Sudan University of Science and Technology

College of Production Animal Science

Section Sciences Fisheries and Wilde life

Effect of Different of Level Locust Meal on Growth Preformance of Nile Tilapia (*Oreochromis niloticus*) Fry

A research submitted in partial fulfillment for the requirement of the degree of B.Sc in Fishers and Wilde life

Submitted By:

- Abdlla Abaker Mohamed
- Asma Mohamed Alhfez
- Musa Esmeil Shoip Rahama

Supervised By:

Fawzi Ali Mohammed

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ا لآيــة

بسم الله الرحمن الرحيم

قال تعالى:

" وهوالذي سخر البحر لتأكلوا منه لحما طريا وتستخرجوا منه حلية تلبسونها وتري الفلك موخرا فيه ولتبتغوا من فضله ولعلكم تشكرون"

سورة النحل الآية(14)

DEDICATION

To our Fathers for Encouragements.

our Mothers their continuous encouragement and blessing

and to whom we are always indebtedours Brother,Sisters, relatives and Friends who Support us

To all love…….

ACKNOWL EDGMENT

Our great thank to Allah almighty, the most merciful who gave us the health, strength and patience to complete this study. Grateful thanks to our supervisor ustaz: FauziAlli Mohammed,, College of Animal Production Science and Technology, Department of Fisheries and Wildlife science for his guidance and supervision of scientific knowledge. Also our appreciations go to all teaching staff in the faculty of Science and Technology of Animal Production in department of Fisheries and Science and wildlife for encouragement and support. Finally our thanks go to our colleagues. Friends for their encouragement.

ABSTRACT

The present study was conduct at fish hatchery Institute of Fresh Water Fish Culture, Department of Fish Science and Wildlife, College of Animal Production Science and Technology. Sudan University of Science and Technology. The aim of this study was to determine the effect of different level of locust meal on growth performance and chemical composition of Nile tilapia *O.niloticus* fingerlings. Experimental culture units consisted of 8 plastic aquarium (45cm in length and31cm in height).Nile tilapia fingerlings was distributed randomly with stockingdensity 20 fish in any aquariumand the fingerlings adapted 3 days before of experimental begin. The fish were fed on 20%, 18%, and 15%and10% from body weight two times a day.Growth performance was evaluated basing one Specific Growth Rate (SGR), Food Conversion Ratio (FCR), Survival Rate (SR) and Daily Weight Gain(DWG)**were measured**.The **statisticalanalyzed** using **ANOVA** one way variance. The test was used to evaluate the mean differences among different treatments at the>0.05 significance level using SPSS(17).The result shows that growth percent highly in control (144.76)% but the(initial weight fish (g) , final (W), and weight gain) is low comported the control with (D1,D2 and D3). The growth performance the control highly in(ADWG(0.085),FCR(1.77),SGR(0.401), SR(98)%).

Keywords:locust,growth performance, diets, proximate composition**.** *O.nilotics*

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CHAPTER ONE
INTRODUCTION

1.1 Background of the study

Consumption is growing at the rate of 2.4% while the human population is increasing the rate of 2%.thus , the growth of the population is out pacing that of fish as food since 1980 creating increasing market demand. This has led to the over exploitation of capture fishing due to overcapacity and over fishing hence ,there is need for increased aquaculture production to supplement the capture fisheries and solve the market demand of fish and fish products The species selected to portray yield potential in Africa for aquaculture production are Nile tilapia(*Oreochromisniloticus*),common carp and cat fish it is also favored for controlling tilapia recruitment because it fetches higher market prices than other police species., (*FAO ,2009)*

Also known as aquafarming it the farming of fish,crustaceans,mollusk and aquatic plant ,alge and other aquatic organisms- Aquacuture involves cultivating fresh water and saltwater population under controlled condition, and can be commercial fishing which is the harvesting. Mariculture refers to aquaculture practiced in marine environments and in underwater habitats (*Jhingran, 2001).*

1.2 Study problem

Traditionally, fishmeal has been used as the major protein source in fish feeds because of its nutritional value and palatability. However, due to the limited world supplies and increasing price of fishmeal, fish farmers in the developing world cannot afford the expensive fish feed. Alternative plant protein sources are generally cheaper compared to animal protein sources. The shortage in world production of fish meal (the main conventional protein source) coupled

with increased demand for fish meal in feeds for livestock and poultry is likely to reduce the dependence on fish meal as a single protein source in aqua feeds. Fish nutritionists have made several attempts to partially or totally replace fish meal with less expensive, locally available protein sources.

1.3 Justification

Locusts, like many insects, are an excellent source of protein, according to the book, insects. Some ssp of locusts vary in protein content from abut50percent of dry weight to almost 60% percent, making them denser in protein than cows. The protein of some spp of locust is not considered complete because it is missing the essential amino acid**.**Locust meal could replace fish meal up to25% in isoproteic diets of Nile tilapia fingerlings without an adverse effect on the nutrient digestibility, growth performance, and hematological parameters.

1.4 Objectives:

1. To determine the effect of different level of locust meal on growth performance of Nile tilapia *O.niloticus* fry.
2. To determine the effect of different levels of locust meal on chemical composition of studied fish.
3. To determine some water quality parameters during treatment and feed prepared.

CHAPTER TWO

LITERATURE REVIEW

2.1Aquaculture of Nile tilapia

Aquaculture of the Nile tilapia (*Oreochromisniloticus*) dates back to ancient Egypt. Because of the dark color of their flesh, that is undesirable for many costomers,and because of the reputation the fish has as being atrash fish and fast growing and produce good fillets.,(**FROESE**&**PAULY** ,**2015**,).

Scientific classification(**Linnaeus**, **1758**)

Kingdom:Animalia

Phylum: Chordate

Order: Perciformes

Class:Actinopterygii

Family:Cichlidae

Genus:Oreochromis

Species:O.niloticus

The culture of Nile tilapia (Oreochromisniloticus) can be traced to ancient Egyptian times as depicted on bas-relief from an Egyptian tomb dating back over 4000 years, which showed the fish held in ornamental ponds.In1978 Nile tilapia was introduced to China, which leads the world in tilapia production and consistently produced more than half of global production in every year from 1992 to2003 the uncontrolled breeding of Nile tilapia in ponds, which led to excessive recruitment. The development of hormonal sex-reversal techniques addition research on nutrition(**Rickman**, **2001**).

Nile tilapia is tropical species that prefers to live in shallow water. The lower and upper lethal temperatures for Nile tilapia are 11-12 C°and42 C°,respectively, while the preferred temperature ranges from 31 to36 C°. (**Barki**, **2005**).

The brooding is accomplished in 1 to 2 weeks depending on temperature Sexual maturity in pond is reached at an age of 5-6 months. Spawning begins when the male establishes territory, digs craterlike spawning nest. The ripe female spawn fertilization by the male, collects the eggs into her mouth and moves off.the female incubates the egg in her mouth and broods the fry after hatching until the yolk sac is absorbed incubating (**Tacon,2010**).

Hormones are not used to induce spawning, which occurs throughout the year in the tropics and during the warm season in the subtropics. Breeding is conducted in ponds, tanks, or hapas the stocking ratio for females to males is 1-4;1 with 2 or 3;1 begin the most common.cmmercial tilapia production generally requires the use of male monosex population.,(**RANA** ,**1986-200**).

Male tilapia grow approximately twice as fast as femals therefore,mixed –sex population develop large size disparity among harvested fish which affects marketability.if female tilpia receive male sex hormone(17a methyltestostron ,MT) in their feed they will develop as phenotypic males.,(**HALLER**,**1982-2003**).

Pond culture of tilapia is conducted with variety of inputs such as agricultural. Annual fish yield using tilapia in polyculture with carps, high levels of culture by products and good stock management ormoculture in pond ,tank ,cage ,and raceways of varying sizes and density.,(**SAYD2006**).

Tilapia culture system known as acombined extensive-intensive system or dekel system recycles water between culture tank and large earthen reservoir ponds which serve as biofilters to maintain water quality.,(**PARKER2011**).

2.2 Nile tilapia feeding

The Nile tilapia juveniles do not have acces to live food disply morphological digstvesystem is aspecies of tilapia,a cichlid fish native to Africa from Egypt suth to east and central Africa- the Nile tilapia fry and fingerlings is an amnivore that feeds on plankton and aquatic plants in wild but in aquaculture the feed formulation by using ingredients.,(**FAO 2003**).

Good nutrition production systems is essential to economically producevahealthy,high quality product infish farming ,nutrition is critical because feed represents '40-50''percent of the production costs.

Understanding of the nutritional requirements for various fish species and technological advances in feed manufacturing ,have allowed the development and use.,(**WINFREE***R*..**A''1992**).

prepared feed that provide acmpleteditet(adequate protein ,lipds ,carbohydrate ,vitamins and minerals are readily available in developed countrie and are also manufactured and available in developing countries with an export market for high quality tilapia products. Some of the main feed ingredients such as soybean meal or fish meal my be imported.prepared feeds are often too expensive for the production of tilapia sold in domestic markets in developing countries.,(**FOA ,2017**).

Complete harvests are necessary in ponds and are accomplished by sining or nets in combination with draning.

Tilapia must be tested for flavor before they will be accepted for processing and marketing in developed countries.,(**FITZSI,MMON**,**1997-2014**).

Diseases can often be avoided by maintaining ahigh quality environment and reducing handiling stress and water contamination.

The major disease problem affecting Nile tilapias are included:

-Bacterial disease

-fungi disease

-parasite disease

-Viral disease.,(**FAO**,**2016**).

Tilapia are produced most economically in tropical countries,which have favourable temperatures for growth.nile tilapia were introducd to developing countries and cultured on subsistence level to meet local protein needs. Ass production techniques improved into the mainstream seafood markets of thesecountries.,(**WWW**.**seafdce**.**org**.**ph**).

2.3 Animal protein in fish nutirion

The most exepensive part of fish feed,it is important to accurately determine the protein requirements for each species and size of culture fish.

Proteins Fish and niletilapia nutrition has advanced dramatically in recent years with the development of, new,balanced commercial diets that promote optimal fish growth and health.,(**HOULIHAN2001**)

The development of new species –speciffic diet formulations supports the aquaculture industry as it expands to satisfy increasing demand for affordable,safe,and high- quality fish and sea food products.

Nutrients essential to fish are same as those required by most other animals.

These include water, proteins lipids,carbohydrates,vitamins and minerals.in addition,pigments .,(**TOM**&**VAN1993**).

In their natural environment fish have developed a wide variety of feeding specializations and physiological to acquire essential nutrients and utilize varied food sources.based on their primary fish are classified, as carnivorus,herbivorous,or omnivorus.,(**TONCI1993**).

Increased areformed by linkages of individual amino acids. Although over 200 amino acids occur in nature,only abut 20 amino acids are common.

Of these10 are essential amino acids cannot by synthesized by fish the are [methionine,arginine,threonine,tryptophanb ,histidine…et.

Protein levels in aquaculture feed generally average in tilapia 38-42% cat fish 32-38% for 28-32% in shrimp marine.

Protein used for fish growth if adequate levels of fate and carbohydrates are present.

Protein are composed of carbon 50.5%, nitrogen 16% oxygen 21.5% and hydrogen’’6.5%.,(**SADASIVAM**,**2009**).

Fish meal

Fish meal is acommercial poroduct mostly made form fish that are not generally use for human.the benefite of fish meal in Aquaculture dites the fish meal carries large quantetities of energy par unit weight and is an excellent source of protein, lipds ,minerals ,and vitamins.,(**JACOBS**,**2017**).

In the UK the term fish meal means aproduce obtained by dring and grinding or otherwiste treating fish or fish waste and any fish or shellfish and used in compound foods for poultry, pigs ,and farmed fish. Manufacturing fish meal and process diagram cooking ,pressing , press liquor ,drying ,grinding and bagging and storage and transport.,(**FAO**,**2001**)

Any complete dite must contain some protein,but the nutritional value of the protein relates directly to amino acid composition and digestibility. High quality fish meal normally contains between 60%&70% curde protein by weight.Typical dites for fish many contain form 32% to45% total protein by weight.

Fish meal used in compound feed in poultry feed and farmed fish or aquaculture.,(**CHAPMAN**,*2015*) .

Fish meal is ahighly regarded source of protein with an excellent composition of essential amino acids,and oil long –chain omega -3 fatty acids.,(**OLSEN**&**HUSAN**,**2012**).

Blood meal

Blood meal is adry ,inert powder made from blood used as high- nitrogen organic fertilizer and high protein animal feed it ususully comes form cattle or hogs as slaughterhouse by product.,(**HEUZE**,**2016**).

Blood meal can be used as a livestock dietary supplement and is mainly added to supply dietary lysine for cattle, fish and poultry.,(**FAO2007**).

Bone and meat meal

Product of the rendering industry. It is typically abut 48-52%protien ,33-35% ash , 8-12% fat ,and 4-7% moisture.it is primarily used in the formulation of animl feed to improve the amino acid profile of the feed used in united states as low-cost and Europe canters.,(**BRIGHAM**,**2012**).

Bone meal or bone manure is amixture of finely and coarsely ground animal bones and slaughter-house waste products.It is used as an organic fertilizer for plants and as anutritional supplement for animals.

Bone meal is primarily used as a source of phosphorus and protein and bone meal used as a human dietry calcium.,(**DAVID&WILSON** ,**2011**).

Shrimp meal

The shrimp meal or shrimp waste is higt protein continte(70%) used in fish dite formulation and human food and medicing .,(**HEUZE**&**TRAN**,**2015**).

-Locust meal

Like other insects are highly nutritious and contain large amounts of protein used in poultry feeds and aquaculture of tilapia.

Locust and other Orthoptera used for livestock feeding are fed live to free-range chickens,pets and zoo animals but dried and ground for braoilers and fish.,(**HEUZE**,**V**,**2016**).

Chemical analysis of locust revealed high (85)%curde protein contents with low lysine and the locust meal nine of dites based on sorghum grains of protein supplements from locust ,super concentrate.,(**SALIMGIBREEL ,2002).**

In a 9-wk study ,replacing 25% of locust meal protein in rainbow trout diets not affect the weight agin and conversion ratio.,(**ST-HILAIREETAL**.,**2007a**)

In cat fish 25% replacement of locust meal and fish meal no significant difference in the growth index and immunity index compared with the control grup.,(**ZHAGETAL**,. **2014**).

Locust meal could replace fish meal up to25% in isoproteic diets of nile tilapiafengerlings without an adverse effect on the nutrient digestibility,growthperformance,and hematologicalparameters.,(***ABANIKANNDA***&EMEHINAIYE,2012).

2.4 Locusta

Locusta are certain spp of short horned in the family acrididae that have aswarming phase . These insects are usually solity but under certain circumstances become more abundant and change their behavior and habits becoming gregarious .No taxonomic distinction is made between locust and grasshopper spescises.,(**STEPHEN**,**2003***)*.

Several cultures throughout the world consume insects and locusts are considered adelicacy and eaten in many African, middle eastern,and asian countries .

They have been used as food throughout history.thy can be cooked in many wise but are often frid ,smoked,or dried.,(**HEBBLETHWAITE2013**).

protein

Locusts,like many insects,are an excellent source of protin. According to the book,, insects.somessp of locusts vary in protein content from abut50percent of dry weight to almost 60% percent,making them denser in protein than cows.the protein of some spp of locust is notconsidered complete because it is missing the essential amino acid., **(STEV,2011*)*.**

Fat

The percentage of fat in desert locust is lower than their percentage of protebein,but still areasonablesurce at almost 12% percent.theprcntages of saturated and unsaturated fatty acids are 44% percent and 54% percent,respectively.palmiteic,oleic and linlenic acids.the cholesterol in locusts is high,abut''286'' milligrams per 100 grams, which is higher than that found in meat or poultry.,**(JOURNAL ,2001*)*.**

Other nutrients

Locusts also contain adequat amounts of iodine ,phosphorus,iron,thimine,riboflavin,niacin, and carbohydrate levels are very low in locusts.,**(JOURNAL,2001).**

The desert locust;'

Scientific classification; **(FORSSKAL1775)**.

Kindom:Anmalia

Phylam;Arthropda

Class; Insec

Order.;Orthoptere

Family; Acididae

Genus; Schistocerca

Locust desert

The desert locus is aspecies of locust plagues of desert locusts have threatened agricultural production in Africa ,the middle east and asia for

Centuries.the locust desert situatuation is currently .low numbers 0f solitarious adults are present in Mauritania,morocco,Algeria,Egypt and iran.the situation it used to be common in europ but has now become rare there.baecause of the vast geographic area it occupies,which comprises many different ecological zones ,numerous sub,ssp,have been described.,(**ERIC** ,**200***).*

.locust aer one of the worled ,smost devastating peste.akind of metamorphosed grasshopper,they can eat their own weight evreday and can invade all or parts of 65 countries form weast Africa to india to austraalia,affecting 20 percent of the of the earthe,s land. in2008,locust swarm neary seven kilometers long plagued Australia.,(ROBERT,**1969**)

locust are eat pretty much anything grains, fruits,vegetables,leaves when people throw blankets.unfortunately for people that live in locust-plagued regions the some consist desertusa. com. ,(**LIFE**; **UNITED NUATION GLOBAL DESERT).**

people who are victims of locust attacks often also eat locusts.when swarms swoop down people scoop them up off the grund or collect them in nests or baskets cook them in boiling water.they are an excellent source of protein.thejewishthalmud recommends eating them from time .the bible classifies locusts and grasshoppers as clean'' after locusts and raid crops often there is nothing else to eat and thus people have tradinonally eaten them during locust-exacerbated famines.according to the exoford companion to food by alanDavidson,locusts can taste like the yellow of aboiled egg'' or not unlike whitebait that somehow, have been suffed with buttered toast locusts frid in oil aer said to taste like shrimp.in poor countries locusts can be made into toys. Children sometimes make belts of dead locusts and attch strings to live ones and let them fly around like toy airplanes.,(*GEFFREYHAYS,2005*).

locusts can stay aloft 17 hours at atime ,and if the winds are strong enough the can range 3,000 miles in their lifetime.,(*NEWYORKERTIME,2011*).

Life cycle;

The life cycle of the desert locust consists of three stages,the egg the hopper and the winged.

Copulation takes place when amature male hops onto the back of mature femaland grips her body with his legs.

Sperm is transferred from the tip of his abdomen to the tip of hers where it is stored.the process takes several hours and one insemination is sufficient for anumber of batches of eggs.

The female then seeks suitable soft soil in which to lay her eggs.

After the fifth moult the insect is said to have fledged but it is not yet mature.it is at first soft and pink with droopiny wings, but over te course of afewdays,thecutuicle hardens and haemolyph is pumped wings which stiffen them. (**HARDOUINet**,.**Al**,**2003**).

Maturation can 0ccur in tow to four week when the food supply and weather conditions are suitable,but many take as long as six months when they are less ideal.mals start matuering first and give off an odour which stimulates maturation in the females.on maturing the insects turn yellow and the abdomens of the females start swelling with developing eggs.,(**FAO**,**2004***)*.

Ecology;

Desert havetowphases,the solitary phase,and the gregarious phase.this is atype of polyphenism .

The change from an innocuous solitary insect to voracious gregarious one normally follows aperiod of drought when rain falls and vegetatation flushes occur in major desert locust breeding location .

Locust can cover from 100 to200 kilometer in aday,will fly up to abut 2,000 meters above sea level,.(**LINDSEY**,R.**2002**).

-Crop loss

it is estimated that desert locusts consume the equivalent of their body weight 2g(0.07 oz).Each day in green vegetation ,they are polyphagous and feed on leaves ,shoots,flowers, fruit,seed,stems and bark.nearly all crops,andnoncrop plants, are eaten including pearl millet,maizesorghum,barely rice ,pasture grasses,sugarcane,cotton,fruittrees,date palms ,banana plants,vegetables and weeds.,(**HAGELE*B*.F**,**1999***)*.

damge and losses cused by locusts;

locusts have probably been an enemy of man ever since he began to grow crops .the desert locust is mentioned in ancient writing such as the old testament of the bible and the Koran.

Locust are still ageat enemy of the farm and in some countries thy are the determining factor between sufficient food for the people and starvation.damge is sometimes diffuse and not very obvious,but it can be very severe in many more restritedaeras .this depends on whether the warms are moving about quickly or wether they stay for several days in one area.,*(***DEFOLIART**,**RAMUS**,1997- *2013).*

Dry the locust meal as protin supplement in broilediteand to detect the effect of feeding locusts killed by insecticide dursban on the apparent performance of broilers .chemical analysis of locust revealed high 85%crud protincontens with low 1.97 lysin.,(**SULIMAN** .*G*,**2015**).

.we manufacture alarge rang of high quality protein rich insect powders from whole crickets,locusts,locust flour can be used in anumber of ways, for example energy bars,used in nutritional conten of any food .protien content of locust flour is higher it contains approximately 78% protein.locusts are high protein and olso zinc and iron.,(**CODELIA** ,**2013**)

In 1958,thelocust invasion of Ethiopia resulted in losses of'' 50-150''thousandtones of cereals in less than six months,equivalent to the annual cereals requirement of abut on million people.,(**BIDOCHKA**,**1991***)*

'.locusts could beneficial effects as source of protein compared to fish meal in animal tations.,(**'DAS**,**2010***)*

analyzed the locusts,schistocercagregaria for useboth as food an fertilizer ,the locust have 61:75 protine and 16:95 fat.

The locusts and other orthroptera used for livestock feeding to free-range chicken,pets and zoo animals but dried and ground for biloers and fish. ,
(**KHUSROetal**.,**2012**).

Proximate composition of desert locust according to (AA.C, 1999)

Fat	Crude protein	Ether extra
49%	52.30%	12%

CHAPTER THREE

MATERIAL AND METHODS

3.1 Study site

The present study was conduct at fish hatchery Institute of Fresh Water Fish Culture, Department of Fish Science and Wildlife, College of Animal Production Science and Technology. Sudan University of Science and Technology.

3.2 Materials

-femur

--Plastic aqurea

garble of ingredient(

-heater of water

-waterspout

-flask-decanter

-Water quality kits

-Proximet analysis inculud(caldhll,sucselte, dry oven, funl, descatr….et).

3.3 Experimental design

Experimental culture units consisted of 8 plastic aquarium (45cm in length and31cm in height).Nile tilapia fingerlings was distributed randomly with stockingdensity 20 fish in any aquariumand the fingerlings adapted 3 days before of experimental begin.

The fish were fed on 20%, 18%, and 15%and10% from body weight two times a day.

The siphoning of the water daly in aquaria by smoll water spout-wast and feed and the time of feeding in the day 3 time 9:12:4 and 2 time in some days according of wither condition and climate patrtcly of tmpurter.

The sampling in the experimental aftuor each 10 days (inculoding water quality and fish body wight in any aquaria.

3.4 Experimental fish

The fish(spp) using of nile tilapia(*O.niloticus*) fry from fish hatchery in animal prodcion and vetrenry collge. Age of the fry 3 weeks.

3.5 Table (1): formulation and composition of the experimental diets:

Ingredients%	Control	D1	D2	D3
Fish meal	30g	20g	15g	-
Locust meal	-	10g	15g	30g
Wheat bran	20g	20g	20g	20g
Ground cake	21g	21g	21g	21g
Breed floor	10g	10g	10g	10g
Starch	10g	10g	10g	10g
Min-mix	40g	40g	4g	4g
Vig-oil	50g	50g	5g	5g

chemical Analysis for ingredients of diets:

Treatments	Moisture%	D.M%	Ash%	C.p%	E.E%	N.F.E%
Control	79.50±2.12	96.5±_2.12	12.0_±0.00	30.6±_0.14	3.6±0.07	44.7±_1.06
D1	5.50±0.71	94.5±0.71	13.5±0.71	30.3±0.28	3.6±0.07	47.8±_2.05
D2	5.50±0.71	94.5±0.71	11.5±0.71	30.7±0.21	3.1±0.21	46.9±0.35
D3	5.0±0.00	95.0±0.00	13.5±0.71	30.7±0.28	3.6±0.07	42.7±3.34
Locust	5.0±1.41	95.0±1.41	5.5±0.71	28.8±0.14	5.9±0.14	53.8±0.98

3.6 Water quality measurement

PH,Nitrate, Nitraite and ammonia wereestimated byaqua solkits during the experimentalperiod according to APHA (1995).Physico- water as follows:

.1. PH:

1. Fill a clean test tube with 5 ml of water to be tested (to the line on the tube).

2. Add 5 drops of High Range pH Test solution, holding dropper bottle upside down in a completely vertical position to assure uniformity of drops.
3. Cap the test tube and invert tube several times to mix solution.
4. Read the test results by comparing the color of the solution to the appropriate High Range pH Color Card (choose either freshwater or Saltwater). The tube should be viewed in a well- lit area against the white area of the card. The closest match indicaters the pH of water sample. Raise the test tube with clean water after use.

3.7.2 Nitrate (NO_3^-):

1. A clean tube with was filled with 5 ml of water to be tested (to the line tube).
2. 10 drops from Nitrate Test Solution Bottle #1 was added, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
3. The test tube was capped and inverts tube several times to mix solution.
4. Vigorously shake the Nitrate Test Solution Bottle #2, for at least 30 seconds. This step is extremely important to insure accuracy of test results.
5. Now add 10 drops from Nitrate Test Solution Bottle #2, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
6. Cap the test tube and shake vigorously for 1 minute. This step is extremely important to insure accuracy of test results.
7. Wait 5 minutes for the color to develop.
8. The test results were read by comparing the color of the solution to the appropriate Nitrate Color Card (use the fresh water color card). The tube

should be viewed in a well – lit area against the white area of card. The closest match indicates the ppm (mg/l) of Nitrate in the water sample. Rinse the test tube with clean water after use.

3.7.3 Total ammonia (NH_3/NH_4)

1. A clean tube was filled with 5 ml of water to be tested (to the line tube).
2. 8 drops from Ammonia Test Solution Bottle #1 were added, holding the dropper bottle upside down in a completely vertical position to assure uniform drops.
3. Add 8 drops from Ammonia Test Solution Bottle #2, holding the bottle upside down in a completely vertical position to assure uniform drops.
4. The test tube capped and shaked shake vigorously for 5 seconds.
5. Wait 5 minutes for the color to develop.
6. The test results were read by comparing the color of the solution to the appropriate Ammonia Color Card (use the fresh water color card). The tube should be viewed in a well – lit area against the white area of card. The closest match indicates the ppm (mg/l) of ammonia in the water sample. the test tube was rinsed with clean water after use. Analytical methods:

.2. Moisture content determination

The samples were first weight (initial weight) then dried in an electric oven at 105c for 24 Analytical methods:

The -30 hours to obtain a constant weight. The moisture content was calculated as follows.

Moisturecontent=initial weigh__-_dry weigh×100

Initial weight

3.crude protein Determination:

The kjeldal method for estimation of nitrogen was applied –nitrogen content was converted to protein percentage by multiply 6.25 follows.

Protein%= _va- vb×n×14×6.25×100)

100×wt

Whereas:

Va=volume of HCL used in titration

Vb=volume of sodium hydroxide

14=conversion factor of ammonium sulfate.

6.25= conversion factor of nitrogen to protein

Wt=weight of sample

N=normality of(NaoH)

3.3.3 Ash content Determination:

Ash was determined by heating 1gm at5500c in muffle furnace until a constant weight was obtained. Ash content percentage was given by the following formula:

Ash= ash wieght×100

Sample weight

3.7 Growth performance analysis:

Growth performance was evaluated basing one Specific Growth Rate (SGR), Food Conversion Ratio (FCR), Survival Rate (SR) and Daily Weight Gain(DWG) using the formulae below:

SGR = (In final body weight - In initial)

Body weight/time (days)] X 100

FI= fish weight x feeding level /100,

FCR= Feed consumed / Weightgain

WG = FBW (g) - IBW (g)

3.8 Statistical Analysis:

Results were expressd as means +_standard deviation (**SD**) .data were statistically analyzed using **ANOVA** one-way analysis of variance. Comparisons among means were made by (**LSD**) when significant F-values were observed (**p<0.05**), using SPSS version (21).

CHAPTER FOUR

RESULTS

Table (2): Growth performances of different treatments fed with feed contain difference level locust meal.

Parameters Treatments	Initial weight (g/fish)	Final weight (g/fish	Weight gain (g/fish)	Growth percent %
Control	7.91±0.37[c]	11.41±0.62[b]	3.50±0.95[a]	144.76±14.32[a]
D1	6.70±0.48[d]	9.30±0.48[d]	2.60±0.05[b]	139.01±4.01[a]
D2	10.81±1.83[a]	14.46±2.18[a]	3.64±0.99[a]	134.23±9.40[b]
D3	8.36±0.65[b]	10.60±0.69[c]	2.24±1.13[b]	127.78±16.18[c]
[a,b,c,d]Means values in the same column with superscripts are significantly different at level (P<0.05)				

Table (3): Growth performances of different treatment fed with feed contain difference level locust meal.

Parameters Treatments	ADWG	FCR	SGR	Survivor rate %
Control	0.085 ± 0.03^{b}	1.77 ± 0.023^{b}	0.401 ± 0.10^{a}	98^{b}
D1	0.065 ± 0.003^{c}	2.38 ± 0.05^{a}	0.360 ± 0.031^{b}	100^{a}
D2	0.091 ± 0.025^{a}	1.72 ± 0.52^{b}	0.320 ± 0.007^{c}	100^{a}
D3	0.056 ± 0.002^{d}	2.76 ± 0.35^{a}	0.260 ± 0.13^{d}	100^{a}
^{a,b,c,d}Means values in the same column with superscripts are significantly different at level ($P<0.05$)				

Table (4): hydro chemical parameters of water quality of different treatments.

Parameters Treatments	PH	No_2	No_3	NH_4	Temperature
Control	7.7 ± 0.34^{b}	2.0 ± 0.00^{a}	160.0 ± 0.00^{a}	1.39±0.27b	30^{a}
D1	7.7 ± 0.50^{b}	1.21 ± 0.80^{b}	7.57 ± 1.86^{b}	1.96 ± 0.83^{b}	30^{a}
D2	7.8 ± 0.47^{b}	1.04 ± 0.71^{b}	4.0 ± 0.00^{c}	2.11 ± 0.79^{a}	30^{a}
D3	8.27 ± 0.35^{a}	1.36 ± 0.67^{b}	4.0 ± 0.00^{c}	1.07 ± 0.71^{b}	30^{a}
^{a,b}Means values in the same column with superscripts are significantly different at the level ($P<0.05$)					

Table (5): illustrate the proximate chemical of Nile Tilapia fryfed with feed contain difference level of locust meal.

Treatments	Parameters					
	Moisture %	D.M%	Ash %	C.P%	E.E%	N.F.E%
Control	79.50±2.1[a]	18.0±5.66[c]	3.05±1.34[c]	31.9±0.00[a]	7.1±0.07[a]	37.1±2.83[a]
D1	72.0±2.82[c]	28.0±2.83[a]	4.6±0.77[a]	31.4±0.14[a]	6.7±0.14[b]	29.1±4.03[c]
D2	73.0±2.83[b]	27.0±2.83[a]	4.0±0.00[a]	31.0±0.14[a]	6.6±0.07[b]	33.5±5.44[b]
D3	74.5±2.12[b]	25.5±2.12[b]	2.0±0.00[b]	30.8±0.12[b]	7.0±0.07[a]	34.9±1.84[b]

[a,b,c] **Means in the same column are significant different at the level ($p<0.05$)**

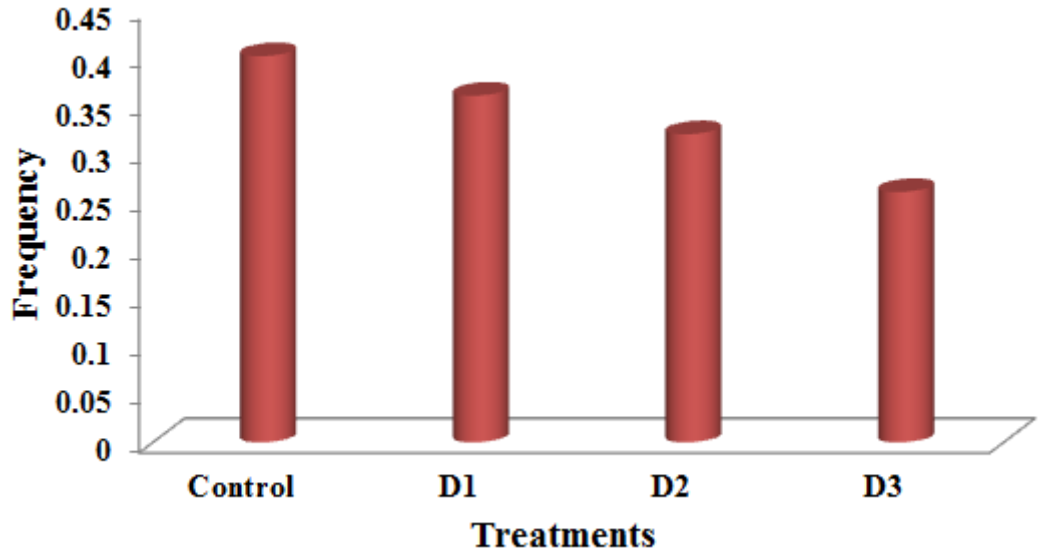

Figure (1): illustrate the FCR for different treatments

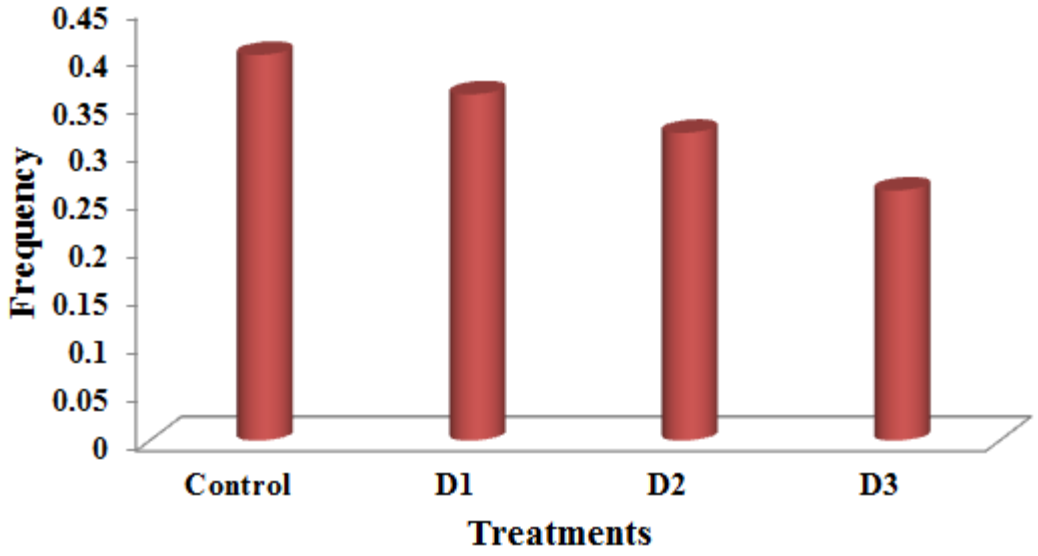

Figure (2): illustrate the SGR for different treatments.

CHAPTER FIVE

DISCUSSION

Unlikely to have had adverse effect on the growth of fish in this study. Temperature is also very vital for optimum growth to be achieved in aquaculture facilities because it affects feeding, growth and maturation of fish. The mean temperatures recorded over the study period were 30˚C. The growth of juvenile in tropical area is highest at temperatures between 28-30˚C (**JOBLING 1993**). The temperature in the culture water was within the optimum range for fingerlings tropic char and this is likely to have an effect on the growth of the fish.

5.1Growth performance

Results in Table **2** and **3** indicated that final body weight (BW), weight gain (WG) and specific growth rate (SGR) of O. niloticus increased with dcreasinginfrygrowth The diet supplemented of locus meal level showed the highest significantly ($P<0.05$) BW, WG and SGR when compared to control groups. Such increase in the growth in aquatic animals that were fed probiotics supplemented diets may be attributed to the improved digestive activity due to enhancing the synthesis of locust dietes (**DING et al. 2004**).

The hightest final BW, WG and SGR were recorded vauluo fish that were fed with D1 containing 10% locust meal .The higher one was shown by fish that were fed the control diet (D2) which contain 15% locust meal this result agree withthe study of**YE et al., 2011)**in diets containing different levels of locust meal (increased in body weight about 50%, 59% and 53%, respectively and improved SGR and FCR in comparison with the control group.

5.2 Proximate analysis

Proximate analysis of O. niloticusfry fed with feed contain difference level: of locust meal showed significant difference in moister, dry mater, Ash, Crude protein Ether extract and Nitrogen free extract ($P<0.05$) fry made a significant divedual in fish body protein content when compared to the control, D1 and D2, D3 (**31**) % but decreased in D3 group (**30**) %these result was in the same line with (Ogata& Shearer, 2000) who stated that chemical composition of fish can be affected by many factors, including species, environmental conditions, fish size, level of protein in the diet, and feeding rate.

CHAPTER SIEX

RECOMONDITION ANDCONCLUSIONS

6.1 Conclusion:

The results obtained from the present study clearly indicated that the supplementation of locust meal enhanced the growth performance and feed utilization ofNile tilapia (O.niloticus), fry Moreover of locust meal has effect on the chemical composition.

6.2 Recommendation:

- Further studied will be needed to determine blood hematology of studied fish.
- Further studied were needed to determine blood immunology response of studied fish.
- Further studied were needed to determine locust meal on enzyme digestion of the studied fish.

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