COMPARATIVE ASSESSMENT STUDIES ON DIFFERENT FEED FORMULATION METHODS WITH NOVEL AQUAFEED SOFTWARE IN AFRICAN CATFISH, *Clariasgariepinus* (BURCHELL 1822) FARMING IN EARTHEN PONDS

Abstract

Thisstudyinvestigatesthe impactofanovelAquafeedsoftwaresystem onthegrowth,nutrientutilization,andeconomicfeasibilityofproductionAfricancatfish,ClariasGariepinus,i nearthenponds.Being a critical species for aquaculture in many continents, optimizing feed management is essentialforenhancingproductivityandsustainability.Fifty(50)apparentlyhealthyClariasgariepinusfinge rlingsweighing(6.50-7.00g)wasallottedintoeachoftheninehapasandfedforaperiodof72days.During the experimental period, water quality parameters were meticulously monitored to ensureoptimalconditionsforthegrowthofClariasgariepinus.Thenutrientcompositionofthefishcarcasses,i ncludingcrudeprotein,lipid,ash,moisture,andnitrogen-freeextract,wereanalyzedintoassesstheirnutritional status. The results revealed that the implementation of the novel FUTA Aquafeed softwaresignificantlyenhancedthegrowthandnutrientutilizationofClariasgariepinusfingerlingsat(p<0.05)when compared to traditional formulation methods of Pearson square and Winfeed. This software-driven approach provides a more precise and tailored feeding regimen, resulting in improved fishperformance. A comprehensive cost analysis underscores the economic advantages of utilizing theAquafeed software. It demonstrates that the software not only contributes to enhanced fish growth butalso reduces production costs, thus improving the overall economic viability of Clariasgariepinusaquaculture in earthen ponds. Aquafeed has the highest amount of water molecule of 14.43%, Proteincontentof44.01%forauqafeed,Lipidcontentfromtheanalyzedresultstate 19.21% foraquafeed,ash recorded,17.01%,17.79%and16.15%forpearson, andaquafeedrespectively,whilefiber accumulate0.63%,0.78%.1.00%pearson,windfeedandaquafeedrespectively.NitrogenFreeExtractdwind lebetween7.50and5.09%,allthesebuttressthefacttheFUTAAquafeedshasbetterperformancethan two others.

Keywords: aquafeed, Clariasgariepinus, nutrientutilization, aquaticenvironments

Introduction

African catfish *Clariasgariepinus*is a freshwater fish species native to Africa, it holds significantimportanceinthefieldofaquacultureforseveralreasons(Toko*etal.*2007).Itversatilefarmingspeci esisahighly adaptableandversatilespeciesmaking itsuitableforaquaculture invariousaquaticenvironments, including earthen ponds, tanks, and even integrated farming systems. African catfish isknownforitsrapidgrowthrate,allowingforefficientproductionandrelativelyquickturnoverin aquaculture operations (Nsofor*et al.* 2012). This characteristic makes it a preferred choice for fishfarmers looking to maximize their yields. The species has gained popularity due to its economic value,ithasamarketdemandforitswhite,bonelessflesh,whichisconsideredtastyandnutritious,contributing to its profitability in commercial aquaculture. *Clariasgariepinus*exhibits a high degree oftolerance to varying water quality conditions, including low oxygen levels and suboptimal waterparameters (Kari *et al*. 2022). This adaptability makes it a hardy species, reducing the risk of losses inaquaculture systems. African catfish is known for its carnivorous feeding habits, readily consuming awide range of natural and artificial diets. This adaptability in feeding preferences allows farmers to usevarious feed sources, including formulated feeds, to promote growth and reduce production costs(Fawole*et al.* 2022). *C. gariepinus*in African countries plays a crucial role in enhancing food securityand providing a source of affordable protein for local communities. Its ability to be farmed in small-scale, backyard ponds also empowers smallholder farmers to participate in aquaculture. Beyond localconsumption,Africancatfishhasexportpotential,contributingtotheeconomicdevelopmentofAfricann ationsbygeneratingrevenuethrough international trade.

Accordingto Fischer*etal*.(2022)importanceofaquafeedincatfishfarmingisparamount asitdirectlyimpacts the growth, health, and profitability of catfish production. Additionally, technology plays acrucial role in optimizing feed management in catfish farming. African catfish have specific nutrientrequirements for growth, reproduction, and overall health. Aqua feed is formulated to provide theseessentialnutrientsintherightproportions,ensuringthatcatfishreceiveabalanceddiet.Propernutritionthr oughaquafeedisvitalformaximizingthegrowthrateofcatfish.Jimoh*etal*.(2022)addedthatwell-formulated feeds promote efficient feed conversion, where a minimal amount of feed produces amaximumamountoffishbiomass,reducingproductioncosts.Feedingcatfishwithnutritionallybalanced feeds helps bolster their immune systems, making them more resistant to diseases and stress.Propernutritioncanreducetheneedforantibioticsandothertreatments,contributingtoahealthierandm ore sustainable farming system (Nankinga*et al*. 2022). Advanced software tools are available forformulating catfish feeds. These tools consider the specific nutritional requirements of catfish and helpfarmers create customized feed formulations that maximize growth and minimize waste. Technologyhasgivenrisetoautomatedfeedingsystemsthatcandispensefeedatpreciseintervalsandincontrol ledquantities (Nowosad*et al*. 2022). This ensures that the African catfish receives their feed consistently,reducingtheriskofoverfeedingorunderfeeding.Precisionfeedingsystemsusedataandalgorith msto adjust feed delivery based on the actual needs of the catfish population. This reduces wastage andoptimizesfeed utilization.

The term "Novel Aqua Feed Software" refers to innovative software solutions specifically designed tooptimize the management of aquafeeds in aquaculture operations. These software systems are tailoredto meet the unique needs and challenges of feeding aquatic species, such as fish and shrimp, inaquaculture settings (Sándor*et al.* 2022). Novel aqua feed software includes sophisticated algorithmsand databases that help aqua culturists formulate feeds tailored to the specific nutritional requirementsof the target species. It considers factors such as the species' growth stage, water temperature, andnutrient composition to create balanced and efficient feed formulas. These software solutions ensurethat the feeds provided to aquatic species contain the optimal balance of essential nutrients, includingproteins,lipids,vitamins,andminerals.Nutrientoptimizationiscriticalformaximizinggrowth,minimizingfeedwaste,andreducingproductioncosts(Shadieva*etal*.2020).Aquafeedsoftwarehelpsfarmers develop and manage feeding regimens that are precise and consistent. It calculates feedingschedules based on factors like fish size, water quality parameters, and environmental conditions,ensuring that fish receive the right amount of feed at the right time. Many novel aqua feed softwaresystemsofferreal-timemonitoringcapabilities(Shadyeva*etal*.2022).Sensorsanddatacollectiontoolsare integrated into aquaculture systems to continuously monitor feeding behavior, water quality, andfishhealth. This datais then usedto adjust feedingpracticesas needed.

The software assists in cost management by tracking feed consumption, calculating feed conversionratios, and providing insights into the cost-effectiveness of different feed formulations and feedingstrategies(Wasiu*etal*.2022).Theobjectiveofthisresearchworkisto formulateandproducefishfeedusinganovelaqua-feedsoftwareknownasFUTAAQUAFEEDandcomparethebiochemicalcomponents with conventional feed formulation methods, determining the growth performance andnutrientutilization of Africancatfish*Clariasgariepinus*rearedinearthen ponds.

MaterialsandMethods

The experiment was carried out at the Teaching and Research Farm of the Department of Fisheries andAquaculture Technology, The Federal University of Technology, Akure, Ondo State, Nigeria. Fourhundred and fifty *ClariasGariepinus*juveniles was obtained and were acclimatized for 7days and fedwith2mmon-farmmade feedof 40% crude proteintwice daily priortothe commencementofexperiment.CompletelyRandomizedDesign(CRD)wasusedforthestudy,ninehapaswith a

dimension 1x1x1m^{3}was used, each was embedded in an earthen pond. Three hapas per experimentaldietrepresentedreplicateperexperimentaldiet.Fifty(50)apparentlyhealthyClariasgariepinusfingerlingsweighing(6.50-7.00g)wasallottedintoeachoftheninehapasandfedforaperiodof72days.

Preparationandformulationofexperimentaldiet

Components of feed formulated consist of soybean meal, fish meal, groundnut cake, yellow maize,vegetable oil, starch and vitamin-mineral premix. The feed was formulated using Pearson square,Winfeed software and Aquafeed software. The Winfeed software and Aquafeed software was procuredfromAquafeedformulationvendors.Variousingredientstobeusedwereweighedandgrindedintofinepowder separately. After grinding the ingredients into fine powder they were measured based on thepercentagecompositionoftheexperimentaldietsandthoroughlymixedtogethertoformahomogeneousmixture.Physico-chemicalparametersliketemperature,pHanddissolvedoxygenwasmeasuredweekly,usingHANNAInstrumentstomeasuretemperatureandpHwhiledissolvedoxygenconcentration was also measured using DO meter. Proximate analysis; the proximate composition ofwhole body of fish and feed was determined using the standard methods of the Association of OfficialAnalyticalChemist(AOAC,2005).Thefollowingparametersweredetermined,moisturecontent,crudeprotein,fiber, lipid,ash,nitrogenfreeextract.

Moisture content, lipid content and fiber was determined using percentage based analysis equation asexpressedbelow,

$$Percentageofcontent\% = \frac{W_2 - W_3}{W_1} x100$$

Where;W_1=filterpaperweight

W_2 = one gram (1g) of the sampleW_3=petroleum etheroilresidue

Evaluationofgrowthperformancewascarriedoutusingthefollowingfactors,weightgainWGspecificGrowthRateSGRFeedConversionRatioFCRFeedIntakeFIProteinIntakePIProteinEfficiencyRatioPERFeed EfficiencyRatio FERaccordingto

$$Weightgain(g) = Finalbodyweight - Initialbodyweight$$

$$SpecificGrowthRate(\%/day) = \frac{Infinalbodyweight - Ininitialbodyweight}{Durationoffeeding} X100$$

$$FeedIntake(g) = Totalamountoffeedgiven(g)Xnumberofdays$$

$$Feed\ ConversionRatio = \frac{Feedintake}{Weightgain}$$

$$Feed\ Efficiency\ Ratio = \frac{Weightgain}{Feedintake}$$

$$ProteinEfficiency\ Ratio = \frac{Weightoffish}{Protein\ fed}$$

StatisticalAnalysis

Datacollectedwerecheckedfornormalityusingone-wayanalysisofvariance(ANOVA)andhomogeneity of variance using Levene's test to test for significant difference in the means usingStatistical Package for Social Sciences (SPSS 22.0 for windows). Where there is significant difference,themeanswasseparatedusingDuncan'smultiplerangetest.Meandifferencewasconsideredstatistically significant with a 95% confidence level and all data were presented as means ± standarderrors.

Resultanddiscussion

Basic component of fish feed formulation were composed for this formulation with cognizance onpercentage of food nutrient in all the food materials selected. Common feed material in Nigeria werefirstconsiderinordertoactualizecostreductioninfishproduction.Pearsonsquaremethodoffishfeedformulationusesarithmeticexpressiontodeterminetherequiredfeednutrientsforspecificfishspecies,in this case African cat *Clariasgariepinus*fish is the case study (Nowosad*et al.* 2022). Aquafeedsoftwarewasdesignontheprincipleofalgorithmsintertwinewithdeeplearningonthebasisofartificialintelligence AI. This make it precision more distinct than person square and other arithmetic basedmethod of formulation.Aquafeed software combined lower percentage of expensive feed and higherpercentageofcheapfeedtoenhancehighprotein content feedthan Pearson squaremethods.

Table1: GrossComposition oftheExperimental Diets(g/100g)for Culturing *Clariasgariepinus*

INGREDIENTS	PEARSONSQUARE	WINFEED	AQUAFEED
Fishmeal(68%)	30.65	22.00	16.9
Groundnutcake(45%)	20.65	28.00	34.10
Soybeanmeal(42%)	18.65	25.00	24.00
Yellowmaize(10%)	20.05	15.00	15.00
Oil	6.00	6.00	6.00
Starch	2.00	2.00	2.00
Vitamin/mineralpremix	2.00	2.00	2.00
Total	100	100	100

PROXIMATECOMPOSITIONOFFEED(%DM)

ProximateanalysisreviledcompositionofmoisturecontentinallthethreefeedsformulatedbyPearsonsquare, winfeed and aquafeed. Aquafeed has the highest amount of water molecule of 14.43% whilewinfeedhasthelowestof11.80%.Proteincontentrangesfrom39.35%frompearsonsquareto44.01%ofauqafeed,thiswasinconcordwithMansour*etal*.(2022).Lipidcontentfromtheanalyzedresultstate23.24% for pearson square, 21.45 for winfeed and 19.21% for aquafeed, in the same vain ash and fiberwere not left out, ash recorded, 17.01%, 17.79% and 16.15% for pearson, windfeed and aquafeedrespectively,whilefiberaccumulate0.63%,0.78%.1.00%pearson,windfeedandaquafeedrespectively.Nitrogen FreeExtract dwindlebetween 7.50 and5.09%.

Table2: ProximateCompositionoftheCulturingClariasgariepinus

COMPOSITION	PEARSONSQUARE	WINFEED	AQUAFEED
Moisture	12.09	11.80	14.43
Crudeprotein	39.35	43.09	44.01
Lipid	23.42	21.45	19.21
Ash	17.01	17.79	16.15
Fibre	0.63	0.78	1.00
NitrogenFreeExtract	7.50	5.09	5.20

PremixmanufacturedbyChemiconsultInternationalLimited,Ikeja,Lagos,Nigeria(2023).

Theproteincontentisthehighestamongallthefeedformulatedwithasignificantdifferenceshowingviabilityofthefeedsinfishgrowth.aquafeedhasthehighestpercentageofproteinwhilepearsonsquarehasthelowest.Thisisafunctionofitconstituentswithlowproteincontentwhichnowaffecttheresultantproteincontent,onlikeaquafeedwithcheapcomponentswithmodratlyhighproteincontent.Mansour*etal*.(2022)hadsimilarresultintheirresearchtofeedfemale*Clariasgariepinus*formeatdevelopment. Fig 1.showed the gradient of decrease in the percentage of lipid, ash and fiber across theproximatecomponents and between the threeformulations.

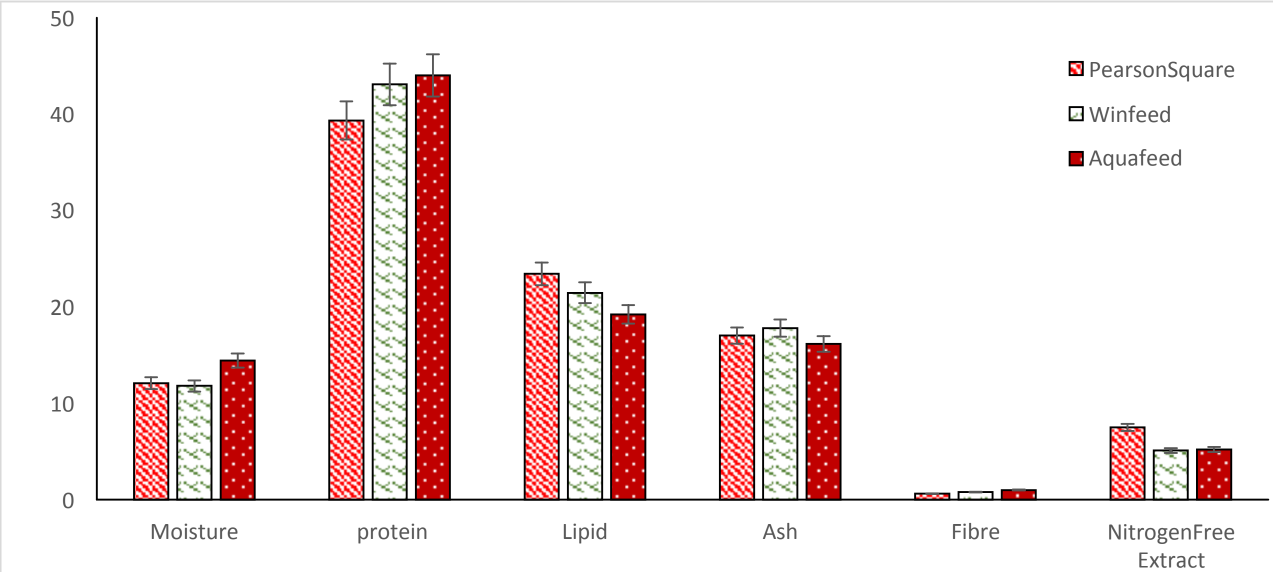

Fig.1. Graphicalrepresentationofproximatecompositionresultoffeeds

PhysicochemicalParametersofCultured*Clariasgariepinus*FingerlingsWater

ThephysicochemicalparametersofwaterresultsispresentedinTable3.ThepHrangedbetween7.58 – 7.6, though winfeed has the lowest pH but does not have any significant impact negatively on thegrowthoftheculturedfish*Clariasgariepinus*sinceallthepHvalues arein thesphereofneutralonthepH scale Baek*et al*. (2021) corroborate this in their research in African cat fish. Temperature levelranged between 27.03°C – 27.05°C which is still considered within the range of normal or roomtemperatureforfishbreeding.Thedissolvedoxygen(DO)concentrationrangedfrom3.1–4.7mg/Larestillverymoderate for thegrowth of thefingerlings.

Table 3: Physicochemical Parameters of Cultured *Clariasgariepinus*Fingerlings in the earthenpond

PARAMETERS	PEARSONSQUARE	AQUAFEED	WINFEED
Temperature(°C)	27.05±0.03	27.00±0.01	27.03±0.01
pH	7.59±0.02	7.63±0.04	7.58±0.01
DissolvedOxygen(mg/L)	5.95±0.05	6.10±0.10	6.20±0.00

Mean ± SE, n=3. Values with same superscripts letter(s) in the same row are not significantly different(P>0.05).

Carcass(drymatter)compositionofAfricancatfish(*Clariasgariepinus*)fedexperimentaldiets

Table4showstheresultsofcarcasscompositionforClariasgariepinusfingerlingsthatwerefedvariousexperimental diets. The analysis revealed that there were no significant differences in the crude proteincontent, ash content, and nitrogen-free extract of the fish carcasses among the groups (P>0.05). Amongthe diets, the highest crude protein content was observed in the AQUAFEED diet 32.18±0.29, while thepearson square diet had the lowest crude protein content 28.84±0.29. Notably, the initial fish had asignificantly lower crude protein content compared to the fish that were subjected to the experimentaldiets over the course of the study. In terms of nitrogen-free extract, the WINFEED group exhibited thehighestvalue25.94±0.78,whereastheAQUAFEEDgrouphadthelowestvalue22.83±0.78Zhang*etal*.(2018). Similar to crude protein, the nitrogen-free extract in the initial fish was significantly higher thanthatintheexperimentalfishthatwerefedthevariousdiets.Thereweresignificantdifferencesinthelipidcontent and moisture content of the fish among the experimental diet groups, this is in consonance withZulfahmi*et al*. (2022). The AQUAFEED group had the highest lipid content 18.57±0.49, while theWINFEED group had the lowest lipid content 12.15±0.49. Regarding moisture content, the WINFEEDgrouphadthehighestvalue15.41±0.51,whilethepearsonsquaregrouphadthelowestmoisturecontent10.72±0.51.

Table 4: Carcass (dry matter) composition of fed experimental diets on African catfish (*Clariasgariepinus*)

PARAMETERS	INITIAL	PEARSON SQUARE	AQUAFEED	WINFEED
Moisture	14.87±1.21[b]	10.72±0.51[a]	11.52±0.51[a]	15.41±0.51[b]
Crudeprotein	23.98±0.29[a]	28.84±0.29[b]	32.18±0.29[b]	29.62±0.29[b]
Crudelipid	6.16±1.32[a]	16.57±0.49[c]	18.57±0.49[c]	12.15±0.49[b]
Ash	16.20±2.55[a]	19.40±0.47[a]	15.45±0.47[a]	17.41±0.47[a]
NFE	38.78±0.84[b]	25.01±0.78[a]	22.83±0.78[a]	25.94±0.78[a]

Mean ± SE, n=2. Values with same superscripts letter(s) in the same row are not significantly different(P>0.05).

GrowthPerformanceandNutrientUtilizationof*Clariasgariepinus*FingerlingsFedExperimentalDiets.

InTable5,wepresentthegrowthandnutrientutilizationindicesobservedinthisstudy.TheinitialmeanweightIMWdidnotshowanysignificantdifferences(P>0.05)amongthegroups.ThehighestIMWwasnotedintheAQUAFEEDgroup7.15±0.08,whilethelowestwasobservedinthepearsonsquaregroup6.31±0.02.However,thefinalmeanweightFMW,meanweightgainMWG,andspecificgrowthrateSGRexhibitedsignificantdifferences(P<0.05)amongthegroups.TheAQUAFEEDgroupshowedthehighestvaluesforFMW 34.49±1.73,MWG27.34±1.66,andSGR2.18±0.05,whiletheWINFEEDgroupdisplayedthelowestvaluesFMW:22.22±2.05,MWG:15.58±2.03,SGR:1.67±0.12Fawoleal.(2022)corroboratetheoutcomeofthisstudy.Thefeedconversionratio(FCR)variedsignificantly(P<0.05)acrossthegroups,withthehighestFCRfoundintheWINFEEDgroup2.29±0.21andthelowestintheAQUAFEEDgroup1.67±0.09Furthermore,thefeedefficiencyratioFERandproteinefficiencyratioPERalsoexhibitedsignificantdifferences(P<0.05)amongthegroups.TheAQUAFEEDgrouphadthehighestvaluesforbothFER0.60±0.01andPER0.80±0.07,whereastheWINFEED grouphad the lowest valuesFER: 0.44±0.06, PER: 0.50±0.08.

These findings collectively demonstrate variations in growth and nutrient utilization indices among thedifferent diet groups in the study. The growth indices in this study revealed significant differences(P<0.05) in the mean weight gain and specific growth rate of fish fed experimental diets. The highestmean weight gain and specific growth rate were observed in the AQUAFEED group, followed by theWINFEEDgroup,whilethepearsonsquaregroupexhibitedtheleastgrowth.Thisdifferenceingrowthcan be attributed to the superior composition of AQUAFEED, which contains a high crude proteincontent of 44.01%. Previous research of Mansour *et al*. (2022) reported that some commercial feedsemit stronger odors and possess different palatability factors that enhance their acceptability to fish.This, in turn, increases the fish's feed intake, leading to improved growth. The findings of this studyalignwiththeresearchconductedbyShadyeva*etal*.(2022)whoobservedhighgrowthperformancein*Clariasgariepinus*when fed commercial-based feeds compared to fish fed locally formulated feedsusing the pearson square method of formulation. These results emphasize the importance of feedcompositionandquality ininfluencing thegrowthandperformance of fishinaquaculture,withcommercialfeedslike AQUAFEEDand WINFEEDshowingnotableadvantages inthis study.

Table 5: Growth Performance and Nutrient Utilization of *Clariasgariepinus*Fingerlings FedExperimentalDiets.

PARAMETERS	PEARSON SQUARE	AQUAFEED	WINFEED
InitialMeanWeight	6.31±0.02	7.15±0.08	6.64±0.02
FinalMeanWeight	24.02±1.46[a]	34.49±1.73[b]	22.22±2.05[a]
MeanWeightGain	17.71±1.44[a]	27.34±1.66[b]	15.58±2.03[a]
SpecificGrowthRate	1.85±0.08[a]	2.18±0.05[b]	1.67±0.12[a]
FeedConversionRatio	2.11±0.15[ab]	1.67±0.09[a]	2.29±0.21[b]
FeedEfficiencyRatio	0.48±0.05[a]	0.60±0.01[b]	0.44±0.06[a]
ProteinEfficiencyRatio	0.61±0.06[a]	0.80±0.07[b]	0.50±0.08[a]

Mean±SE,n=50.Valueswithsamesuperscriptsletter(s)inthesamerowarenotsignificantlydifferent(P>0.05).

Table5withinthisstudyprovidesacomprehensivebreakdownoftheingredientcostsforeachtreatment.Yellow maize, serving as the energy source, was procured from Farm Support Feed Mill in Akure.Vegetable oil was sourced from Oja Oba in Akure, Ondo State. The protein sources, which include fishmeal,soyabeanmeal,andgroundnutcake,wereacquiredfromFarmSupportFeedMillinAkure,OndoState. Cassavastarchwasobtainedfrom IsinkanMarketinAkure,OndoState,whilethevitamin/mineralpremix was sourced from Farm Support in Road Block, Akure. Significant differences (P>0.05) werenoted in the cost of fish meal across all treatment groups. The highest cost was observed in the pearsonsquaretreatment827.55±135.51,whilethelowestcostwasfoundintheAQUAFEEDtreatment456.30 ±65.40across thetreatments.

Table6:Costofingredientspertreatment

INGREDIENTS	PEARSON SQUARE(₦/kg)	WINFEED(₦/kg)	AQUAFEED(₦/kg)
Fishmeal	827.55±135.51[b]	594.00±65.40[a]	456.30±65.40[a]
Soybeanmeal	92.93±15.60[a]	112.00±22.10[b]	136.40±21.32[ab]
Groundnutcake	74.60±11.40[b]	112.50±14.49[a]	108.00±15.33[a]
Yellowmaize	60.15±1.08[b]	45.00±0.22[c]	45.00±0.22[c]
Veg.Oil	96.00±0.00[a]	96.00±0.00[a]	96.00±0.00[a]
Vit/MinPremix	50.00±0.00[a]	50.00±0.00[a]	50.00±0.00[a]
Starch	20.00±0.00[a]	20.00±0.00[a]	20.00±0.00[a]
TOTAL(TFI)	1221.23±23.94[b]	1029.50±14.74[a]	911.70±14.75[a]

Valueswithsamesuperscriptsletter(s)inthesamerowarenotsignificantlydifferent(P>0.05).

TFI:TotalCostofFeed Ingredients

The highest cost was associated with the AQUAFEED treatment, while the Control group had thelowest cost. Groundnut cake costs displayed significant variability (P>0.05) among the treatments,with the highest price recorded in the WINFEED treatment and the lowest in the pearson squaretreatment. Furthermore, there were significant differences in the prices of yellow maize across thetreatments,withtheWINFEEDandAQUAFEEDtreatmentshavingthelowestpricesandthepearsonsquare treatment having the highest cost. Conversely, the costs of vegetable oil, vitamin-mineralpremix,andstarchdidnotexhibitsignificantdifferencesacrossthetreatments.Themeantotalcostoffeed ingredients (TFI) per treatment also displayed significant differences (P>0.05), with the highesttotal cost observed in the pearson square treatment 1221.23±23.94 and the lowest total cost in theAQUAFEED treatment 911.70±14.75, Nankinga*et al*. (2022) made a similar observation in theirresearchon tilapiafeeding.

Table7: Costoffeedpreparation

Preparation	Locations	Cost(₦)
Transportation	Farmsupport,Roadblock	300
	Ojaoba	150
	Isinkanmarket	250
Grinding	Isinkanmarket	1000
Workmanship	Farmsupport,Roadblock	1700
TOTAL(TFP)		3400

TFP=Totalcostoffeedpreparation

Table8: Costoffeed

Ingredients	PearsonSquare(₦)	WINFEED(₦)	AQUAFEED(₦)
Fishmeal	827.55	594.00	456.30
Soybeanmeal	92.93	112.00	136.40
Groundnutcake	74.60	112.50	108.00
Yellowmaize	60.15	45.00	45.00
VegetableOil	96.00	96.00	96.00
Vit/MinPremix	50.00	50.00	50.00
Starch	20.00	20.00	20.00
TFP	3400.00	3400.00	3400.00
TOTAL(CF)	4621.23	4429.50	4311.70

TFP=Totalcostoffeedpreparation

Conclusion

The study found that water quality parameters remained within recommended ranges and did notadverselyaffectthegrowthofClariasgariepinusjuveniles.Thenutrientcompositionoftheexperimentalfishcarcasses(crudeprotein,lipid,ash,moisture,andnitrogen-freeextract)fellwithinacceptablelevels forthisspecies.Furthermore,utilizingAQUAFEEDforfeedingClariasgariepinusfingerlingsimprovedtheir growth and nutrient utilization compared to other feeding methods. Cost analysis revealed thatusing AQUAFEED was a cost-effective choice compared to Pearson square and WINFEED methods,reducing expenses while still meeting the nutritional needs of Clariasgariepinus fingerlings. Thesefindings suggest that employing AQUAFEED software can help reduce the reliance on imported fishfeed tailored for tropical fishes like the African mud catfish (Clariasgariepinus). This, in turn, couldenhanceproductivityandprofitabilityinNigeria'saquacultureindustrybyoptimizingcostsandnutrientrequirementswithout compromisingfeed quality.

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