponds see plate 2 and plate 3.



Plate 2; Procedure for measurement of Standard and Total Length



Plate 3; Procedure for measurement of Initial and final weight

The growth performance variables considered in this study are

1. Change in Weight; this is the increase or decrease in weight of the fish recorded within specific period and it is expressed as;

$W_C = W_2 - W_1$

2. Change in total length; this is the increase or decrease in total length of the fish recorded within specific period and it is expressed as;

$TL_C = TL_2 - TL_1$

3. Change in standard length; this is the increase or decrease in standard length of the fish recorded within specific period and it is expressed as;

$SL_C = SL_2 - SL_1$

4. Weight gain; this is a growth performance parameter that assess the change in weight of a sampled animal with respect to the initial weighted expressed as percentage. It is expressed as WG and given as

$$\boldsymbol{WG = \frac{W2 - W1}{W1} \times 100}$$

5. Growth Rate: this variable in expressed in three different forms based on the three changes expressed above. based on weight, the growth rate is expressed as

$$\mathbf{GR_W = \frac{Change\ in\ weight}{duration\ of\ the\ experiment} = \frac{W2 - W1}{14}\ (g/week)}$$

Based on standard length, the growth rate is expressed as

$$\mathbf{GR_{SL} = \frac{Change\ in\ standard\ lenght}{duration\ of\ the\ experiment} = \frac{SL2 - SL1}{14}\ (cm/week)}$$

Based on total length, the growth rate is expressed as

$$\mathbf{GR_{SL} = \frac{Change\ in\ total\ lenght}{duration\ of\ the\ experiment} = \frac{TL2 - TL1}{14}\ (cm/week)}$$

2.4 Data analysis and Presented

All data used in this study were presented in form of mean±standared error. The effects of feeding treatment on different treatment group were analyzed using one-way ANOVA as was used in Marconato et al (2020). Duncan's New Multiple Range Test was used to separate differences among the various means using the SPSS software Version 20 and Microsoft office Excel program 2010 is also used in developing graphs and other relevant charts.

3. RESULTS AND DISCUSSIONS

The results of the growth parameters considered in this study are presented in this sub-section and they include change in weight, change in standard length, change in total length, Percentage weight gain, growth rate and specific growth rate.

3.1 Change in weight of the Fish samples

Change in Weight is a growth parameter that measures the increase or decrease in weight of the fish samples in the four cultures fed with the four different feed samples within 14 weeks of feeding trials in this study. In this study the results of the initial, final and change in weight for the four cultures is presented in Figure 4.5, The results revealed that fish samples fed with the control feed sample had the highest and significant change in weight (80.57 ± 0.13^{a}) followed by fish samples fed with T3 feed sample (63.59 ± 0.49^{d}) while those fed with T2 feed sample showed the lowest and significant change in weight (45.15 ± 0.54^{c}).

These results mean that fish sample feed with the control feed sample showed the best growth performance in terms of weight increment within the 14 weeks of feeding trial followed by those fed with feed sample with combined sweet potatoes peel and watermelon while those fed with deed that contain only watermelon peel showed the lowest growth performance.

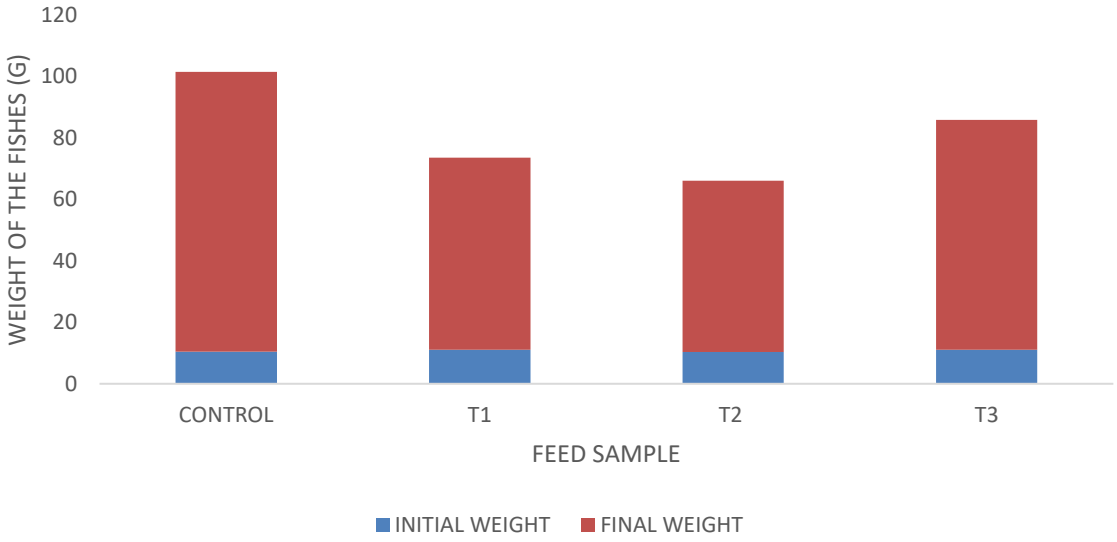


Figure 4.5 Bar chart of the weight of the Fishes for the four different feed samples

3.2 Change in standard length of the Fish samples

Change in standard length is a growth parameter that measures the increase or decrease in effective or standard part of the fish samples in the four cultures fed with the four different feed samples within 14 weeks of feeding trials in this study. In this study the results of the initial, final and change in standard length for the four cultures is presented in Figure 4.6. The results revealed that fish samples fed with the control feed sample had the highest and significant change in standard length (7.05 ± 0.19) followed by fish samples fed with T2 feed sample (6.02 ± 0.15^{b}) while those fed with T1 feed sample showed the lowest and significant change in standard length (5.53 ± 0.26^{b}).

These results mean that fish sample feed with the control feed sample showed the best growth performance in terms of increment in length within the 14 weeks of feeding trial followed by those fed with feed sample with watermelon while those fed with feed that contain only sweet potatoes showed the lowest growth performance.

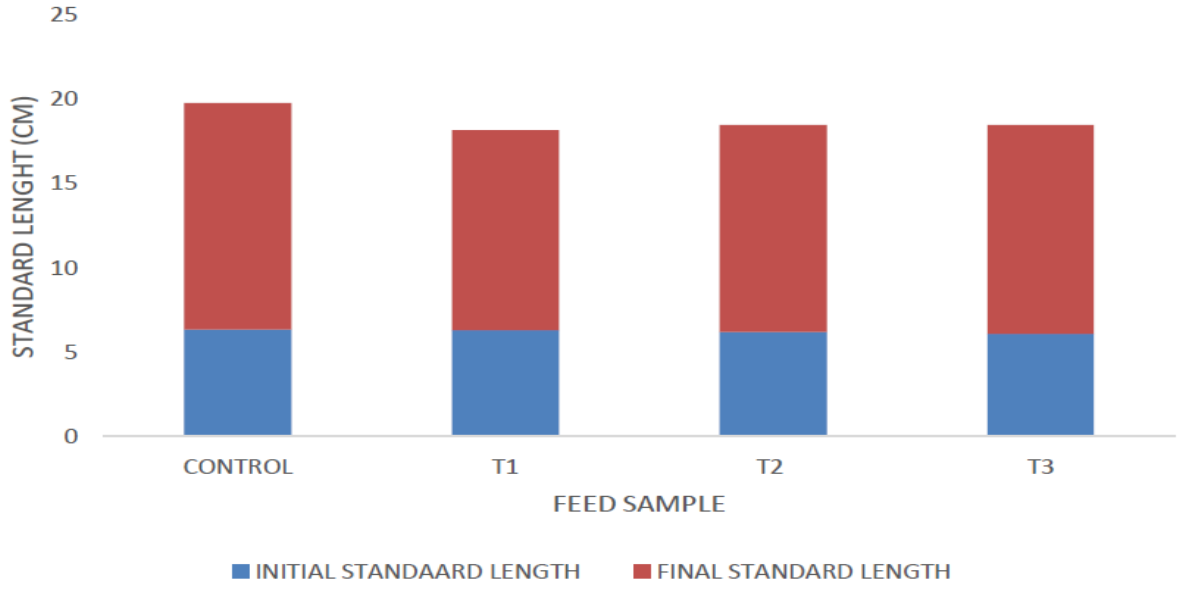


Figure 4.5 Bar chart of the Standard length for the four different feed samples

3.3 Change in Total Length of the Fish samples

Change in total length is a growth parameter that measures the increase or decrease in entire length of the fish samples in the four cultures fed with the four different feed samples within 14 weeks of feeding trials in this study. In this study the results of the initial, final and change in total length for the four cultures is presented in Figure 4.7, The results revealed that fish samples fed with the control feed sample had the highest and significant change in total length (8.78 ± 0.25^{a}) followed by fish samples fed with T3 feed sample (7.87 ± 0.31^{b}) while those fed with T2 feed sample showed the lowest and significant change in weight (6.99 ± 0.17^{c}).

These results mean that fish samples feed with the control feed sample showed the best growth performance in terms of total length increment within the 14 weeks of feeding trial followed by those fed with feed sample with combined sweet potatoes peel and watermelon while those fed with feed that contain only watermelon peel showed the lowest growth performance.

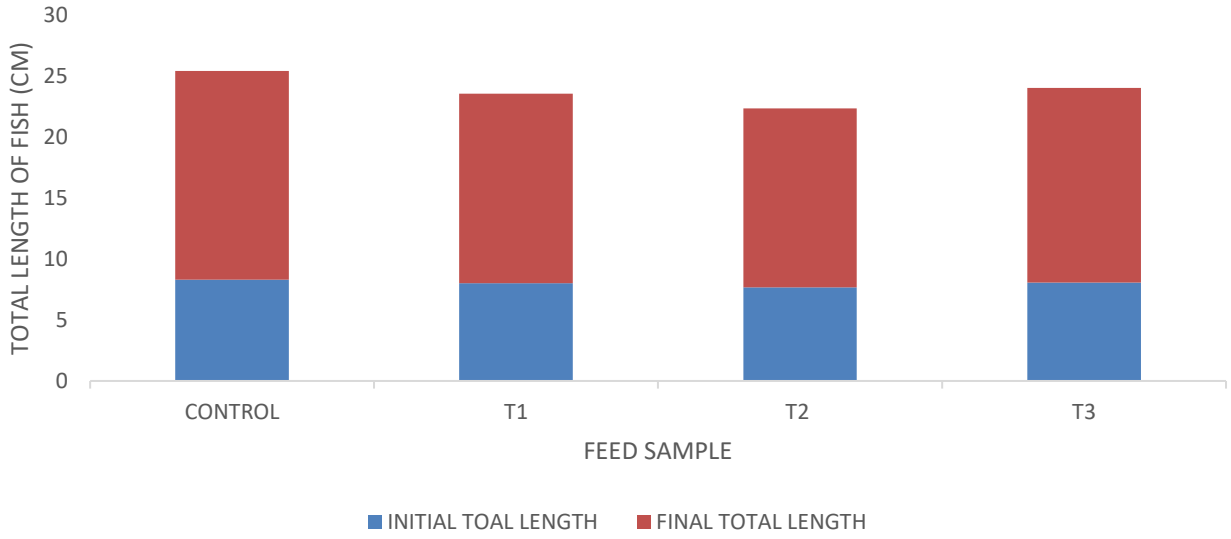


Figure 4.6 Bar chart of the Total Length for the four different feed samples

3.4 Percentage Weight Gain of the Fish samples

Parentage Weight gain is a growth performance parameter that assesses the change in weight of the fish samples with respect to the initial weighted of the same samples expressed as percentage. The results in Figure 4.7 revealed that fish samples fed with the control feed sample had the highest and significant change in weight (772.48 [a]) followed by fish samples fed with T3 feed sample (573.92[c]) while those fed with T2 feed sample showed the lowest and significant change in weight (437.50 [b]). These results mean that fish sample feed with the control feed sample showed the best growth performance in terms of weight gain within the 14 weeks of feeding trial followed by those fed with feed sample with combined sweet potatoes peel and watermelon while those fed with feed that contain only watermelon peel showed the lowest in this growth parameter.

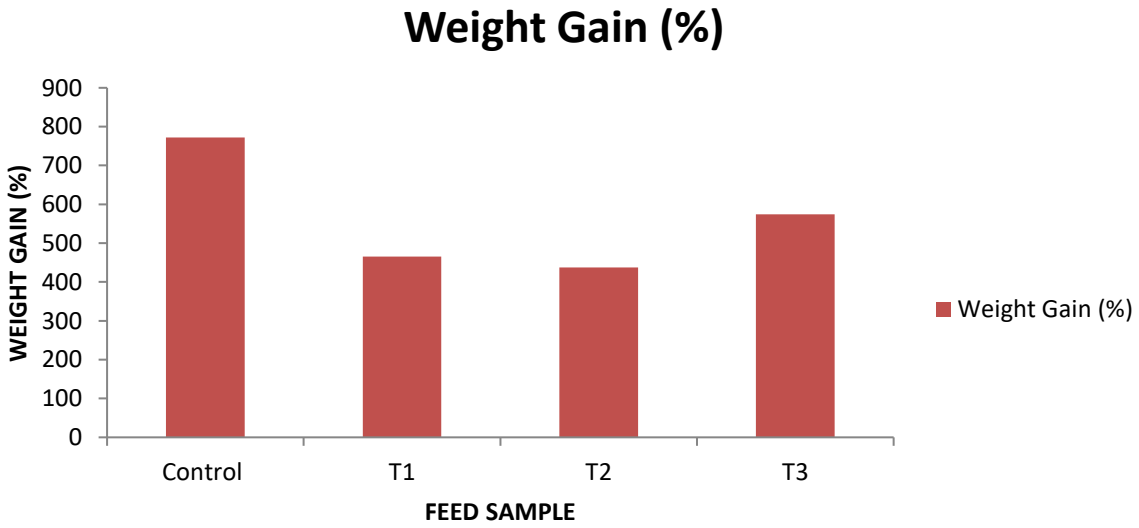


Figure 4.7 Bar chart of the Weight Gain by the fish sampled feed with the four different feed samples

3.5 Growth Rate of the Fish samples

Growth Rate is another crucial growth indicator that expressed that rate of increment per unit time. In this study, the growth rate is expressed in three different forms based on the three changes expressed above.

3.5.1 Growth rate based on weight;

In Figure 4.8, The results revealed that fish samples fed with the control feed sample had the highest and significant growth rate based on weight (5.76^{a}) followed by fish samples fed with T3 feed sample (4.54^{c}) while those fed with T2 feed sample showed the lowest and significant change in weight (3.23^{b}).These results mean that fish sample feed with the control feed sample showed the best growth rate with respect to their weight within the 14 weeks of feeding trial followed by those fed with feed sample with combined sweet potatoes peel and watermelon while those fed with feed that contain only watermelon peel showed the lowest in this growth rate based on weight.

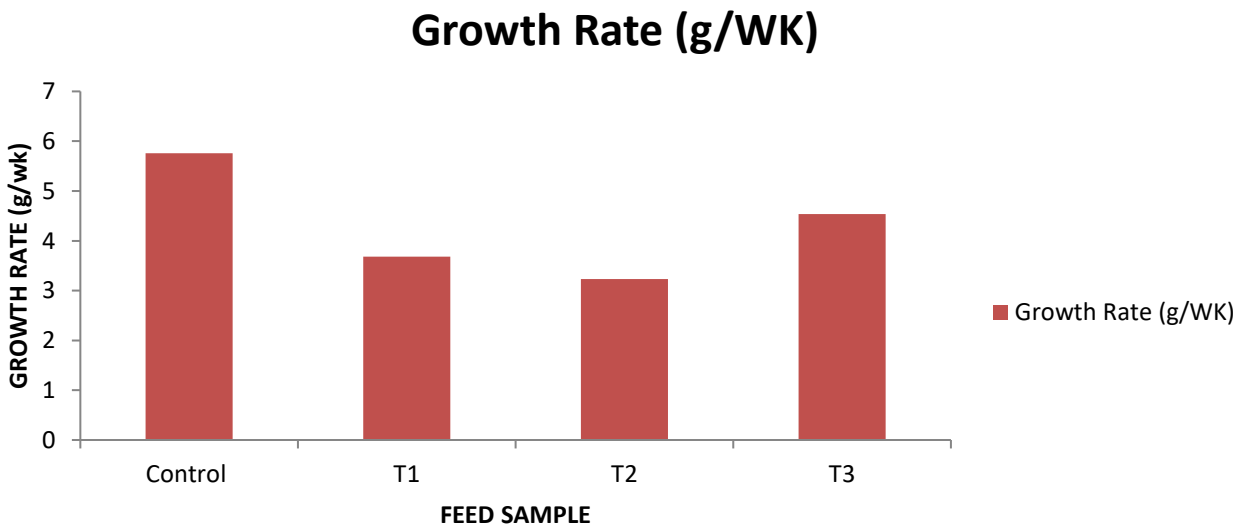


Figure 4.8 Bar chart of the Growth rate based on Weight of the fish sample

3.5.2 Growth rate based on standard length;

In Figure 4.9 show the results of growth rate based on standard length The results revealed that fish samples fed with the control feed sample had the highest and significant growth rate based on standard length (0.50^{a}) followed by fish samples fed with T2 feed sample (0.43^{b}) while those fed with T1 feed sample showed the lowest and significant change in standard length (0.40^{b}).

These results mean that fish sample feed with the control feed sample showed the best growth rate performance in terms of increment in standard length within the 14 weeks of feeding trial followed by those fed with feed sample with watermelon while those fed with feed that contain only sweet potatoes showed the lowest growth rate based on standard length.

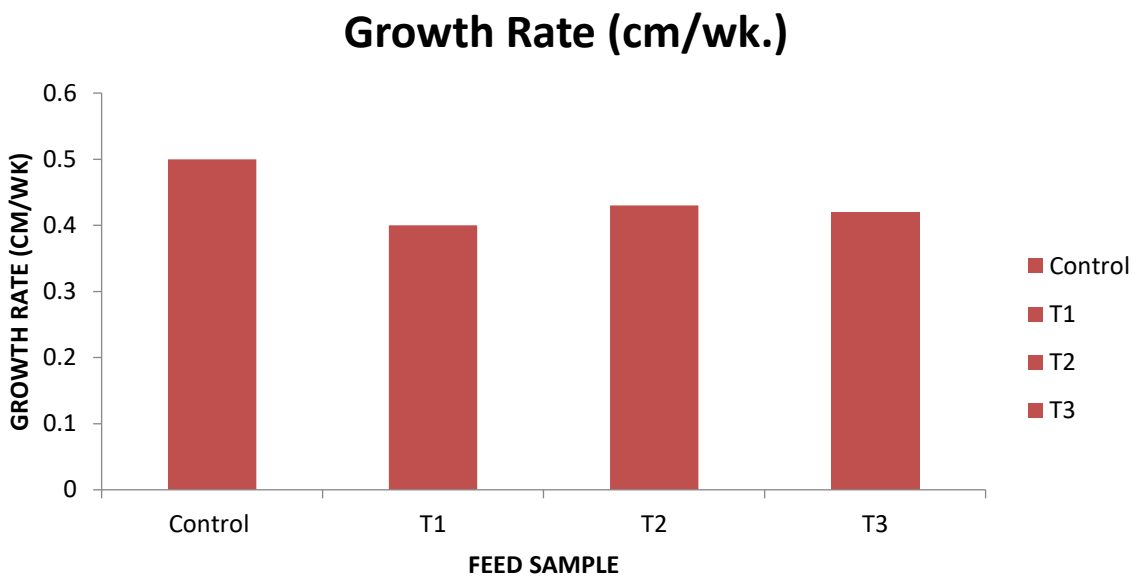


Figure 4.9 Bar chart of the Growth rate based on standard length of the fish sample

3.5.3 Growth rate based on Total Length

Figure 4.10 show the results of growth rate based on total length, The results revealed that fish samples fed with the control feed sample had the highest and significant growth rate based on total length (0.62^{a}) followed by fish samples fed with T3 feed sample (0.56^{b}) while those fed with T2 feed sample showed the lowest and significant change in weight (0.50^{b}).

These results mean that fish sample feed with the control feed sample showed the best growth rate performance in terms of total length within the 14 weeks of feeding trial followed by those fed with feed sample with combined sweet potatoes peel and watermelon while those fed with feed that contain only watermelon peel showed the lowest in this growth parameter.

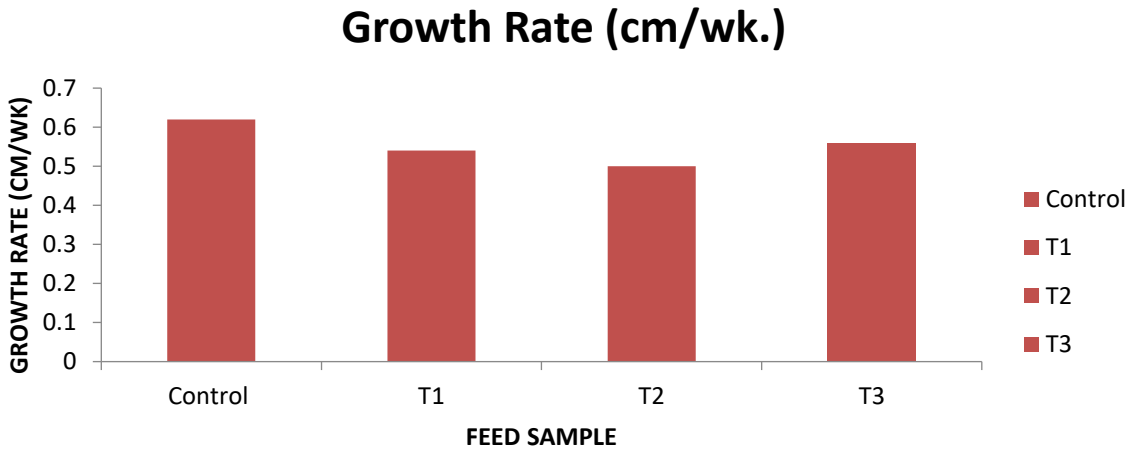


Figure 4.10 Bar chart of the Growth rate based on total length of the fish sample

3.6 Discussion of Findings

The results of the formulation and experimental trial of the three feed samples formulated by inclusion of dried sweet potatoes peels, watermelon peels and combination of dried sweet potatoes peels and watermelon peels denoted as T1, T2 and T3 respectively revealed that the feed samples are suitable for fish feeding because the growth indicators of the fish samples fed with the three feed samples such as the standard length, total length and weight increased appreciably with increase in experimental feeding period which lasted for 14 weeks. This is a good indication that the three feed samples contain the necessary feed nutrient required for the growth and maturity.

The outcome of this feeding trial is in line with the results presented by Faramarzi et al (2012) who carried out experiment study to ascertain the performance of the mixed sex Cat-fish fingerlings fed with different levels of dried sweet potato peels and the results of their study revealed that dried sweet potato peels is suitable as an inclusion in fish feeds without severe nutritional impact of the fish and basically to reduce feed formulation cost. The outcome also concurred with research carried out by Solomon *et al.,* (2015) who conducted empirical study aimed at investigating the viability and suitability of using dry sweet potato peel as energy source and to replace increasingly conventional yet expensive yellow maize feed stuff in feed for African catfish fingerlings and the outcome of their study reveals that sweet potatoes peel can completely be used to replace maize at 30% inclusion level.

This outcome of this current study on growth performance of dry watermelon peel concurred with the work carried out by Oladipupo & Salami (2020) who carried out empirical study to examine nutritional viability of feeding catfish with watermelon peel as an inclusion in the feed and their results revealed inclusion of watermelon peel in feed of catfish was ideal for improving their growth parameters., and also the work Iheanacho *et al.,* (2018) who carried out a study to ascertain the impact of inclusion of different amount of peel of water melon on growth juveniles of *Oroechromis niloticus* and their results revealed that dried peel of water melon is suitable as inclusion in the fish feed

The outcome of current study on the combination of both dried watermelon and sweet potatoes peel also align with empirical study by Omokore & Oluwafemi (2020) who conducted feed trial to ascertain the possible impacts of using dried watermelon peel and sweet-orange peel mixture as feed for rabbits considering their performance in terms of growth and their results revealed that the feed formulated with dry watermelon and sweet potatoes peel contained numerous bioactive chemicals and nutrients that can support growth of animals and it could be used as fed for rabbits with no negative impact in their overall performance.

The results of this current study on the impact of the feed containing only dried sweet potatoes peels on the growth performance of tilapia fingerling revealed that the feed sample formulated by including the only dry sweet potatoes peels was better in improving the growth performance indictors based on weight of the fish samples because it contained good amount of caloric but the feed sample has limitation in improving the growth indicators based on length because it contain certain level of anti-nutrient that hinders increment in growth indicators based on length and dried sweet potatoes peel do not contain minerals and vitamins to counter the effects of the anti-nutrients.

This study concurred with work of Omoregie et al (2009) who carried out empirical examination on the growth-based performance of the Tilapia *Oreochromis niloticus* which were fed with feed of different levels of sweet potato peels. Analysis of the results of plasma glucose and plasma protein revealed that there were no deleterious effects recorded in the test fish due to the dietary inclusion of

the sweet potato peel and the results revealed that the fish samples could tolerate up to 15% level of inclusion of sweet potato peel due to presence of some anti-nutrient in the peel. The outcome of current study also aligned with work of Solomon et al (2015) who reveals from their study that sweet potatoes peel can completely be used to replace Maize at 30% inclusion level, finally, the results concurred with study carried by Agubosi *et al.,* (2022) on the nutrition value of sweet potato peels dried using air-drying and sun-drying methods and their results revealed that dried sweet potatoes peel contained tolerable amount of anti-nutrients such as flavonoids, phenols, alkaloids, saponins, trypsin, phytate, cyanogenic glycosides, condensed tannins, hydrolysable tannins and anthocyanins

The results of the current study on the impact of the feed sample containing only dried watermelon peels on the growth performance of tilapia fingerling revealed that the feed sample formulated by including only dry watermelon peels is better in improving the growth indictors based on length of the fish samples because watermelon peel contains good amount of minerals and vitamins that are responsible for improving growth such as calcium and magnesium but the feed sample is limited in improving the growth indicators based on weight because it contain small amount caloric and carbohydrates responsible for improved growth based on weight

This outcome of this current study on growth performance of dry watermelon peel concurred with results of Oladipupo & Salami (2020) revealed inclusion of watermelon peel in feed of catfish is ideal for improving their growth parameters., and also the work Iheanacho et al (2018) who carried out study to ascertain the impact of inclusion of different amount of peel of water melon on growth juveniles of *Oroechromis niloticus* and their results revealed that dried peel of water melon is suitable as inclusion in the fish feed. The results from this study agreed with results of Adejumo et al., (2015) which revealed that water melon is full of vitamins line vitamin C, vitamin B6 and vitamin A and numerous minerals like copper, zinc, iron, magnesium, calcium, potassium and many other essential minerals required for growth and for neutralizing the side effect of anti-nutrients.

The results of the current study on the impact of the feed containing both the dried sweet potatoes peels and watermelon peels on the growth performance of tilapia fingerling revealed that the feed sample formulated by including both dry sweet potatoes and dry watermelon peels is better in improving both the growth indictors based on length and did analysis based on weight because it contains both good amount of minerals and vitamins to improve growth indicators based on length by reducing the activities of the anti-nutrients in sweet potatoes peel and good amount of caloric to improve the growth indicators based on weight and compensate for small amount of caloric in dry watermelon peel responsible for growth based on weight. This compensation made by inclusion of both the dried sweet potatoes peels and watermelon peels in the same feed helped to significantly improve the growth performance indicators based on both length and weight of the fish samples fed with the feed sample. These results correspond with the results of Omokore & Oluwafemi (2020) who concluded that the feed formulated with dry watermelon and sweet potatoes peel contain numerous bioactive chemicals and nutrients that can support growth of animals and it could be used as fed for other animal including tilapia fish with no negative impact in their overall growth performance. Thus, being that this reviewed empirical literature is the only empirical work, to the researchers best of knowledge, which examined the impact of combining the two peels as inclusion in feeds and its possible impact on growth parameters of animal, it became necessary to examine the combination of the same two peels for tilapia fish feed formation, basically to improve their growth performance and reduce cost of feeds.

The results of this study on the significant difference between the growth performances of the tilapia fish samples fed with the three (3) feed samples (T1, T2 and T3) and the normal feed sample (Control) revealed that there was significant difference in the growth indicators The normal fish feed (control) is the best among the four in all the growth indicators considered followed by the feed formulated by inclusion of both dry sweet potatoes peel and dry water melon peel. The feed formulated using sweet potatoes peels was better than the one formulated with dry watermelon peel for growth indicators based on weight while that formulated using dry water melon peel was better for growth indicators based on length, however, on overall, there was no significant difference in the growth indicators for the fish samples fed using feed formulated by including dry sweet potatoes peel and dry water melon peel ($p<0.05$)

These results agreed with the results from the study of Omoregie et al (2009) who examination the growth-based performance of the Tilapia *which* were fed with feed of different levels of sweet potato peels and the results revealed the best increase in weight of the fish samples was achieved with the control diet and the best specific growth rate (SGR) and digestibility were also obtained in the fish fed the control diet. This was attributed to presence of anti-nutrient the feed sampled with dry sweet potatoes inclusion which is not present in the control feed. Similar outcome was also reported by Faramarzi *et al.,* (2012) who carried out experiment study to ascertain the performance of the Catfish fed with different levels of processed dried potato peels and the results revealed that the greatest increase in weight of the fish was noticed with fish samples fed with the control feed and the best SGR and digestibility values were noticed in fish that were fed with control feed while fish fed using feed that contain highest amount of sweet potatoes peel recorded the lowest SGR and digestibility. This could also be linked to presence of anti-nutrient in sweet potatoes peel which tends to hinder growth.

However, the best performance shown by control feed sample could also be attributed to the facts that the control feed has all the necessary nutrient with little or no anti-nutrition therefore a small amount of the feed contain enough nutrient that would produce a unit increase in the weight of the fish samples fed with feed while the lowest growth performance observed in feed with only sweet potatoes peel could be attributed to presence of anti-nutrition agent and limited minerals and vitamins in the feed which tend to hinder the feed absorption thus, more of the feed is required to generate a unit increase in the body weight of the feed samples fed with the feed. However, the combination of sweet potatoes peel to water melon made a better compensation for by introducing the mineral and vitamins that counters the activities of the anti-nutrient thereby improving the feed utilization of the fish sample as compare to feed with only sweet potatoes peels.

4. CONCLUSIONS

Based on the findings of this study, the following conclusions were drawn;

1. Dried water-melon and sweet potato peels are suitable as inclusion in formulating fish feed for tilapia fingerlings.
2. Using only dried sweet potato peel as inclusion in formulation of fish feed for tilapia will provide significant improvement on their growth performance based on weight with little improvement on growth performance based on length.

3. Using only dried water-melon peels as inclusion in formulation of fish feed for tilapia will provide significantly improve on their growth performance based on length with little improvement on growth performance based on weight.
4. Using both dried water-melon peels and dried sweet potatoes peels as inclusion in formulation of fish feed for tilapia will provide significant improvement on their growth performance based on length and weight.
5. However, the feed sample without inclusion of both dried water-melon peels and dried sweet potatoes peels were still be best in improving the growth performance of the fish samples based on both length and weight. Based on the findings and conclusions of this study it is therefore recommended that;

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