

## GROWTH PERFORMANCE AND NUTRIENT UTILIZATION OF *Clarias gariepinus* FINGERLINGS FED SWEET POTATO PEELS FERMENTED AT DIFFERENT DURATIONS.

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### ABSTRACT

Conventional sources of protein are becoming inadequate for protein-based food supply. Non-conventional sources are of much concern, but literature is sparse on protein quality of fermented sweet potato peel biomass. Hence this study investigates the potentials of anaerobic fermented sweet potato peel in the diets of *Clarias gariepinus*. Four diets were formulated at 40% crude protein level containing different duration of fermented sweet potato peels (3 days, 6 days and 9 days) designated as T1, T2, T3 and T4 respectively. The study lasted for 10 weeks. Each treatment contained 15 fingerling having an average weight of  $4.54 \pm 0.06$ g with three replicate per treatment. Test fish in each tank were fed 5% of their biomass twice daily. At the end of the experiment, proximate composition and growth parameters were analyzed. Result showed that fish fed T1 (3 Days fermentation) compared favourably with the control diet ( $P < 0.05$ ). Fish fed control diet had the best specific growth rate ( $0.34 \pm 0.11$ a) and feed efficiencies (protein efficiency ratio,  $0.28 \pm 0.03$  and food conversion ratio,  $7.78 \pm 0.13$ ). The result of the proximate analysis of the sweet potato peel fermented for different duration showed that the percentage composition of ash, fibre and protein content decreased insignificantly while the moisture and carbohydrate content increased insignificantly. From this study it has shown that 3 days fermentation of sweet potato peel can be incorporated into the diet of *Clarias gariepinus* without any adverse effect on the growth performance.

### INTRODUCTION

The importance of feed in aquaculture cannot be over-emphasized. It is a major input in aquaculture production. Its high cost has caused a lot of problem in the aquaculture sector, which has actually hindered aquaculture development in Nigeria since fish feed cost accounts for at least 60% of the production cost (Gabriel et al, 2007). Expensive feeds has actually reduced the profitability of fish farming thereby limiting the expansion of farms and reducing the yield in terms of quantity and quality (Adikwu, 1992). Hence, considerable efforts have been channeled to evaluate the suitability of several unconventional feed stuff in replacing conventional feed ingredients bearing in mind their low cost and availability, high amino acid composition and ability to produce fast growth in fish within a short duration. Fish nutrition trials in the past with non-conventional tuber crops and their byproducts include Cassava peels (Solomon et al., 1996), wild variegated cocoyam (*Caladium hortulanum*) (Agbabiaka et al., 2006), cocoyam (Aderolu and Sogbesan, 2010), etc. However, there is scanty information on the utilization value of sweet potato peel in the nutrition of African catfish. Sweet potato peels contain carbohydrate which is highly digestible and soluble. It also contains adequate amount of calories in form of vitamin C ( $2.4\text{mg} / 100\text{g}$ ) and B as well as some micronutrients such as Iron. The starch it contains is predominantly 4-7% occurring as sugar. It is moderately high in carotene, ascorbic acid and other vitamins such as niacin, riboflavin and thiamine. However, the amino acid is observed to be short in total sulphur and

tryptophan when comparing to the amino acid profile of other crops (FAO, 1970). Raw sweet potato peel contains anti nutritive factors such as raffinose and trypsin inhibitory activity. Raffinose is one of the sugars responsible for flatulence; it is not digested in the upper digestive tract. Trypsin inhibitory activity (TIA) is a serine protease inhibitor that reduces the biological activity of trypsin, they interfere with its protease activity. Oyin 2006 also identified phytins, oxalates and solamines as some antinutritional factors found in raw sweet potato. The fermentation of sweet potato peel helps reduce these antinutritional factors and also make the nutrients more bioavailable. This study is therefore designed to evaluate the suitability of fermented sweet potato peels on the growth and nutrient utilization of African Catfish

### MATERIALS AND METHODS

The feeding trial was carried out at the Research Farm of the Department of Fisheries and Aquaculture, Faculty of Agriculture, Federal University, Dutsin-Ma, Katsina State for a period of 10 weeks. A total of one hundred and eighty fingerlings of average weight of  $4.54 \pm 0.06$ g of *Clarias gariepinus* were obtained from the College of Agriculture and Animal Science, Kaduna, Kaduna State and transported to the Research farm. 15 of the experimental fish were randomly distributed in 50 litres capacity plastic tanks and acclimatized for a period of one week. The fish were starved for 24 hours prior to the onset of the experiment to empty their gut and increase their appetite for the new diet. Treatments were in

triplicate. Fish were fed twice daily at 5% of their body weight. Fish from each tank were weighed biweekly and corresponding adjustments made in the amount of feed fed. The water used for the experiment was from the well situated at the farm and all physico-chemical parameters were taken to determine its suitability for fish growth and utilization. The water physico-chemical parameters (Dissolved Oxygen, PH and Temperature were measured using Hanna water testing kit (HI9871301) from each of the experimental tanks were measured.

Sweet potatoes (White flesh) were obtained from the local farmers in Dutsin-Ma Local Government area of Katsina State. The fresh tubers were washed peeled and the peels collected into separate bowls, water added and left to ferment for 3 days, 6 days and 9 days respectively. The fermentation set up was covered with polyethene bags to increase the rate of fermentation. At the end of the fermentation period, the fermented sweet potato peels were sun dried for a period of five days under hygienic conditions (placed on pre-sterilized white tray and covered with wire-mesh). The dried fermented sweet potato peels were then milled using a hammer mill and sieved to obtained a fine particle size before incorporated into the diets.

The proximate composition (Moisture, Crude protein, Crude lipid, Crude fibre, Ash and

Nitrogen free extracts) of the dried fermented sweet potato peels, experimental diet and carcass was determined before and after the experiment

Four diets were formulated designated as Diet T1, which is the control containing yellow maize alone while Diet T2, T3 and T4 contained the fermented sweet potato peels at different fermentation duration of 3 days, 6 days and 9 days respectively.

Feed ingredients were obtained from PHED Agrovet, Kano State. The ingredients used were yellow maize, dried fermented sweet potato peel meal, fish meal and Soya bean meal. The fix ingredients are cassava starch which was used as a binder for easy pelleting. Other ingredient includes bone meal, salt, palmoil, vitamin and mineral premix, lysine and methionine. All ingredients were mixed thoroughly with palm oil, processed into paste by adding hot water at 90°C and pelleted using pelleting machine. The resulting pellets were then sun dried to prevent fungal growth and the feed was sieved to obtain fine feed size.

Data obtained was analyzed statistically using One-way analysis of variance (ANOVA) followed by the Least Significant Difference (LSD) test for a comparism among treatment means where need be.

## RESULT

**Table 1: Proximate Composition of sweet potato peel fermented at different duration**

Time (Day)	Crude Protein (%)	Fibre (%)	Lipid (%)	Ash (%)	Moisture (%)	CHO (%)
0	6.23±	3.65 ±	5.43±	6.05±	2.32±	79.98±
3	5.18±0.03	3.57±0.25	6.33±0.04	5.65±0.05	2.45±0.01	80.40±
6	4.56±0.01	3.32±0.02	5.13±0.03	4.92±0.03	2.49±0.03	82.91±
9	4.33±0.03	3.00±0.00	6.40±0.00	4.66±0.00	2.64±0.04	82.40±

**Table 2: Ingredient and proximate composition of experimental diets**

Ingredients	T1	T2	T3	T4
Maize	39.36	18.30	18.20	18.12
SPPM	0.00	18.30	18.20	18.50
Fish meal	25.67	24.46	26.60	26.60
Soya Bean meal	25.67	26.46	26.60	26.60
Salt	0.50	0.50	0.50	0.50
Vitamin premix	1.50	1.50	1.50	1.50
Mineral premix	1.50	1.50	1.50	1.50
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Cassava starch	2.00	2.00	2.00	2.00
Palm oil	2.50	2.50	2.50	2.50
	100.00	100.00	100.00	100.00
<b>Proximate Composition (%DM)</b>				
Moisture	2.69±0.08	2.43±0.06	2.95±0.03	2.26±0.00
Crude protein	19.25±0.08	12.38±0.13	10.63±0.16	10.75±0.20
Fiber	3.98±0.03	4.00±0.00	2.44±0.10	3.78±0.23
Lipid	10.05±0.05	8.95±0.05	9.40±0.00	10.04±0.20

Ash	6.38±0.03	6.48±0.48	4.18±0.13	6.47±0.07
NFE	61.64±0.02	70.28±0.15	70.85±0.01	69.73±0.39

**Table 3: Growth performance and nutrient utilization of *Clarias gariepinus* at the end of the 10 weeks feeding trials.**

Parameters	T1	T2	T3	T4
Mean initial Weight(g)	4.54±0.06b	5.00±0.04ab	4.67±1.01b	4.82±0.49a
Mean final Weight (g)	8.46±0.19b	7.53±0.20a	7.16±0.04a	6.01±0.04ab
Mean weight gain (g)	3.49±1.32a	3.27±0.52a	2.86±0.34a	2.62±1.11a
Percentage weight gain (%)	67.88±0.45a	66.12±60.10a	64.86±30.49a	64.08±0.44a
Specific growth rate	0.34±0.11a	0.32±0.03a	0.30±0.04a	0.28±0.20a
Feed Conversion ratio	7.78±0.13a	8.73±0.13a	9.35±0.19a	9.48±0.53a
Protein Intake	0.07±0.01a	0.04±0.00b	0.04±0.00c	0.04±0.00c
Protein Efficiency ratio	0.28±0.03b	0.27±0.04ab	0.14±0.09a	0.03±0.09a
Average Survival Rate (%)	93	91	89	86

\* Values within the same row with same superscripts are not significantly different at  $P > 0.05$  probability level.

## DISCUSSION

The result of the proximate analysis of fermented sweet potato peel shows that the percentage composition of ash, fibre and protein content decreased insignificantly while the moisture and carbohydrate content increased insignificantly. Water content is a very significant factor in the fermentation process. Mahanta et. al., (2008) stated that high water activity can lead to the decrease in porosity of the substrate, thereby reducing the exchange of gases. On the other hand, low water activity may result in the reduction of microbial growth and consequent lower production of enzyme. According to Krishna and Chandrasekaran (1996) moisture content is a notable factor in fermentation due to its influence on growth, biosynthesis and secretion of various metabolites. Ash content represents the total mineral content in foods. Ogbonnaya et. al., (2010) stated that an improvement in the ash content of fermented peels might be due to the non-leakage of the soluble minerals into the fermenting liquid during fermentation but from the result of the proximate composition of the Ash content of the fermented sweet potato peels reduced as the fermentation period was increasing this might be due to leakage of soluble minerals from the fermenting liquid. Starch content of potato peels depends on the peeling process: while steam peels contains approximately 28% starch, abrasion peels have about twice as much starch (58%), since more potato flesh is removed during the abrasion process this is in line with the observation by Camire, et. al. (1997), on the effect of cooking and extrusion on potato peels and also of Adegunloye and Oparinde (2017) who also got the same result used abrasion process to peel Irish potato and sweet potato. However, the reduction in the carbohydrate content during the fermentation might be due to the utilization of some sugars as carbon source by fermentative organisms for growth and other

metabolic activities. This is also in line with Adegunloye and Oparinde (2017). Nwabueze and Uchendu (2011) noted that the general reduction in carbohydrate contents may be as a result of respiratory activities of hydrolytic enzymes. From the study there was an increase in the moisture content which might had led to the decrease in the carbohydrate during fermentation. This agrees with the findings of Balagopalan (1996). There was a decrease in Crude fiber content which is an indication of softening of the fibrous tissues during fermentation. This could also be due to the activities of microorganisms which are known for the bioconversion of carbohydrates and lignocelluloses into protein.

However, the growth performance of fish as reported in the present study showed that fish fed on the three different diets responded well with no deleterious effect on growth when compared with the control diet. The groups of fish fed on diet T1 (control diet) had the highest percentage weight gain (67.88± 0.45%), and this was not significantly different ( $P < 0.05$ ) from the percentage weight gain of the groups of fish fed on diets T2, T3, and T4, while the groups of fish fed diet T4 recorded the least percentage weight gain (64.08±0.44). this is in line with Ofojekwu et al. 2003 who reported a decrease in weight gain of *Oreochromis niloticus* with an increase in levels of palm kernel meal. This is also in agreement with the result obtained by Omoregie et al.1991 when they included cassava peelings and mango seeds in the diet of *Oreochromis niloticus*. From the result of Feed Conversion ratio, the values of the Control diets, T1 are not significantly different ( $P > 0.05$ ) from T2, T3 and T4. The feed conversion ration of fish fedon diet T1 was the lowest followed by T2, T3 and T4. The lower FCR value in treatment T1 showed that it was highly digested by the fish than other treatments which may be due to the presence of high fibre content owing to poor digestion of cellulose by the fish. The Protein

efficiency ratio (PER) results indicate that there was significant difference ( $P < 0.05$ ) between the control T1 and T2 but no significant difference ( $P > 0.05$ ) between the control T1, T3 and T4. The PER was highest in fish fed diet T2 and lowest in fish fed diet T4. This indicates that the protein content of diet T2 was efficiently utilized by the fish. Olaniyi (2009a & b) asserted that the higher SGR and smaller FCR values, the better the feed quality. Also Adikwu (2003) reported that a lower FCR value implies efficient feed utilization by fish.

#### CONCLUSION AND RECOMMENDATION

In conclusion, the present study revealed that 3 days fermentation of sweet potato peel can be incorporated into the diet of *Clarias gariepinus* any adverse effect on the growth performance. It is therefore recommended that further studies should be done on other processing methods.

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