People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
Ibn Khaldoun University –Tiaret-
Faculty of Nature and Life Sciences
Department nutrition and Agri-food Technology

End of studies dissertation
In view of obtaining the Master's degree

Field: Nature and Life Sciences
Sector: agronomic science
Specialty: Animal production

Title

Study of the effect of diet on the zootechnical performances of red tilapia *(Oreochromis sp*)

Presented by

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July 2023

Acknowledgements

Above all, wethank Almighty God for giving us the courage and patience to complete this work.

Our heartfelt thanks and deep gratitude go to our supervisor Dr. Achir for his help, guidance, patience and availability.

We would also like to thank the members of the jury who agreed to judge this work and to devote their time to its reading.

Finally, we would like to thank everyone who contributed to the development of this work.

Ferial & Imane

Dedication

With the help of God Almighty, who traced the path of my life, I was able to carry out this work that I dedicate:

My whole family without exception, and especially

***My Cristina** my mom who gave me life, in the light of my soul, who sacrificed herself for my happiness and my success , thank you for your presence in the moments that were most difficult for me, I love you*

***My brother Houari** no dedication smiled be eloquent enough to express what you deserve, I wish you a future full of health, happiness of success and serenity.*

***Imane Sabah Meriem Soumia** words are not enough to express the attachment, love and affection I have for you, my Sisters, I wish you a happy life.*

My teachers:Dr.Achir ,Dr.Taibi, Dr.Tadj,Dr.Souana,Dr.Bousaid

Ferial

With GOD's help and virtueI dedicate this dissertation to the incredible individuals who have beenpillars of support and inspiration throughout my academic journey.

my parents, who have played an important role in my entire career and life "BOUSSADJRA AEK ...KHATIR Laabdia".my brothers and my sisters GOD bless you I love you to the moon and back

I would like to thank ME for the effort I have made. On my own faith , I want to thank me for believing in me , for being ME all the time .

I would like to thank my friend my partner in this experience "Berrabeh ferial" thank you for being there for me all the time. six years of adventures . u became a member of my family

I dedicate this success to the woman who believed in me and helped me discover my abilities "KOUachi sabah". Your place in my heart is irreplaceable.

I want to thank my friends Soumia... Meriem... Maroua and Manal, sanding you all the love and affection.

my special thanks and appreciation of my gratitude to my teacher and my supervisor Professor **ACHIR Mohammed**. I want to thank him for standing next to us, for his patience... and sincerity in his work.

I want to give special thanks to Professor **TAIBI Khaled**, who has given us the information he has. For his diligence, thank you so much.

Professor **TADJ, SOUANA** and **BOUSSAID** a dedication full of gratitude for your permanent presence with us and your great positive support... thank you

I would like to thank the teacher who stood by my side since my first day at the University for the protection and backing he gave me **Mr. FETTOUHI**

A special dedication to Mr. **BENAISSA Toufik** for his important role in the university and his interest in all students and their moral, education needs. Thank You for being There for us god bless you.

Imane...

Résumé

Cette étude vise à tester les aliments fabriqués à partir de produits et de sous-produits locaux (fèves, son de blé, huile d'olive, maïs, œufs, levure, soja) en les incorporant dans les régimes de tilapia tout en étudiant leurs effets sur la performance zootechnique.
pour cela, nous proposons cette méthode comparative entre un aliment fabriqué et un aliment témoin (ONAB). Les résultats de recherche obtenus montrent un lien entre des paramètres de croissance tels que le gain de poids.la meilleure performance de croissance observée chez les poissons nourris avec des aliments ONAB.

Mots clés : tilapia-aliment-performance zootechnique-gain de pois

Abstract

This study aims to test foods made from local products and by-products (beans, wheat bran, olive oil, corn, eggs, yeast, soybeans) by incorporating them into tilapia diets while studying their effects on zootechnical performance.
For this, we propose this comparative method between a manufactured food and a control food (ONAB). The research results obtained show a link between growth parameters such as weight gain. The best growth performance observed in fish fed ONAB feed.

Keywords- tilapia- food - zootechnical performance - weight gain

ملخص

تهدف هذه الدراسة إلى اختبار الأطعمة المصنوعة من المنتجات المحلية والمنتجات الثانوية (الفاصوليا ونخالة القمح وزيت الزيتون والذرة والبيض والخميرة وفول الصويا) من خلال دمجها في حميات البلطي أثناء دراسة آثارها على الأداء الحيوان لهذا، نقترح طريقة المقارنة هذه بين الغذاء المصنع وغذاء التحكم
تظهر نتائج البحث التي تم الحصول عليها وجود صلة بين معلمات النمو مثل زيادة الوزن. أفضل أداء نمو لوحظ في الأسماك التي تتغذى مع طعام مصنع الاعلاف.

كلمات البحث: سمك البلطي- الغذاء-قدرات انتاجية-زيادة الوزن

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Introduction

Introduction

Aquaculture plays a major role in global food security. Global aquaculture production has grown rapidly since the 1950s. Aquaculture production surpassed human consumption capture production in 2016 , and contributed 52% of the total harvest weight of aquatic animals for human consumption in 2018 (FAO, 2020).

Thus, the production of tilapia in the world follows a growing pace, in 1990 the production reached 400.000 tons, to reach 1.800.000 tons in 2004. China accounts for just over 20% of global tilapia production, but its share has declined as producers in other parts of Asia, Africa and Latin America have shown much faster growth rates (FAO, 2021).

In Algeria, aquaculture production increased from 351 tonnes in 2000 to 5 436 tonnes in 2020 (FAO, 2023)

Tilapia breeding is in full emergence in recent years, in 2010, a total of 316 tons of Tilapia of the Nile and Tilapia red (FAO, 2010). Indeed, a particular interest is given to this sector by the public authorities for the revival of this sector by the creation of aquaculture farms, of support programs for production (FNRDA.FNDA).

The major constraint to the emergence of fish farming in Algeria is the cost of food. In terms of expenditure, food accounts for about 80% of the cost of producing farmed fish (Siddhuraju & Becker, 2003).

The use of soya meal, fish meal as the main source of protein, maize and other dietary supplements (CMV, amino acids) The high cost of tilapia feed is mainly due to the import of tilapia feed.

It is in this context that this study aims to test foods made from local products and by-products by incorporating them into tilapia diets while studying their effects on zootechnical performance

Chapter I
general on tilapia fish

I. **Presentation of the species red Tilapia (Oreochromis sp)**

The Red Tilapia (Oreochromis sp) is a hybrid species of freshwater, they are genetic mutants chosen from the species of Tilapia of the genus Oreochromis, The first hybrid of Red Tilapia was produced in Taiwan in the late 1960s. It was a cross between (Oreochromis mossambicus), a mutant reddish orange female, and (Oreochromis niloticus) male, called red Tilapia taïwanais**(Galman and Avtalion 1983).**

Tilapia is a trade name for some fish of the Cichilidaefamily **.**The vernacular names of red tilapia differ from one continent to another, from one region to another and from one country to another (Creole red mullet (Guadeloupe), St Pierre (Martinique), Red face (Réunion) and Red tilapia (Africa)).They account for a significant share of inland artisanal fisheries with over 50% of annual catches (**Ayoade and Ikulala 2007).** They are native to Africa, but were introduced to many tropical, subtropical and temperate regions of the world during the second half of the 20th century **(Pillay, 1990; Charo-Karisa and.al,2006).**

II**. Tilapia cultivation in Algeria**

In Algeria, the species Tilapia is bred because of its hardiness to climatic conditions and especially in the Saharan zone where water temperature and salinity stimulate its growth and reproduction. **(Cherif and Djoumakh 2015).**

The National Board for Aquaculture Development and Production (O.N.D.P.A.) and those responsible

Chapter I Bibliographic summary20of the Egyptian Fisheries Resources Authority have reached agreement on the introduction of Tilapia in Algeria. Following the success of the first experiment concerning the 2001 production of tilapia in Algeria, an estimated 1.5 tonnes of tilapia fry was delivered. Thesefry intended for the repopulation of dams, basins, and rivers, have well the cold climate of the northern regions of Algeria. Then, Algeria has now the artificial production stage. This is the creation of specialized farms tilapia according to modern techniques (by private developers, some 30 farms Tilapia aquaculture. Private entrepreneurs who received financial support under the economic recovery support program, whose projects are expected to be will result in the creation of 303 jobs distributed as follows: Nile tilapia in the south of the country: 139 jobs (six managers, 10 technicians, 123 workers)**(Benammar, 2017).**

The availability of water, the numerous irrigation basins and canals made it possible to plan the development of an integrated aquaculture pole in agriculture, based on extensive farming freshwater fish (mainly Nile tilapia and its hybrids such as tilapia red) in synergy with agricultural activities **(FAO, 2018).**

Red tilapia

The red tilapia hybrid, like all other species of the same order Oreochromis, is one of the most important species currently bred in tropical freshwater and Its breeding is carried out all year round, in open or closed circuits in several regions of the world. Its rapid growth and adaptation to diverse ecosystems that his tasty flesh makes him an excellent candidate for Aquaculture.

Their global average consumption would increase from 14 to 25 kg per capita by 2030 (FAO, 2018).The term Tilapia is generally used to refer to the large group high for of the Cichlidae family. This expression is of African origin. The "thiape" meaning fish, the fish that dig the soil of the pond to make nests in which they spawn, are called tilapia. The breeding of the Tilapias has existed for more 2500 years **(Chapman, 2003)**

Figure1 : red Tilapia (Alpifood, 2022).

1.Taxonomic hierarchy :

Kingdom : animalia

Phylum : chordata

Subphylum : vertebrata

Class : actinopterygii (formerly osteichthyes)

Order : perciformes

Family :cichlidae

Genus :oreochromis

Species :oreochromis sp

2.Ecological Requirement:

Tilapia are more tolerant than most commonly farmed freshwater fish to high salinity, high water temperature, low dissolved oxygen, and high ammonia concentrations.

Field and laboratory studies have shown that Tilapia rouge (oroechromis sp) is a Euryecea and Eurytope species adapted to wide variations in aquatic ecological factors and is resistant to extremely varied environments **(Watanabe et al., 1997).**

2.1.Temperature:

Oreochromis sp is a thermophilic species, occurs in a natural environment between 13.5 and 33°C but the thermal tolerance interval observed in the laboratory is wider: 7 to 41°C for several hours **(Balarin &Hatton, 1979*in*Ait Hamouda, 2005).**

Optimum temperature from tilapia ranges from 20ºC to 30ºC, and the reproduction occurs successfully at 26-29ºC **(El-Sayed, 2006; Saavedra-Martínez, 2006).** Pargo-UNAM (PU) is a red tilapia obtained via hybridization through inter-specific crosses **(Ramírez-Paredes et al., 2012)**

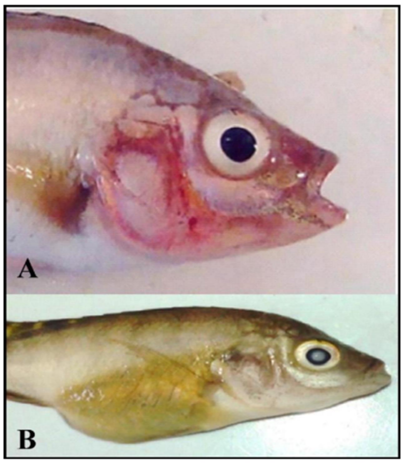

Figure. 2. A. Oreochromis niloticus X O. aureus juveniles of treatment 40o C after fifteen days. Red eyes very smooth skin and spills blood; B. Belly distension and spleen and pancreas sickness

2.2.Salinity :

Although Tilapias are freshwater fish, several species are euryhalines, tolerance of juveniles and adults has been discussed by several authors **(Hadjadji N, Toumi M, 2003).**

Red Tilapia has a salinity tolerance of up to 24 ppt. The behavior of tilapia during changes in salinitywas light stress at salinity 10 and 20 ppt. However, when it rises to 30 ppt the fish are alreadyexperiencing severe stress, which is indicated by erratic swimming direction (up, down, to the right, tothe left) and the number of operculums that are getting slower**.(A AFuadi et al 2021 IOP Conf. Ser.: Earth Environ.)**

Figure 3. Fish mortality at a salinity of 40 ppt

Figure 4. Fish mortality at 30 ppt salinity

2.3.Dissolved oxygen:

Tilapia can endure low amounts of dissolved oxygen and high levels of nitrogen better than any other fish. This species can endure both obvious deficiencies and oversaturations, but only for short periods at dissolved oxygen concentrations as low as 0.1 ppm.

In general, tilapias tolerate low DO concentrations even down to 0.1 mg L^{-1}, but maximum growth is achieved with DO concentrations greater than 3 mg L^{-1}. Oxygen is essential for fish growth and survival, and as a result, it affects fish respiration and nitrate and ammonia toxicity. Under tilapia species, the minimum DO requirement is 5 mg L^{-1}, and respiration and feeding activities decrease when the DO concentration decreases **(Mallya 2007).**

2.4.pH:

The range optimum of water quality PH between (6-9) (government regulation No.82(2001)

According to Malcolm et al. in 2000, pH values of 2 and 3 cause physiological stress that usually manifests itself in fast swimming, accelerated opercular movements, inability to control body position, a surface lift to swallow the air and finally death.

2.5.Nitrogen compounds:

The concentration of nitrogenous waste excreted by the gills and urine is based on temperature, the size of the individual, the concentration of ammonia in the medium and the quality of the food, it must be kept below the critical threshold ,it should not exceed 5mg/L for nitrites, 500mg/L for nitrates, 200 mg/L for suspended solids (Malcolm et al. 2000) and 0.1 mg/L for total ammonia (Suresh 2003).

2.6. Biology of Red Tilapia:

2.6.1.Morphology:

All the species belonging to this genus oreochromis (smith, 1840) are characterized by an oval body, rather high and compressed and oral incubation and a maternal custody unit **(Trewavas, 1980, 1981 and 1983).**

Red tilapia differs from its parents (Oreochromis niloticus and Oreochromis mossambiccus) by some morphological features. It has a body usually compressed laterally of a red and orange color on the chest and the sides, tending towards the oval and elongated, it has a head carrying a nostril on each side with a small mouth, Tilapia has 3 to 4 sets of teeth on each jaw and 6 in individuals exceeding 20cm (standard length).

This species has a spineless opercular bone, an upper lateral line containing 21-24 scales, a lower lateral line of 14-18 cm **(Melard 1986).**

A single piece dorsal fin consisting of a spiny part with 17 or 18 spines and a soft part with 12 to 14 soft rays, a truncated caudal fin, an anal fin formed of 3 spiny rays and pelvic fins with a hard ray followed by 5 soft rays, red **(Trewavas,1983).**

Figure 5: RED Tilapia Oreochromis sp (CNRDPA, 2012) (original).

2.6.2.Anatomy:

The anatomy of Oreochromis sp is adapted to dietary behaviour. In general, the size of the digestive tract of Oreochromis sp is adapted to the food intake of small meals and with high frequency **(FAO, 2010).** According to Arrignon's 1993 description, Tilapia's anatomy is as follows:

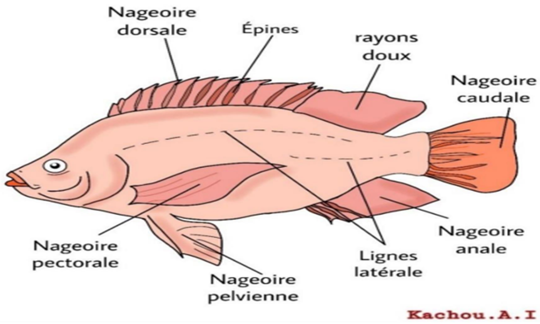

Figure 6 : Morphological characteristics of the Tilapia (Kachou, 2022).

2.6.2.1.Digestive System :

The digestive system of Oreochromis sp is simple and not very spatialized. Anteroposterior teeth (maxillary and pharyngeal), esophagus, sac-shaped stomach, and a long, sinuous intestine characteristic of animals with short food chains are distinguished. The Gross morphology of gastrointestinal tract (GIT) in T. sparrmanii ,like other typical teleost, consists of a short oesophagus, which is attached to the stomach. The stomach itself was sack-like structure connected to oesophagus and proximal region of the intestine .Morphologically, the intestine was tubular, long and highly coiled and was divided into three segments; the anterior, mid region (mid-intestine) and posterior (rectum). The size of the intestine was not uniform through the entire length wherein; the proximal intestine was larger than the rest of the intestine

Figures 7 : 1- Image of an adult of *Tilapia sparrmanii* in the lateral view

A histological study of the stomach of Oreochromis sp reveals a structure allowing a great possibility of distension, hence an easy accommodation in case of large variations in the amount of particles ingested. The intestine is differentiated into a short, thin-walled anterior duodenum and a very long posterior section with a smaller diameter. The total length of the whole intestine varies by 5 times the length of the body **(Moriaty, 1973).**

2.6.2.2.Respirator system:

The Tilapia has a pair of four gills. They are protected by a kind of hinged lid: the operculum.

When one comes out of the water a Tilapia or a fish in general, after a while, they die. Since man cannot breathe in water, fish cannot normally breathe in air (there are exceptions). Yet man and fish need the same oxygen to live. As well as man who has lungs that can take oxygen from the air, fish have gills capable of taking oxygen dissolved in water.

The movements of the fish's lids cause water to be sucked into the mouth, pass through the gills and exit under the lids.

When one looks under the lids of a fish one sees a large number of very red lamellae (because of the blood). It is at these red slats that the oxygen dissolved in the water passes through the thin membrane that covers the slats in the fish's blood. Blood carries oxygen throughout the body of the fish where it is used for various functions of the body (growth, movements, reproduction, etc…). The consumption of oxygen by the fish produced as waste carbon dioxide (CO2) which is toxic and must therefore be removed from the body. It is again the blood that loads the carbon dioxide (CO2), transports it to the gills or it is released into the water.

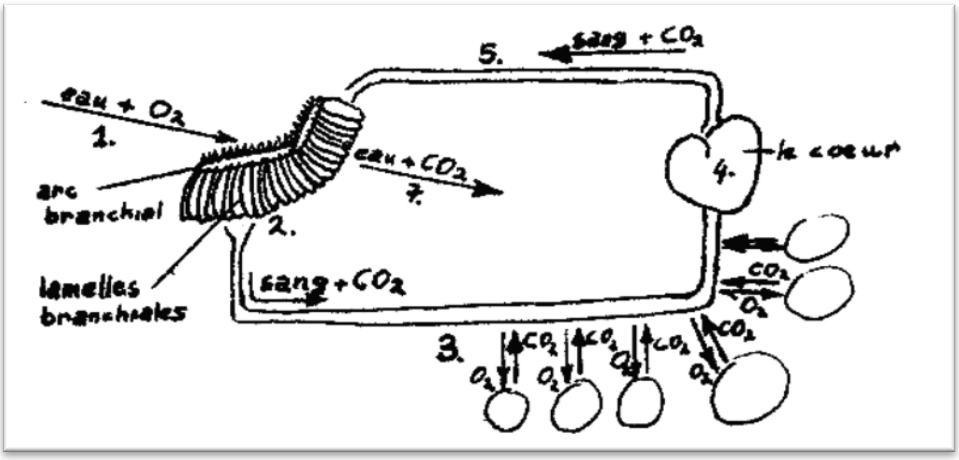

Figure 8: Breathing system

1_Water charged with dissolved oxygen (O2) comes into contact with the gills.

2_Oxygen (O2) from the water passes through the thin membrane of the gills and into the blood

3_Blood takes oxygen to all organs of the body where it is exchanged for carbon dioxide (CO2)

4_It is the heart that pumps lesang through the blood vessels of the body.

5_Blood exchanged all oxygen (O2) for carbon dioxide (CO2)

6_Once at the gills, the blood discharges the carbon dioxide (CO2) into the water and recharges itself with oxygen (02).

7_The water coming out of the fish lids is loaded with carbon dioxide (CO2).

Lids: The gills are under the lids.

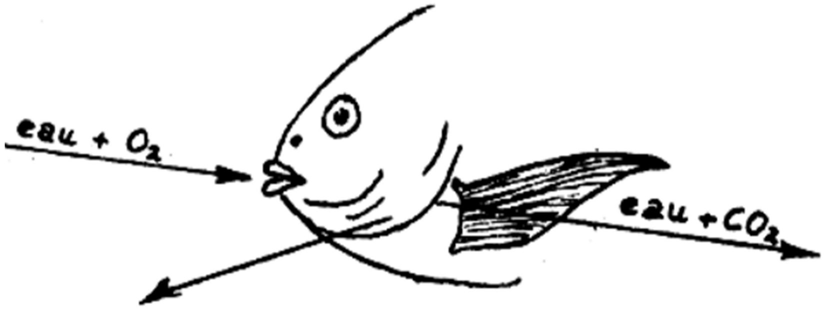

Figure 09 : image of gas exchange /breathing/

Lids: The gills are under the lids.

In order for the fish to breathe, the gills have to be clean. But not everything. There has to be oxygen in the water.

2.6.2.3.Skeleton:

The skeleton of the Tilapia is bony. The skeleton of the head consists of the bones of the skull that protect the nerve centres and the bones of the face, essentially the jaws that support the gills.

The bones of the trunk include the spine and small bones, the supports of the fins, which themselves consist of bone or cartilage rays.

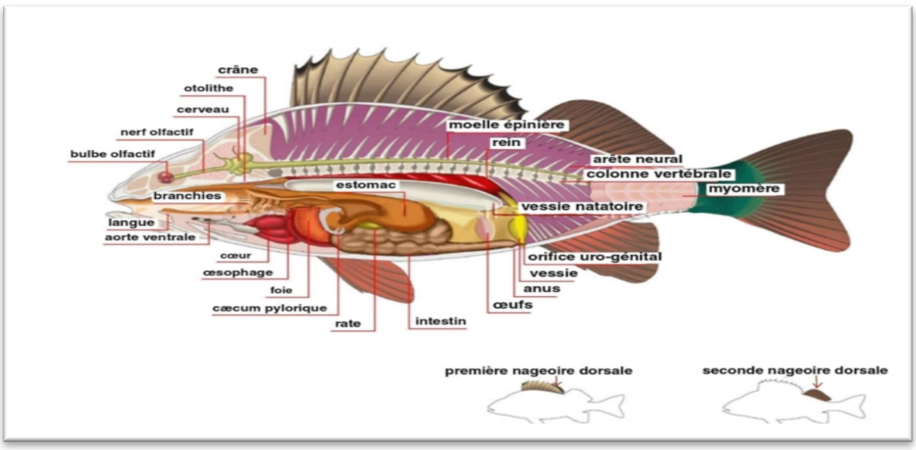

Figure 10 : Internal anatomy of the Tilapia

2.6.2.4.Muscles:

When a cooked Tilapia is examined, there is a muscle mass consisting of two thick dorsal "nets" and two thinner flanks closely related to the bones. These muscular masses drive the fish: these are the ones that are interesting for the consumer. Other muscles, smaller, work the jaws, pharynx, opercules, fins.

2.6.2.5.Circulatory system

The circulatory system that supplies blood to the body of Tilapia is a closed circuit comprising the arteries, very fine vessels, capillaries and a heart that animates the whole, located behind the gills.

2.6.2.6.Excretory apparatus:

The excretory apparatus is essentially constituted by the kidneys, a kind of brown glands, very elongated and branched, lining the dorsal part of the visceral cavity with which they are related.The urine is drained to the urinary orifice by two channels: the ureters.

3.Reproduction:

Tilapia is a prolific breeder and breeds throughout the year. However, comparatively, small sized eggs and low fecundity,occur in red tilapia during the summer months (April – May).

Reproduces year-round as long as the temperature is above 22°C. (Optimum between 28 and 32°C) and salinity is less than 15 psu.

First sexual maturity size: 14-20 cm (depending on sex and environment)

Red Tilapia is part of the relatively advanced tilapia group: maternal uniparental oral incubators. When abiotic conditions become favorable, the adults migrate to the shallow littoral zone and the males gather in a breeding arena on a low-sloping, soft-substrate area, sandy or clayey where they each delimit their small territory and excavates a nest in the pond bottom (generally in water shallower than 3 feet) and mates with several females (polygamous)**.(Lowe mc connel, 1959; Perrone and Zaret, 1979).**

Females live in groups away from the breeding arenas where they make brief passages. Moving from one territory to another, they are solicited successively by the males. In case of stopping above a nest and after a nuptial parade of sexual synchronisation, the female deposits a lot of eggs that the male immediately fertilizes and the female takes back in mouth to incubate them **(Stickney, R. R. 2019).**

This operation may be repeated with the same male or a neighbour. After this successive reproduction, the female leaves the arena and incubates her eggs fertilized in shallow area **(RUWET et al, 1976).**

At this time, the female shows a lowering of the floor of the mouth, Lids slightly spread and the lower jaw becomes slightly prominent.Eggs hatch in the mouth 4-5 days after fertilization. Once their yolk vesicle has been absorbed (10 days after hatching).

Figure 11: eggs incubation

Fry stays in the female mouth by absorbing the yolk bag and often seeks refuge in her mouth for several days after she starts feeding. Sexual maturity in tilapia is a function of age, size and environmental conditions

Colour of the eggs	Condition of the eggs
Slightly brownish	Good condition and ready to hatch
Yellow	Mostly immature eggs and takes more time for hatching
White	Unfertilised eggs

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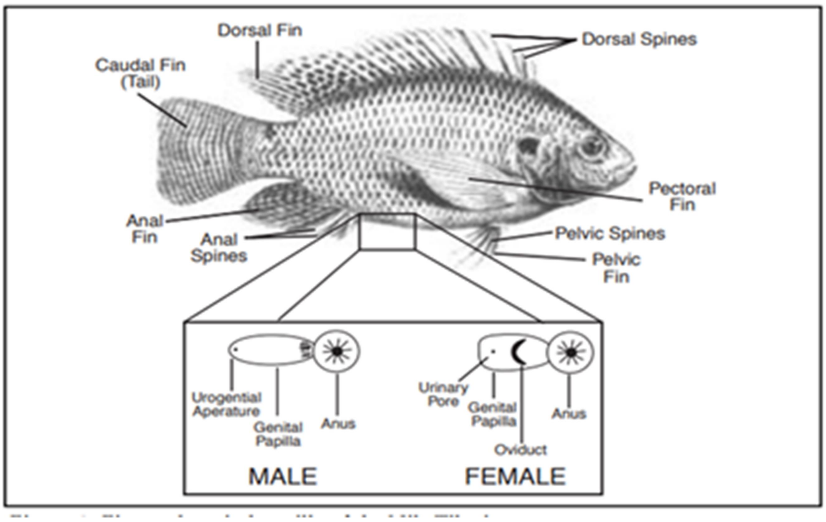

Figure 12 : fins and genital papilla of the Nile Tilapia

4.Growth

The growth rate of tilapia is influenced by a variety of factors; water temperature, sex, diet, and storage density **(Chapman 2000).**

In tilapia populations, males grow faster and have a more uniform size than females. Depending on its diet, tilapia can reach the market size of 400 g in 8 months.

5.Diet:

The Oreochromis sp is classically classified among microphytophage fish capable of ingesting and digesting large quantities of phytoplankton algae and cyanobacteria but in reality, the degree of opportunism of the species is very great and its diet is often closer to that of the detritivorous omnivorous fish than of the strict herbivores.

The young are first zooplankton phages up to a size of 50 mm, then from 50 to 100 mm they become omnivorous and they consume filamentous algae, zooplankton, insect larvae and macrophytes. Above 100 mm, the main food consists of macrophytes. If plants are rare they maintain a diet based on algae, insects, zooplankton, top plant debris.

In an artificial environment (fish farming system), this species is practically omnivorous (euryphage), it recovers various agricultural waste (brewery waste, etc. etc.), by extracting some of the feces of pigs or poultry, household waste and by easily accepting compound feed in the form of pellets **(Kestmont et al.,1989).**

It should be noted that the particularly strong gastric acidity in oreochromis sp allows it to be among the few species to be able to digest cyanophycea (abundant source of protein) without significant competition with other fish species inthe aquatic ecosystem (Lauzanne 1988). This phenomenal capacity for adaptation

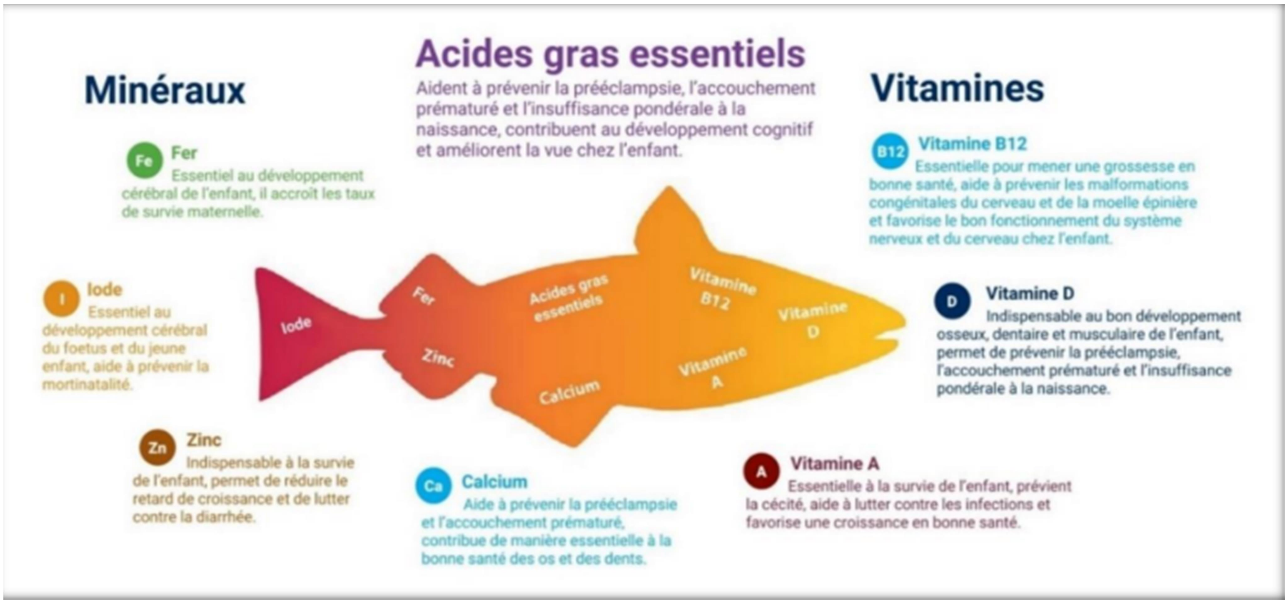

Figure 13 : Main components of fish muscles. (FAO, 2021)

5.1.Feeding behavior and nutrition requirements Tilapia :

ingest a wide variety of natural food organisms, including plankton, some aquatic macrophytes, planktonic and benthic aquatic invertebrates, larval fish, detritus, and decomposing organic matter.

With heavy supplemental feeding, natural food organisms typically account for 30 to 50 percent of tilapia growth. (In supplementally fed channel catfish only 5 to 10 percent of growth can be traced to ingestion of natural food organisms)

Tilapia are often considered filter feeders because they can efficiently harvest plankton from the water. However, tilapia do not physically filter the water through gill rakers as efficiently as true filter feeders such as gizzard shad and silver carp. The gills of tilapia secrete a mucous that traps plankton. The plankton-rich mucous, or bolus, is then swallowed. Digestion and assimilation of plant material occurs along the length of the intestine (usually at least six times the total length of the fish). The Mozambique tilapia is less efficient than the Nile or Blue tilapia at harvesting planktonic algae. Two mechanisms help tilapia digest filamentous and planktonic algae and succulent higher plants: 1) physical grinding of plant tissues between two pharyngeal plates of fine teeth; and 2) a stomach pH below 2, which ruptures the cell walls of algae and bacteria. The commonly cultured tilapias digest 30 to 60 percent of the protein in algae; blue-green algae is digested more efficiently than green algae

When feeding, tilapias do not disturb the pond bottom as aggressively as common carp. However, they effectively browse on live benthic invertebrates and bacteria-laden detritus. Tilapias also feed on midwater invertebrates. They are not generally considered piscivorous, but juveniles do consume larval fish. In general, tilapias use natural food so efficiently that crops of more than 2,700 pounds of fish per acre (3,000 kg/ha) can be sustained in well-fertilized ponds without supplemental feed. The nutritional value of the natural food supply in ponds is important, even for commercial operations that feed fish intensively. In heavily fed ponds with little or no water exhange, natural food organisms may provide one-third or more of total nutrients for growth. In general, tilapia digest animal protein in feeds with an efficiency similar to that of channel catfish, but are more efficient in the digestion of plant protein, especially more fibrous materials.

Tilapia require the same ten essential amino acids as other warmwater fish, and, as far as has been investigated, the requirements for each amino acid are similar to those of other fish. Protein requirements for maximum growth are a function of protein quality and fish size and have been reported as high as 50 percent of the diet for small fingerlings. However, in commercial foodfish ponds the crude protein content of feeds is usually 26 to 30 percent, onetenth or less of which is of animal origin. The protein content and proportion of animal protein may be slightly higher in recirculating and flow-through systems

The digestible energy requirements for economically optimum growth are similar to those for catfish and have been estimated at 8.2 to 9.4 kcal DE (digestible energy) per gram of dietary protein. Tilapia may have a dietary requirement for fatty acids of the linoleic (n-6) family. Tilapia appear to have similar vitamin requirements as other warmwater fish species. Vitamin and mineral premixes similar to those added to catfish diets are usually incorporated in commercial tilapia feeds. The feeding behavior of tilapia allows them to use a mash (unpelleted feeds) more efficiently than do catfish or trout, but most commercial tilapia feeds are pelletized to reduce nutrient loss. In the absence of feeds specifically prepared for tilapia, a commercial catfish feed with a crude protien content of 28 to 32 percent is appropriate in the United States

Arly juveniles and young fish are omnivorous, feeding mainly on zooplankton and zoobenthos but also ingest detritus and feed on aufwuchs and phytoplankton. At around 6 cm TL the species becomes almost entirely herbivorous feeding mainly on phytoplankton, using the mucus trap mechanism and its pharyngeal teeth **(Moriarty and Moriarty, 1973; Moriarty et al., 1973)**. The pH of the stomach varies with the degree of fullness and when full can be as low as 1.4, such that lysis of blue-green and green algae and diatoms is facilitated (Moriarty, 1973). Enzymatic digestion occurs in the intestine where pH increases progressively from 5.5 at the exit of the stomach to 8 near the anus. Nile tilapia exhibit a diel feeding pattern. Ingestion occurs during the day and digestion occurs mainly at night **(Trewavas, 1983)**. The digestive tract of Nile tilapia is at least six times the total length of the fish, providing abundant surface area for digestion and absorption of nutrients from its mainly plant-based food sources **(Opuszynski and Shireman, 1995).**

Diseases :

Tilapia are more resistant to viral,bacterial and parasitic diseases than other commonly cultured fish,especially at optimum temperatures forgrowth. Lymphocystis, columnaris, whirling disease, and hemorrhagic septicemia may cause high mortality, but these problems occur most frequently at water temperatures below 68o F. “Ich,” caused by the protozoan Ichthyopthiriusmultifiliis, can cause serious losses of fry and juveniles in intensive recirculating systems.

External protozoans such as Trichodina and Epistylis also may reach epidemic densities on stressed fry in intensive culture. In recent years the bacterial infection Steptococcusinae has caused heavy losses, primarily in recirculating and intensive flow-through systems.

Chapter II
material and methods

methodology

Installation of breeding system

Laboratory Facility

Tank preparation : we started with cleaning and sanitizing the tanks to get them ready for the fish

Figure 14: tanks preparation

Tank installation

During our study, we used 5 tanks with a capacity of 1000 L each one we used only 1/3 of them . These have been thoroughly washed and sterilized. Each tank contains **10** pieces of fish, a submerged

pump, a resistance and a diffuser air and an Aquarium heating

Figure 15: tank installation

The filtration system

In our experiment, we used a simple mechanical filtration system by a crate plastic that contains two layers: Layer of cotton wool _2nd layer ceramic cylinder

Main components of fish muscles

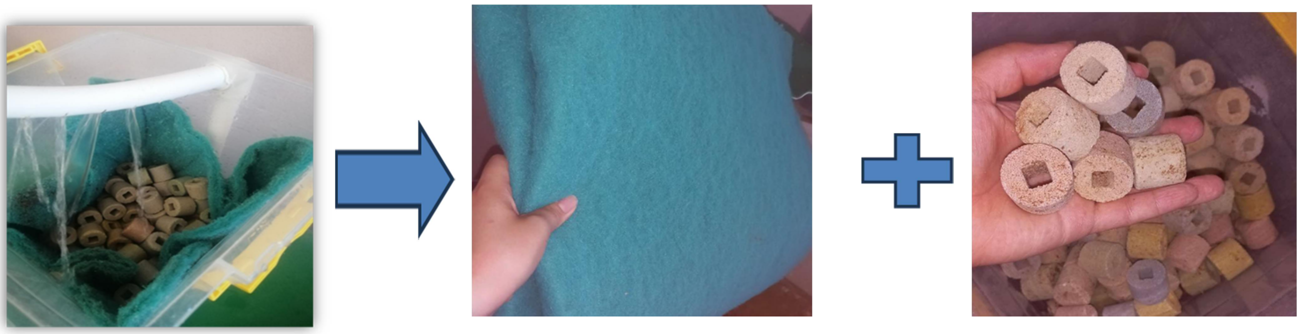

Figure 16: the filtration system

Water evacuation

With a water pump attached to a plastic tube, we empty a basin each time, and this is done every week

Preparation of feed:

The nutritional components of this tilapia feed formula are 25%-30% crude protein, 3%-5% crude fat, 7%-9% ash, 40%-55% carbohydrate, 9%-11% moisture.

During our experiment, we prepared a food with ingredients available in the region at a lower cost and within the reach of all farmers

Table 02 : Ingredients of feeds

Ingredients	formulation	formulation 1	Formulation 2	Formulation 3	Formulation 4
Corn	8,5	4	4	4	4
soy	55	30	30	30	30
Wheat	30	10	5	5	5
eggs	-	6	6	6	6
Olive oil	-	0,02	0,02	0,02	0,02
Acid oil	2,5	-	-	-	-
bean	-	41,5	41,5	41,5	41,5
Yeast	-	4,5	4,5	4,5	4,5
limestone	1,5	1,5	1,5	1,5	1,5
phosphate	0,8	0,8	0,8	0,8	0,8
CMV (A/S)	0,5	0,5	0,5	0,5	0,5
CMV fish	1	1	1	1	1
TOTAL	100	100	100	100	100

Preparation steps:

Preparation steps in formulating fish feed pellets were then followed :

1.Each ingredientwas grinded to powder

2.Each ingredient was then weighed and portioned according to information generated from feed formulated

3.The ingredients were mixed thoroughly in a mixer.

4.Moisturise **(distilled water)** was added to form a cake like mixture.

5.A pellet machine (maual) was used to formulate the extrusion

6.A knife was used to cut pellets into similar sizes of 2mm

7.The pellet was then placed in an ovenlaboratory at40°C to dry

feeding:

In each tank the average weight of 10 fishes,the amount of food brought and 3% of the weight of 1 fish. the daily meals are divided on 3 occasions:

1- In the morning.

2- at noon.

3- In the evening

The food was distributed as a result of:

The first day: 50% food tested, 50% control.

Continued distribution of 100% tested food for all the rest of the days of the experience

The parameters studied

1. The weight

The weight measurements are carried out using an electric scale after the cleaning of the tanks, which is done in 5days by the complete emptying of the tanks.

there is an empty intermediate tank in which fish are evacuated during emptying.

2. The size

Measurements of the size (Lengthand width) of the fish are also made every 5 days after cleaning the tanks with a ruler.

Figure 17:size measurements

Growth performance and feed utilization parameters

At the end of the experiment, fish in each earthen pond were weighed to calculate the growth performance parameters according to **Lovell (2001)**, with the following equations:

- **Total weight gain** (TWG, g) = FW (g)/ IW (g)

- Average daily gain (ADG, g/fish/day) = TWG (g) / T

Body weight gain (BWG) = Final weight (g) – Initial weight (g)

Sampling blood:

We took blood samples from each tank (the blood of five fishes from 10) for the **Biochemical analyses**

Figure 18: Sampling blood

Figure 19: Samples blood

Results and discussion

1.Weight of fish

The results for farm fish weights are summarized in Figures .The onab formulation is at the forefront in terms of growth and weight gain compared to the rest of the formulations.

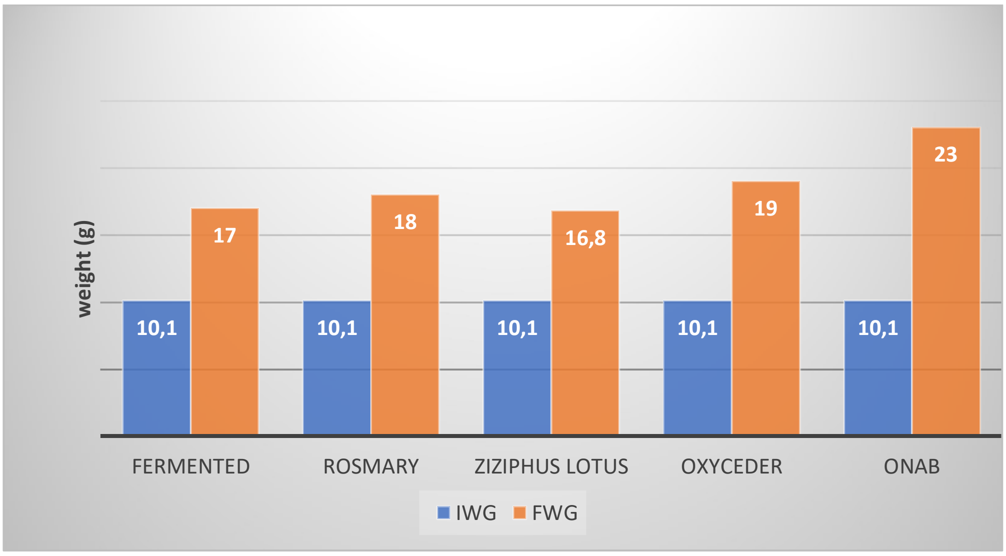

Figure 20 : Variation in fish weight over time(Initial and Final weight parameters)

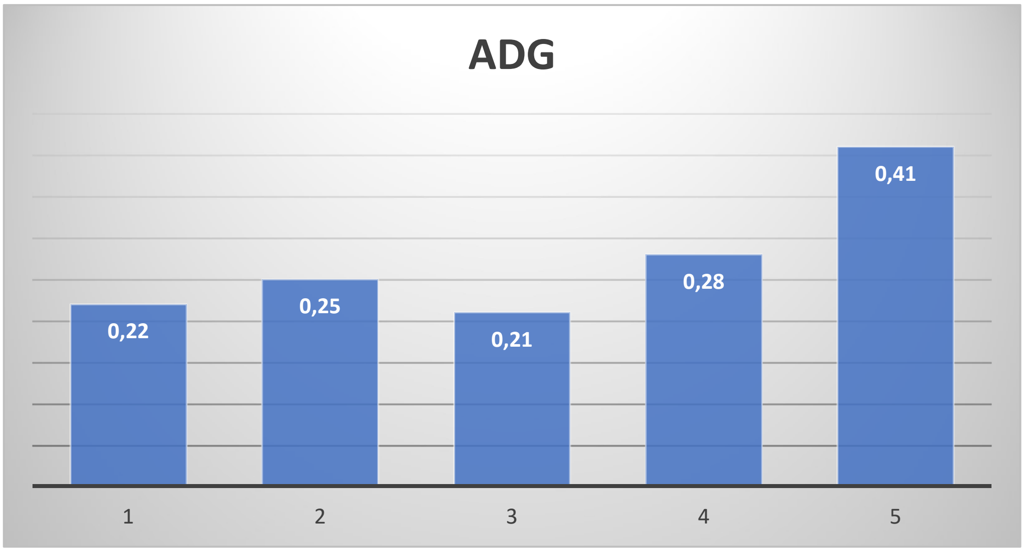

Figure 21: The average daily gain

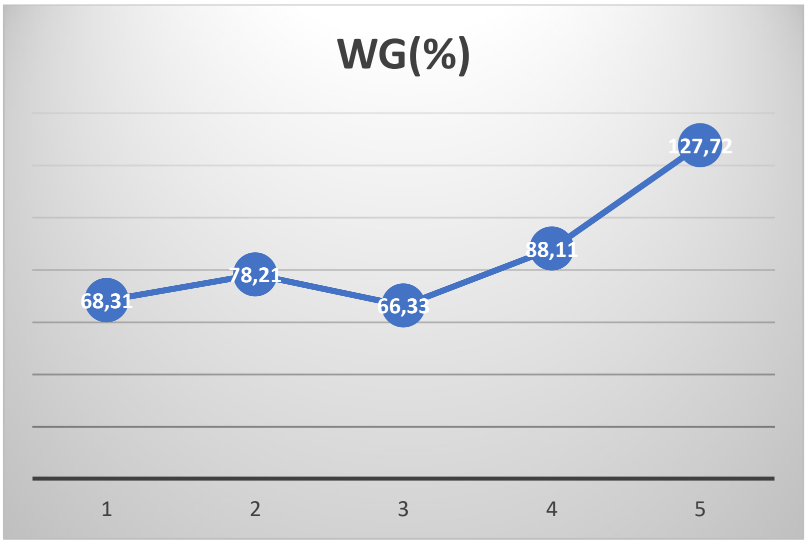

Figure 22: Weight gain

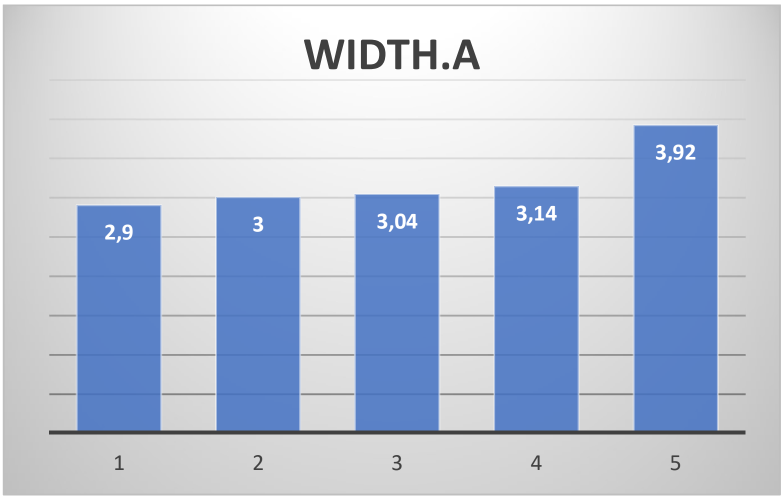

Figure 23: Width average

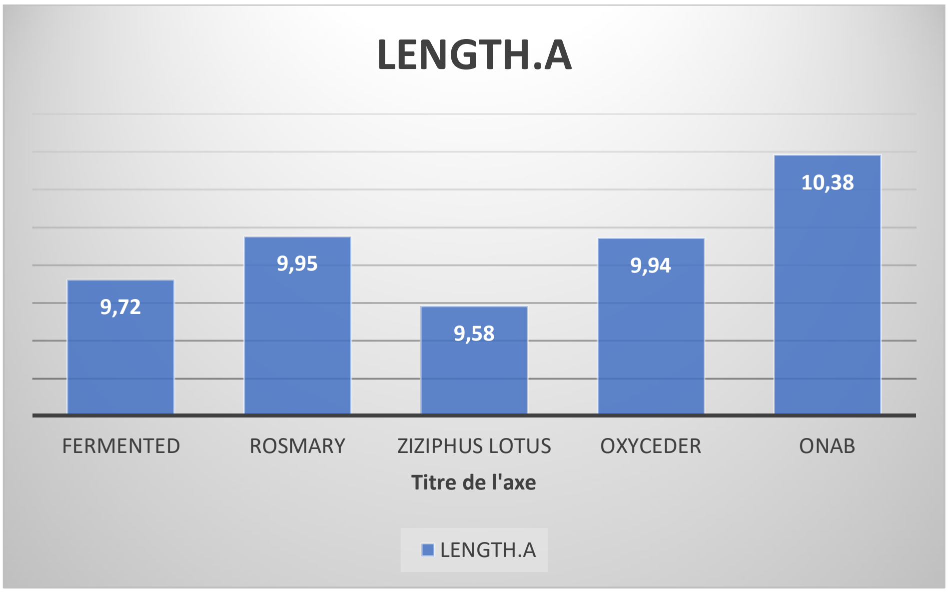

Figure 24: Length average

2.Biochemical analyses of fish blood :

We took blood samples from each tank (the blood of five fishes from 10) and we got this table:

	ONAB	Fermented	Jujube	Juniper	Rosemary
Amylase	897 U/l	267 U/l	870 U/l	153 U/l	652 U/l
Cholesterol	0,77 g/l	0,99 g/l	0,76 g/l	1,1 g/l	0,86 g/l
glycemia	0,31 g/l	0,5 g/l	0,25 g/l	0,45 g/l	0,4 g/l
Lipase	4,9 U/l	4,2 U/l	2,9 U/l	6,7 U/l	3,7 U/l
total protein	1,2 g/l	2,32 g/l	1,01 g/l	1,25 g/l	1,25 g/l
Triglycerides	1,45 g/l	1,13 g/l	1,28 g/l	1,54 g/l	1,13 g/l

Table 03 : biochemical analyses

An increase in amilase is observed in the ONAB blood sample , on the other hand, cholesterol , lipase ,triglycerides in the juniper blood sample are the higher ,the fermented sample gave the best results of the glycemia and total protein .

Discussion

Feed is the most expensive component of the aquaculture industry, accounting for over 50% of operating costs. Much research has reported that good feed management is a necessary tool for successful tilapia farming. To date, the major challenge that tilapia producers generally face is the development of commercial and profitable tilapia feed using available, less expensive and unconventional resources (Pezzatoet al., 2000; El-Sayed, 2006; Burel and Médale, 2014).

In this study, a trial of an experimental feed made from locally available ingredients was conducted and the effect on the growth of red Tilapia “Oreochromis Sp.” with a reference food.

The total weight and average size of red tilapia fish were also monitored every ten days at the level of the 5 experimental basins. Weight and morphometric measurements revealed variations in weight and size between the different batches.

For this purpose, the lot receiving the reference food went from an average of 10.1 g on average to 23 g with a ego. On the other hand, the weight of the lot fed with another food called fermented increased from 10 . 1 g on average to 17 g ttrente (30) days . The feed containing the rosemary extract led to a variation in the average weight of the batch from 10.1 g to 18 g during the period.

These results are, however, less interesting compared to those reported by Dibala et al, (2018) which observed the strongest growths with food control and food 4, followed by food 2 which has an intermediate growth. Low growth was observed with feed 3 with. The 1witness feed is manufactured by the Fish Farming Project (PEP) and includes vegetable protein, animal protein (fishmeal). Food 2 is made of cotton cake, rice bran, but Food 3 is made of soybean meal, corn bran, rice bran. Feed 4 consists of roasted soybeans, rice bran and corn bran]. For this purpose, the lot receiving the reference food went from an average of 10.1 g on average to 23 g with a ego. On the other hand, the weight of the lot fed with another food called fermented increased from 10 . 1 g on average to 17 g ttrente (30) days . The feed containing the rosemary extract led to a variation in the average weight of the batch from 10.1 g to 18 g during the period. These results are, however, less interesting compared to those reported by Dibala et al, (2018) which observed the strongest growths with food control and food 4, followed by food 2 which has an intermediate growth. Low growth was observed with feed 3 with. The 1witness feed is manufactured by the Fish Farming Project (PEP) and includes vegetable protein, animal protein (fishmeal). Food 2 is made of cotton cake, rice bran, but Food 3 is made of soybean meal, corn bran, rice bran. Feed 4 consists of roasted soybeans, rice bran and corn bran]. For this purpose, the lot receiving the reference food went from an average of 10.1 g on average to 23 g with a ego. On the other hand, the weight of the lot fed with another food called fermented increased from 10 . 1 g on average to 17 g ttrente (30) days . The feed containing the rosemary extract led to a variation in the average weight of the batch from 10.1 g to 18 g during the period. These results are, however, less interesting compared to those reported by Dibala et al, (2018) which observed the strongest growths with food control and food 4, followed by food 2 which has an intermediate growth. Low growth was observed with feed 3 with. The 1witness feed is manufactured by the Fish Farming Project (PEP) and includes vegetable protein, animal protein (fishmeal). Food 2 is made of cotton cake, rice bran, but Food 3 is made of soybean meal, corn bran, rice bran. Feed 4 consists of roasted soybeans, rice bran and corn bran].

The proposed food must therefore be able to meet all their nutritional needs (30% protein). These foods were distributed on the fly 3 times a day (8:30, 11:30 and 15:30), six days a week out of seven for 60 days. Average daily earnings (ADG) gave values of 1.36 for the control feed, î1.04 for feed 2, 0.99for feed 3, These results show that fish that were fed the control feed and feed 4 would have the best QMG (Dibala, et al, 2018).

Studies of IGA-IGA (2008) in Gabon which demonstrated that the food based on local ingredients had similar and economically more profitable performance than manufactured control foods.

Decreased appetite may result from orosensory (taste or texture of the food) or post-absorptive feedback (Burel et al., 2014).

Bamba et al 2005 Köprücü & Özdemir (2005) indicate that the digestibility of a food depends on the nature of the ingredients used.

Our weight gain results ranged from 66.33 to 127.72, a high proportion compared to yacouba et al (2008), which ranged from 40.24 to 54.03

In addition, according to Ouattara (2004), corn bran (an ingredient of A1 and A2) provides better growth to fish than wheat (a component of the control feed) and rice (a component of the A3 feed). This would indicate that the observed growth gap could be related to the nature of the ingredients used as pointed out by Burel et al. (2000) and Köprücü & Özdemir (2005) As regards the quality of farmed water,

In general, the physico-chemical parameters of the water are within the recommended range of optimal values. The temperature values of 26°C recorded during this experiment are in accordance with the European regulation on fish waters (2006/44/EEC and 2006/113/EC) which is 8 to 30°C. (Mélard, 1999) has located the optimum temperature for growth of OreochromisSpentre 26-30°C.

Results and discussion

Morphometric measurements showed an increase in the average width of the fish receiving the reference feed, the average widths increased from 2.6 cm on average to 3.92cm in 30 days. On the other hand, the fermented feed induced an evolution of the average width from 2.5 cm to 2.9 cm during the same period. On the other hand, the same trend was observed for the lengths of the experimental subjects, the reference food to gives an increase in the average length from 8.5 cm to 10.38 cm 30 days. The food containing a Roman extract induced an average aumentation of 8.5cm to 9.95cm.

Nilotica and Balarin (1979) have shown that this species becomes adult around the age of four (4) months at a size between 10 and 17cm. However, the first maturity size of males reared in ponds was observed to be 8 cm in length (Lowe-McConnell 1959; Mc Namara 1988). Mukankomeje (1984) pointed out that if the same population was exploited, the first maturity size could be smaller.

CONCLUSION

Conclusion

This study tested foods made from local products and by-products by incorporating them into tilapia diets while studying their effects on zootechnical performance.

The results shows that the effect of the five foods had different effects:

For ADG , was 3.44g, 1.78g, 1.78g, 1.55g, 0.33g respectively for Food 1 (ONAB); Food (Formula 1), Food (Rosemary Formula 2), Food (Sharp Cedar Formula 3), Food (Lotus Zizifus Formula 4)Morphometry was noted that there is an increase in length and width of our experimental animals with some superiority for animals receiving a diet (ONAB)

At the end of this study and the results obtained, it is necessary to conclude that the effect of the tested feeds on zootechnical performance is variable and the best values are observed for the feed manufactured by ONAB compared to the feed.

Finally and by way of perspective, it would be advisable to broaden this study by increasing the number of fish per test, by incorporating other raw materials into the formulation of the food by increasing the duration of the tests, by studying digestive histophysiology, the pathologies.

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