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EFFECTS OF ARIDAN POD POWDER (*TETRAPLEURA TETRAPTERA:* FABACEAE) ON GROWTH PERFORMANCE OF AFRICAN CATFISH (*CLARIAS GARIEPINUS:* CLARIIDAE)

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ABSTRACT

Tetrapleura tetraptera is a deciduous tree native to tropical Africa with medicinal and nutritional properties and so has the potential for use in aquafeed as a functional feed additive for better feed utilisation and growth. The present research investigated the effects of *Tetrapleura tetraptera*-derived Aridan Pod Powder on the growth performance of African Catfish. A total of 300 fingerlings were acclimatized for two weeks and divided into five treatment groups with 20 fish per replicate. Treatment A served as the control, while treatments B to E included 2.5%, 5%, 7.5% and 10% inclusion levels of *Tetrapleura tetraptera*, respectively. The experiment lasted eight weeks; growth and survival rates were evaluated as parameters. The inclusion of 2.5% *Tetrapleura tetraptera* resulted in the highest weight gain (7.85g) and survival rate (78.00%) among all treatments. 5% inclusion also showed significant improvements in weight gain (3.48 g) and survival rate (65.50%). In contrast, 10% inclusion had the lowest weight gain (0.83 g) and survival rate (55.00%). The study concluded that a 2.5% inclusion of *Tetrapleura tetraptera* in the catfish diet can enhance weight gain and survival rates, suggesting its potential as a dietary supplement for improved growth performance in African Catfish.

INTRODUCTION

Global fish consumption is expected to rise in lockstep with global population growth. While the global trend is to reverse overfishing in capture fisheries, the aquaculture sector has the potential to grow continuously. Aquaculture expansion necessitates the adoption of new sustainable development strategies (FAO, 2020). This can be done by improving aquafeeds with new sustainable alternative components such as insect and plant meal, microbial biomass, and food waste (Hua *et al*., 2019). Also, use of functional additives such as organic acids, medicinal herbs, probiotics, (Dawood *et al*., 2018) can help increase fish production by improving feed utilization, growth performance, overall health condition, disease resistance, and fish survival rate, resulting in lower economic losses for fish farmers.

The African catfish (*Clarias gariepinus)*, is widely cultured in Nigeria under strict management (Adewolu *et al*., 2009). Increased production of fry and fingerlings with faster growth rates and greater environmental tolerance is essential for ensuring Nigerian fish food security. Aquaculture necessitates high-quality feeds that include not only essential nutrients but also complementary feed additives to keep organisms healthy, growing at a faster rate, and being environmentally friendly. There are numerous feed additives available in the Nigerian market to improve fish growth performance, and some of these additives used in feed mills are chemical products, particularly hormones, and antibiotics, which may have side effects.

The World Health Organization promotes the use of medicinal herbs and plants to replace or reduce the use of chemicals as part of the global trend to return to nature. Attempts to use natural materials such as medicinal plants as feed additives could be widely accepted to improve feed utilization efficiency and aquaculture productive performance. Recently, medicinal plants and probiotics have been reported as potential alternatives to antibiotics in aquaculture diets, among other feed additives. Much of this interest stems from increased public awareness of the use of antibiotics as growth promoters in aquaculture diets, which has been prohibited. Some studies from the past show that dietary medicinal plants and feed additives have a positive effect on fish growth and feed uutilization (Dada and Oviawe, 2011; Prasad and Mukthiraj, 2011; Cho and Lee, 2012).

Tetrapleura tetraptera (Aridan) is a deciduous tree native to tropical Africa, ranging from Mauritania to Tanzania (Katende *et al*., 1995; Blay 1997). The tree can reach a height of 25 m and has a diameter at breast height (DBH) of 1.5-3.0 m. Although savannah woodlands, dry forests, and riverine forests are its preferred habitats, it is most common in dense rainforests and preserved forest patches around villages. In Ghana, the species is known as "Prekese," "Aidan" in Nigeria, and "Kikangabalimu" in Uganda. *T. tetraptera* has the potential to be used in aquafeed as functional additives. *T. tetraptera* is reported to have medicinal and nutritional properties (Adesina *et al.,* 2016). The medicinal properties of the species are due to the presence of bio-active compounds (alkaloids, flavonoids, saponins, tannins, phenols, and glycosides) that are necessary for health (Okwu, 2003*). For example, T. Tetraptera* fruit has anti-arthritic, anti-inflammatory and anti-diabetic properties (Ojewole and Adewunmi 2004). *T. tetraptera* was also mentioned by Aladesanmi (2007) and Soladoye *et al.* (2014) in the treatment of schistosomiasis, a chronic parasitic disease caused by blood flukes (trematode worms). The nutritional properties of *T. tetraptera* are due to essential food micronutrients found in the dry fruit, such as iron and zinc (Uyoh *et al.,* 2013).

The objective of this study was to investigate the effects of Aridan Pod Powder (*Tetrapleura tetraptera:* Fabaceae) on the growth performance of African Catfish (*Clarias gariepinus :*Clariidae)

MATERIALS AND METHODS

Experimental procedures

300 post-juvenile African catfish were purchased from Aquatech Nigeria Limited, Ibadan, Nigeria and were randomly divided into five treatments. They were fed with the finished fish feed for two weeks for acclimatization before the experiment commenced. To mitigate the environment as a result of the exposure of the plastic materials to atmospheric temperature, and the volume of the water used for the experiment, the fish were fed daily with 2 mm feed size of the formulated feeds with inclusion of *T. tetraptera* at 4% body weight throughout the eight (8) weeks of experiments. The initial body weights (g) of the fish were taken using sensitive scale before stocking. The top of the

vessels was also covered with 5 mm mesh size net to protect the stocks from jumping out while the water in the vessels was changed bi-weekly to avoid build-up of nitrates and nitrites as effluent leaching was not possible due to the use of plastic materials.

The experiment had five treatments with three replicates:
Treatment A: Inclusion of *T. tetraptera* at 0.0%
Treatment B: Inclusion of *T. tetraptera* at 2.5%
Treatment C: Inclusion of *T. tetraptera* at 5.0%
Treatment D: Inclusion of *T. tetraptera* at 7.5%
Treatment E: Inclusion of *T. tetraptera* at 10.0%

Parameters measured were:
1. Live weight (g) of the fish using a sensitive top-loading scale
2. Feed intake of the fish a using top-loading loading scale

Data generated were used to calculate weight gain and mortality was monitored and recorded on daily basis.

Calculations

Live Weight Gain of Fish = Final body weight of fish – Initial body weight gain of fish.

Total Length Gain of Fish = Final body length of fish – Initial body length of fish.
Feed conversion ratio (FCR) = total feed intake (g)/total wet weight gain (g).

Specific Growth Rate = Final body weight of fish – Initial body weight of fish/No of Days reared.

Statistical analysis

Data obtained were subjected to Analysis of Variance (ANOVA) using generalized model of SAS moonscape programmed version. Significant differences among means for treatments were portioned by Duncan Multiple Range test at 5% level of probability

Table 1: Gross composition (g/100 g dry matter) of experimental diet containing varying levels of *Tetrapleura tetraptera* meal (TTM) in the diet of *Clarias gariepinus.*

Ingredient	0%	2.5%	5.0 %	7.5%	10.0%
FM (72%)	30.55	30.55	30.55	30.55	30.55
SBM (45%	42.20	42.20	42.20	42.20	42.20
YM (%)	10.00	10.00	10.00	10.00	10.00
FISHPREMIX	2.50	2.50	2.50	2.50	2.50
FISH OIL	2.50	2.50	2.50	2.50	2.50
T.TM	0	2.50	5.00	7.25	10.00
STARCH	12.25	9.75	7.25	5.00	2.25

Key:
FM: Fish Meal
YM: Yellow Maize
SBM: Soya Bean Meal
TTM: *Tetrapleura tetraptera* Meal.

The results of the phytochemical analysis of *Tetrapleura tetraptera* meal showed that it was rich in various types of phytochemicals, including tannins, saponins, flavonoids, and total polyphenols. Tannins were found to be the highest in concentration, followed by saponins and flavonoids. (Table 2).

Table 2: Phytochemical in *Tetrapleura tetraptera* meal (mg/100 g)

Content	Amount
Tannin	967.25
Saponin	786.88
Flavonoid	298.77
Total polyphenol	1896.17

The diet containing 10% inclusion had the highest crude protein content of 40.08% compared to other treatments, moisture content of 9.16%, ether extract of 2.76%, crude fibre of 1.89%, ash content of 8.96%, and nitrogen-free extract of 37.15% based on dry matter (Table 3).

Table 3: Proximate Composition of Nutritional Content on the Diet

TTM (%)	Crude Protein (%)	Moisture Content (%)	Ether Extract (%)	Crude Fibre (%)	Ash Content (%)	Dry Matter (%)	Nitrogen-free Extract (%)
0.0	38.89	9.21	2.67	1.65	8.61	90.79	38.97
2.5	38.91	9.64	2.58	1.73	8.68	90.54	38.46
5.0	39.47	9.38	2.63	1.76	8.79	90.62	38.03
7.5	39.88	9.21	2.67	1.83	8.79	90.79	37.62
10.0	40.08	9.16	2.76	1.89	8.96	90.84	37.15
TTM	6.37	6.49	1.86	3.79	4.29	93.51	77.80

KEY
TTM:*Tetrapleura tetraptera* meal

Tetrapleura tetraptera meal is a source of several important minerals. Sodium was present in the smallest amount, with a concentration of 0.119% of the total composition (Table 4). Potassium was found in a higher concentration, constituting 0.863% of the total composition, while calcium was present in a relatively lower amount at 0.137% of the total composition. The trace minerals copper, zinc, and iron were also present in the *Tetrapleura tetraptera* meal. Copper was found in a concentration of 5.800 mg/kg, zinc at 13.20 mg/kg, and iron at 48.20 mg/kg.

Table 4: Mineral Composition of *Tetrapleura tetraptera* meal

Content	Amount
Sodium (%)	0.119
Potassium (%)	0.863
Calcium (%)	0.137
Copper (mg/kg)	5.800
Zinc (mg/kg)	13.200
Iron (mg/kg)	48.200

The highest mean value weight gain was observed in the 2.5% (5.85g) followed by 5.0% (3.48g), 0.00% (1.54g), and 7.5% (0.83g) while the lowest weight gain was in 10% (0.63g) inclusion levels. Feed intake was significantly, decreased for catfish on 10% and 7.5% (2.00g and 3.00 g respectively) compared to 2.5% (6.20g) also achieved the best feed conversion ratio (FCR) (1.06g) followed by 5.0% (1.61g), 0.00% (2.27g), 10% (3.17g) and 7.5% (3.61g) while the lowest weight gain (Table 5).

In the final weight gain 2.5% inclusion level of *Tetrapleura tetraptera* had the highest weight gain of 9.85g, followed by 5% (7.43g) 10%, and 7.5% with 4.63g and 4.83 g respectively compared to the control. There was a significant difference in the survival rate where 2.5% (70.00%) had the highest, followed by 7.5% (55.0%), control (48.0%), and 10% (42.0%) (Table 5).

Table 5: Effect of *Tetrapleura tetraptera* Meal on the performance of the catfish

Parameters	T_A	T_B	T_C	T_D	T_E	SEM±
Initial Weight (g)	4.00	4.00	4.00	4.00	4.00	0.00
Final Weight (g)	5.54^{bc}	9.85^{a}	7.43^{b}	4.83^{c}	4.63^{c}	0.51
Weight Gain (g)	1.54^{bc}	5.85^{a}	3.48^{b}	0.83^{c}	0.63^{c}	0.52
Feed Intake (g)	3.50^{bc}	6.20^{a}	5.60^{c}	3.00^{bc}	2.00^{c}	0.54
FCR	2.27^{bc}	1.06^{b}	1.61^{b}	3.61^{c}	3.17^{c}	0.53
Survival Rate (%)	48.00^{c}	70.00^{a}	65.50^{b}	55.00^{bc}	42.00^{c}	0.52

^{abc} Means on the same row having different superscripts were significantly different($p>0.05$)

T_A- control 0% *Tetrapleura tetraptera* meal
T_B- 2.5% *Tetrapleura tetraptera* meal
T_C-5% *Tetrapleura tetraptera* meal
T_D -7.5% *Tetrapleura tetraptera* meal
T_E-10% *Tetrapleura tetraptera* meal
FCR – Feed Conversion Ratio

The inclusion level of 2.5% *Tetrapleura tetraptera* meal had the highest mean value (12.67g) in live weight, followed by 5% (10.66g), 7.5% (9.00g) 10% (8.4g6), and control had least mean value of 8.33g (Table 6). In the head without gill and muscle, there were no significant differences in the mean values of control (2.53), 7.5% (2.67), and 10% (2.33) while 2.5% had the highest mean value of 4.36g followed by 5% (3.67g). Also, in the whole body with intestine, 2.5% had the highest mean value of 11.43 g which is highly significant from other treatments, followed by 5% with a mean value of 9.54g, 7.5% (8.00g) and 10% (7.43g) and control (7.33g) having the mean value compared to other treatment. (Table 6).

In the bone, there were no significant differences between the mean values produced by control (1.76g), 5% (2.22g), and 7.5% (1.89g) while 2.5% (2.56g) had the highest mean value and treatment E had the least mean value of 1.55g. In the whole body without intestine, 2.5% had the highest mean value of (9.10g) followed by 5% (8.90g), 7.5% (7.67g), 10% (6.34) and control having the least mean value of (5.55g) at 5% level of significance. In intestine, 2.5% had the highest mean value of (1.30g) at 5% level of significance, followed by 5% having a mean value of 0.79g with no significant difference between the mean value produced by control (0.26g), 7.5% (0.43g) and 10% (0.20g). In muscle, 2.5% had the highest mean value of 5.67g followed by 5% (4.78g) and 7.5% (4.78g) with 10% (2.98g) having the least mean value. (Table 6)

Table 6: Carcass Analysis of Experimental Fish

Parameters	T_A(0%)	T_B(2.5%)	T_C(5.0%)	T_D(75%)	T_E(10%)
LW(g)	8.33^c	12.67^a	10.66^b	9.00^{ab}	8.46^c
HG(g)	4.00^a	5.00^a	4.56^a	3.33^a	3.33^a
H^OG(g)	2.53^b	4.36^a	3.67^{ab}	2.67^b	2.33^b
G	0.76^b	1.8^a	1.6^a	0.66^b	0.89^{ab}
WB+I+B	7.33^b	11.43^a	9.54^{ab}	8.00^b	7.43^b
WB-I	5.55^b	9.10^a	8.98^a	7.67^{ab}	6.34^b
B	1.76^{ab}	2.56^a	2.22^{ab}	1.89^{ab}	1.55^b
I	0.26^b	1.30^a	0.79^{ab}	0.43^b	0.20^b
M	3.80^a	5.67^a	4.78^a	4.78^a	2.98^a

^{abc}Means on the same row having different superscripts were significantly different(p>0.05) LW (g)- Live weight, HG (g)- Head with gill, HOG (g)-Head without gill, G-Gill, WB+I+B, Whole body with intestine and bone, WB-I -Whole body without intestine, B - Bone only, I-Intestine only, M-Muscles

DISCUSSION

The highest content of phytochemicals was found in tannin, it is known for its antioxidant properties and has been associated with potential anti-inflammatory and anti-cancer effects (Adesina *et al.,* 2016) Saponins are known for their cholesterol-lowering effects and have been studied for their potential anti-inflammatory, anti-cancer, and anti-microbial properties (Aladesanmi, 2007).

These minerals are important for various physiological functions in the body, such as electrolyte balance, nerve function, bone health, and enzyme activities. The mineral composition of *Tetrapleura tetraptera* meal suggests that it may be a potential source of these essential minerals. However, it is important to note that the bioavailability and absorption of these minerals can be influenced by various factors, such as processing, cooking, and individual differences in nutrient absorption.

These proximate composition values provide information on the nutrient content of the diet samples, including protein, moisture, fat, fiber, ash, and carbohydrate content. These values can be important for assessing the nutritional quality and potential health benefits of the diet samples.

The findings indicate that a dietary feed supplement aided in the growth of *C. gariepinus* fingerlings. These findings demonstrated that feed supplement improves nutrients utilisation, as evidenced by increased weight gain and FCR. Feed supplements in diets promoted growth and feed efficiency in catfish *C. gariepinus* (Turan and Akyurt, 2005), tilapia *Oreochromis niloticus* (Felicitta *et al*., 2013), and shrimp Peneaus indicus (Olmedo Sanchez *et al*., 2009). Similarly, Olaniyi *et al.* (2020) found that 20% *Z. officinale* powder supplementation increased weight gain, specific growth rate, and protein efficiency ratio in the same fish species. Dada and Ikuerowo (2009) also demonstrated that G. kola extracts supplemented diets resulted in higher weight gain and specific growth rate in the same fish species.

CONCLUSION

The efficacy of *Tetrapleura tetraptera* as a supplement in *C. gariepinus* fingerlings feed was established in this study, and fish farmers should be encouraged to supplement these in fish diets. Catfish fed with 2.5% inclusion of *Tetrapleura tetraptera* improved their weight gain. Future research should concentrate on improving rearing technologies for various species of fish reared with feed supplements.

REFERENCES

Abi, T. A., Elegalam A. 2007. Investigation into the chemical composition of the dry fruit of *Tetrapleura tetraptera* (*Ubukirinu). Journal of Food Technology* Research; 5:229-232.

Adekoya B.B., Miller J.W. 2004 Fish cage culture potential in Nigeria – an overview. National cultures. *Agriculture* Focus, 1(5***):***1-10.

Adesina S.K., Iwalewa E.O., Johnny I.I. 2016. *Tetrapleura tetraptera* Taub-Ethno pharmacology, chemistry, medicinal and nutritional values—a review. *British Journal of Pharmaceutical Researches.* 12:1–22.

Adesina, S.K., Adewunmi, C.O., Marquis V.O. 1980. Phytochemical investigations of the molluscicidal properties of *Tetrapleura tetraptera* Taub. *Journal. of African Medicinal Plants* ; 3:7-15.

Adesina, S.K., Ojewole J.O., Marquis,

V.O. 1980. Isolation and identification of an anticonvulsant agent from the fruit of *Tetrapleura tetraptera* (*Aridan/Aidan).* The *Nigerian Journal of Pharmaceutical Resources.* 11 (6):260-262.

Adewolu M.A., Akintola S.L., Akinwunmi O.O. 2009. Growth performance and survival of hybrid African catfish larvae (*Clarias gariepinus* X *Heterobranchus bidorsalis*) fed different diets. *Zoologists* 7(1) 45-51

Aladesanmi A. J. 2007. *Tetrapleura tetraptera:* molluscicidal activity and chemical constituents. *African Journal of Traditional Complementary and Alternatives Medicines.* 4(1):23–36.

Amiengheme, P. 2005. The Importance of Fish in Human Nutrition. A paper delivered at a Fish Culture Forum, Federal Department of fish farmers, Abuja.

Blay D.J. 1997. The distribution and ecological requirements for the growth of *Tetrapleura tetraptera. Ghana Journnal of Medicinal Plant.* 5:40–50

Cho S.H., Lee S. 2012. Onion powder in the diet of the olive flounder, *Paralichthy olivaceous*: Effects on the growth, body composition, and lysozyme activity. *Journal of World Aquacultural Science.* 43(1): 30 – 38

Dada A.A., Ikuerowo M. 2009. Effects of ethanolic extracts of *Garcinia kola* seeds on growth and haematology of catfish (*Clarias gariepinus*) broodstock. *African Journal of Agricultural Resources.* 4:344–7. 10.5897/AJAR.9000249

Dada A.A., Oviawe N.E. 2011. The use of bitter kola Garcinia kola dry seed powder as a natural growth- promoting agent for African sharptooth catfish *Clarias gariepinus* fingerlings. *African Journal. Aquatic Science.* 36(1): 97 – 100.

Deng J., An Q., Bi B., Wang Q., Kong B.L., Tao L. and Zhang X. (2011): Effect of ethanolic extract of propolison growth performance and plasma biochemical parameters of rainbow trout (*Oncorhynchus mykiss*). *Fish Physiololigical Biochemistry.* 37(4): 959 – 967

Dawood A.O., Koshio, S., Esteban, M.A. 2018: Beneficial roles of feed additives as immunostimulants in aquaculture: A review. *Revolutionary Aquaculture.* 10, 950–974.

Eyo, A.A 2001. Chemical Composition and amino acid content of the commonly available feedstuff in Nigeria. In: fish Nutrition and Fish Feed Technology, A. An Eyo (ed.) *Proceedings of first National Symposium on Fish Nutrition and Fish Feed Technology*

Food Agriculture Organisation. The State of World Fisheries and Aquaculture 2020: Sustainability in Action; FAO: Rome, Italy, 224p.

Felicitta J., Arti Manju R., Ronald J., Sakthika T., Nagarajan R. Chelladurai G. 2013. Effect of different concentrations of somephytoadditives (*Allium sativa and Allium cepa*) 0n growth, survival and hematological parameters in tilapia (*Oreochromis mossambicus*) juveniles. *The Israeli Journal of Aquaculture-*Bamidgeh, 64: 8p

Hua K., Cobcroft, J.M., Cole A., Condon K,. Jerry D.R., Mangott A., Praeger C., Vucko, M.J., Zeng C. Zenger K. 2019. The future of aquatic protein: Implications for protein sources in aquaculture diets. *One Earth*, 1, 316–329.

Katende A.B., Birnie A., Tengnas B. 1995. Useful trees and shrubs for Uganda. identification, propagation and management for agricultural and pastoral communities. Regional Soil Conservation Unit (RSCU), Swedish International Development Authority (SIDA).

Ojewole J.A.O., Adewunmi C.O. 2004. Anti-inflammatory and hypoglycaemic effects of *Tetrapleura tetraptera* (Taub) [fabaceae] fruit aqueous extract in rats. *Journal of Ethnopharmacology*. 95(2–3):177–182.

Okwu D.E. 2003. The potentials of *ocimum gratissimum, penrgularia extensa* and *Tetrapleura tetraptera* as spice and flavouring agents. *Nigeria Agricultural Journal,* 34(1):143–148.

Olaniyi C.O., Atoyebi M.O., Obafunmiso H.T., Salaam K.A. 2020. Effect of ginger (*Zingiber officinale*) in the nutrition of African catfish-A cholesterol reducer and fertility enhancer. *International Journal of Aquatic Fish Science*. 6:021–8. 10.17352/2455-8400.000052

Olmedo Sanchez J.A., Curiel Flores A., Orozco J.R. 2009. The effect of a herbal growth promoter feed additive on shrimp performance. *Research Journal of Agriculture and Biological Science.* 4: 1022- 1024

Prasad G., Mukthiraj S. 2011. Effect of methanolic extract of *Andrgraphis paniculata* (Nees) on growth and haematology of *Oreochromis mossambicus* (Peters). *World Journal of Fish Marine Science 3*(6): 473 – 479

Soladoye M.O., Chukwuma E.C., Sulaiman O.M., Feyisola R.T. 2014. Ethnobotanical survey of plants used in the traditional treatment of female infertility in Southwestern Nigeria. *Ethnobotany Research and Application*. 12:081–090.

Turan F., Akyurt I. 2005. Effects of red clover extract on growth performance and body composition of African catfish *Clarias gariepinus* (Burchell, 1822). *Fish Science Journal.* 71: 618 – 620

Uyoh E.A., Ita E.E., Nwofia G.E. 2013. Evaluation of the chemical composition of Tetrapleuratetraptera (Schum and Thonn.) Taub. Accessions from Cross River State Nigeria. *International Journal of Medicinal Aromatic Plants*. 3(3):386–394.

Viveen W.J., Richter, C.J, Van Oordt, P.G Jansen, J.A., Huisman E.A. 1986 Partial manual for culture of African catfish *Clarias gariepinus* section for research and technology, box 20061, 2500EB. The Hague Netherlands 121pp.

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