Original Research Article

Zootechnical performance and bromatological composition of the flesh of *Oreochromis sp* (Red Tilapia) fed with local feed supplemented with *Afrostyrax lepidophyllus* seed powder

ABSTRACT

Objective: this study aimed to evaluate the effect of supplementing *Afrostyrax lepidophyllus* seed powder on some zootechnical performances of *Oreochromis sp*. fry and the bromatological composition of the chair obtained.

Study area: the study was carried out from March to June 2023 at Moungo Fish Farm in the locality of Yundi, located in the southwest region of Cameroon, Fako department, Tiko district.

Methodology: A total of 375 monosex fry of *Oreochromis sp*. with an average weight of 5.5 ± 0.34g were distributed in 15 tanks of 0.8m^3. Five (05) feed rations. T0- feed without supplement, T (0.3%) feed containing 0.3% powder of *A. lepidophyllus*, T (0.4%) feed containing 0.4% powder of *A. lepidophyllus*, T (0, 5%) (feed containing 0.5% *A. lepidophyllus* powder) and an imported Skreting brand feed rated T_{0+} were allocated in a completely randomized design in triplicate with 75 subjects per treatment. were recorded daily before feeding.

Results: The highest survival rate was recorded with treatment T0.3 (82.67±12.22%); the highest values significantly ($p<0.05$) for final biomass (66.53±5.82g), daily weight gain (0.68±0.64g/d), weight gain (61.05±5.82g), the specific growth rate (2.77±0.02%J) was recorded with the T0.5 treatment. However, the lowest consumption index ($p<0.05$) (1.55±0.05) was recorded with the T0.3 treatment.

Conclusion: This study showed that dietary supplementation of *A. lepidophyllus* seed powder improves growth performance, utilization of dietary nutrients and bromatological composition of the stool in *Oreochromis sp*.

Keywords: *Afrostyrax lepidophyllus*; supplementation; local feed, *Oreochromis sp.*; zootechnical performance.

INTRODUCTION

"The decline in catches observed today is attributable to the increase in fishing intensity, the introduction of new species and climate change" [3]. According to [7], "the absence of fish feed industries, difficult access to credit, the absence and/or insufficiency of quality fry, the lack of qualified personnel, the lack of mastery of production technologies production and the

poor development of fish ponds are all constraints which continue to hamper the development of the sub-sector in Cameroon". "Despite the various efforts made by the Cameroonian government to intensify the aquaculture sector, feeding fish species remains a major difficulty faced by fish farmers; limited access to quality, available and inexpensive exogenous food is therefore highlighted by breeders" [9]. "This being said, paying particular attention to the formulation of a feed that can meet production expectations remains essential for the improvement of the aquaculture sector and fish farming in particular. Tilapia, being one of the species of piscicultural interest prized by the population, and whose breeding requires a nutritional, ecological and biological contribution. The peels and seeds of *Afrostyrax lepidophyllus* commonly known as washer or wild onion contain active molecules whose functions are to stimulate pancreatic enzymes (lipases, amylases and proteases) and increase the activity of digestive enzymes of the stomach and gastric mucous membranes" [6]. According to [10], "the bark and seeds of this spice also contain compounds with important antioxidant properties along with many other attributes, including stimulation of digestive enzymes, lipid metabolism and modulation of microbial populations". Considering the fact that certain studies on the zootechnical effects of the powdered bark and seeds of *Afrostyrax lepidophyllus* have had improvements in the growth and strengthening of the resistance of poultry, and the fact that it is an endemic plant and permanently available in Cameroon encourages us to pay attention to the supplementation of the seed powder of this plant in the feed of red tilapia fingerlings (*Oreochromis sp*).

MATERIALS AND METHOD

Study zone

The study was carried out at Moungo Fish Farm, in the locality of Yundi, located in the southwest region of Cameroon, Fako department, Tiko district. The geographic coordinates are between 4°08'50''North; 09°32'24"East and 12m altitude from the sea. The objective was to evaluate the effect of supplementing *Afrostyrax lepidophyllus* seed powder in feed on some zootechnical performances of fry of *Oreochromis sp*. in concrete tank.

Biological material and duration of the study.

The study lasted 94 days, with the aim of evaluating the monitoring rate, growth parameters as well as the cost of production of the feed. 375 *Oreochromis sp* fry with an average weight of 5.42±0.8g were taken from the fry production of the Mas-soma farm.

Origin of *Afrostyrax lepidophyllus* fruit

The fruits of *Afrostyrax lepidophyllus* were purchased from the local market, crushed, sifted, then the powder was incorporated into the food at different rates.

Non-biological material

It consisted of 15 concrete tanks with a capacity of 0.8m^3 each, in a 150m^2 room, a 14kpa aerator used to supply the tanks with oxygen.

Feed ration

An imported Skreting brand feed (T_{0+}) containing 35% protein was purchased on the local market and then four other iso-protein rations were formulated.

T_{0+}: imported feed;

T_{0-}: feed without supplement;

$T_{0.3}$: feed containing 0.3% *A. lepidophyllus* seed powder;

$T_{0.4}$: feed containing 0.4% *A. lepidophyllus* seed powder;

$T_{0.5}$: feed containing 0.5% *A. lepidophyllus* seed powder) were randomly distributed in a completely randomized design in triplicate with 75 subjects per treatment.

Table 1 : centesimal composition of the experimental feed

Ingredients	**Percentage (%)**
Fish meal	24
Soya flour	22
Low rice flour	17.48
Peanut cakes	15
Dicalcium phosphate	0.52
Méthionine	0.12
Probiotique	16
Yeast	0.08
Prémix 5%*	0.32
Salt	2.48
Vegetable oil	2
Total	100
Chemical composition analyzed (%)	
Dry matter	95
Humidity rate	5
Proteins	35.8
Lipids	18.0
Ash	12.5
Fiber	4.1

***Premix 5%; Metabolizable energy = 2078 Kcal/Kg; Crude protein = 40%; Lysine = 3.3%; Methionine = 2.40; Calcium = 8%; Phosphorus = 2.05%.

Experimental design

375 fry were distributed in triplicates in 5 treatments of 75 individuals with an average weight of 5.42±0.8g following a completely randomized design (3 repetitions x 5 treatments). Each replicate contained 25 fry and each treatment 75 fry. Five rations were formulated and distributed randomly.

Conduct of the test

"Each treatment thus contained a total of 75 fry, therefore 3 happas of 25 fry each. These fries were fed at a frequency of four times (4) per day at a regular interval of 3 hours including 7 a.m., 10 a.m., 1 p.m. and 4 p.m. with quantities of food equivalent to 11% of their biomass during the first month then 10 % over 6 weeks of experience for all treatments. A control fishing was carried out every two weeks (after 14 days) and at the end of the fishing, the growth characteristics such as the weights were measured using a balance sensitive to 0.001g under loading. then with an SF-400 balance with a sensitivity of 1g, the size (total length) of the fry was measured using graph paper. The fry was placed in a bucket containing water and were handled so as not to leave them out of the water for long. Before distribution of the different diets, the quantities proportional to the densities of the fry for each happa were calculated, weighed and crumbled. These quantities of food distributed to the fry were adjusted according to their development. A TDS/EC/PH/SALT/SG/ORP brand multi-parameter was used for taking the temperature and the JBL brand analysis kit for taking the physicochemical parameters". [19]

Zootechnical parameters and characteristics studied

- **Survival rate** (SR)

SR (**en**%) = 100 × NF/Ni

NF = number of fish at the end of the experiment and Ni = number of fish at the start of the experiment.

Growth characteristics

- **Live weight**

At the start of the test and every 14 days thereafter, fish from each experimental unit were weighed. The weekly weight gain was obtained by taking the difference between 2 consecutive average weekly live weights

- **Average weight gain (AWG in g)** = final average fish weight (FAFW in g) - initial average fish weight (IAWG in g);
- **Average daily gain (ADG in g/day)** = (FAWG-IAWG)/t With IAW = initial average weight (g), FAW = final average weight (g), t = duration of the experiment (in days);

- **Specific growth rate (SGR in %day)** = [(ln Pmf –ln Pmi)/ rearing time (day)] x 100; Pmi = initial average weight (g), Pmf = final average weight (g);
- **Feed conversion ratio (FCR)** = Quantity of feed distributed / Body mass gain;
- **Condition factor (K)** = W×100/ LT3 with W: weight (g), LT: Total length (cm).

Analysis of fish flesh

Analyzes: the analyzes carried out mainly included protein, lipid, ash, dry matter, fiber, and energy contents.

The methodology: The biochemical parameters contained in the samples were determined according to international methods in force at the Laboratory of the Soil Analysis and Environmental Chemistry Research Unit (URASCE) of the University of Dschang recommended by Pauwel et al. (1992), and respecting ISO, AOAC standards. It is :

• **Protein:** mineralization by acid attack of 0.1g of sample, distillation by steam distillation and determination with sulfuric acid, Kjedahl method (AOAC, 1995);

• **Lipid**: the lipid content is determined by the Soxhlet method (AOAC,1995). This method is based on the solubilization of lipids in nonpolar organic solvents;

• **Ash (%)**: the percentage of ash relative to dry matter is determined by incineration of 2g of the sample in a muffle furnace at 550°C for 6 hours (AOAC, 2000);

• **Dry matter**: the percentage of dry matter is determined by drying 05g of the sample in the oven at a temperature of 105°C until a constant dry mass is obtained (AOAC, 1990);

• **Humidity rate** (%): It is measured on samples of approximately 5 g, placed in an oven at 1050C for 24 hours;

• **Fiber (%)**: the method described by AOAC (1995), "Official Methods for crude fiber" was used.

Statistical analyzes

Data on survival, growth (Daily Weight Gain, Average Weight Gain, Specific Growth Rate, Coversion ratio, condition factor K) were subjected to analysis of variance to a factor. When there were differences, the Doncan test at the 5% threshold was applied to separate the means. SPSS (Statistical Package of the Social Sciences) software version 20.0 was used to carry out the analyses.

Results

From Figure 1 which shows the average temperatures according to the time of day, we can observe that the temperatures were higher when the sun was at the zenith with values reaching 28.5°C.

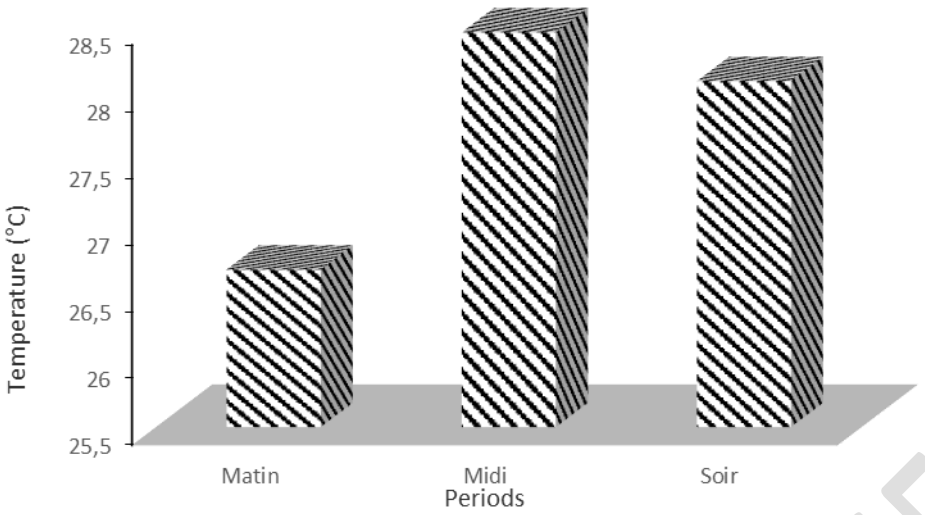


Figure 1: Temperature variation depending on the time of day over the entire study period

It appears from Figure 2 that the highest pH values were recorded in the evening with a higher value of 7.42

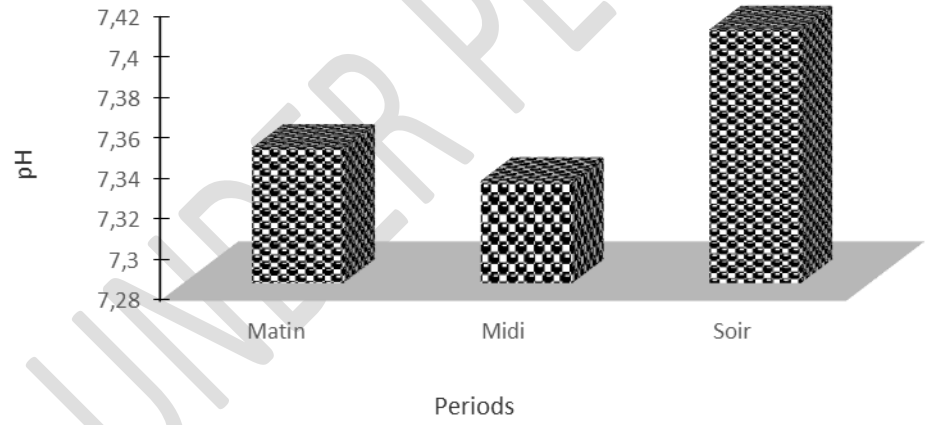


Figure 2: Variation of pH depending on the time of day over the entire study period

It appears from Figure 3 which shows the variation in the oxygen level in the water depending on the time of day that the highest oxygen levels were recorded in the evening (4.5ppm) and the lowest in the morning (3.5ppm)

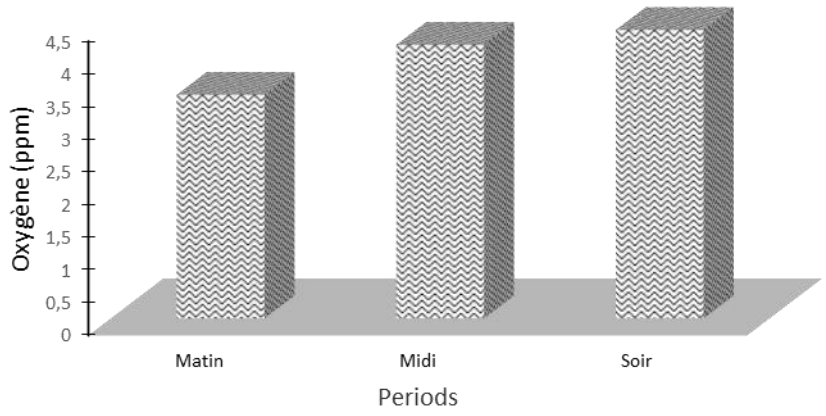


Figure 3: Variation of the oxygen level in the water depending on the time of day over the entire study period

It appears that apart from the survival rate, the quantity of feed, the K factor and the feed production cost, all the other parameters were significantly affected $p<0.05$ by the supplementation of the feed to the *A. lepidophyllus* seed powder.

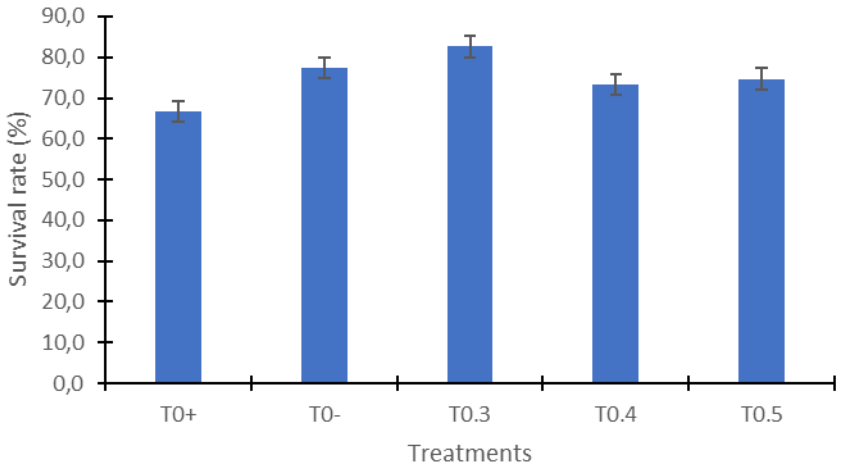
Table 2: Variation in zootechnical parameters of fry of *Oreochromis sp.*

Parameters	**T_{0+}**	**T_{0-}**	**$T_{0,3}$**	**$T_{0,4}$**	**$T_{0,5}$**	**P**
IW (g)	$5.35\pm0.83^{a\,b}$	5.55 ± 0.11^{a}	5.48 ± 0.00^{a}	$5.28\pm0.28^{a\,b}$	5.48 ± 0.00^{a}	/
FW (g)	51.80 ± 7.18^{b}	$59.04\pm2.29^{a\,b}$	62.08 ± 3.16^{a}	62.52 ± 3.77^{a}	66.53 ± 5.82^{a}	0,036
SR (%)	66.67±4.62	77.33±12.87	82.67±12.22	73.33±2.3	74.67±10.06	0.386
DWG (g/d)	0.52 ± 0.08^{b}	$0.59\pm0.02^{a\,b}$	$0.63\pm0.35^{a\,b}$	0.64 ± 0.38^{a}	0.68 ± 0.64^{a}	0.033
AWG (g)	46.45 ± 6.93^{b}	$53.49\pm2.41^{a\,b}$	56.59 ± 3.16^{a}	57.24 ± 3.50^{a}	61.05 ± 5.82^{a}	0.033
SGR (%J)	2.52 ± 0.17^{b}	2.63 ± 0.07^{a}	2.70 ± 0.07^{a}	2.75 ± 0.01^{a}	2.77 ± 0.02^{a}	0.068
FCR	2.15 ± 0.12^{a}	1.68 ± 0.19^{b}	1.55 ± 0.05^{b}	1.61 ± 0.10^{b}	1.60 ± 0.17^{b}	0.001
K	0.94±0.17	1.28±0.17	1.19±0.07	1.20±0.08	1.08±0.18	0.106

a,b:($p>0.05$) values with the same letter are not significantly different; T_{0+}: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*; IW: Initial weight; FW: Final weight; DWG: Daily weight gain; SR: Survival rate; AWG: Average weight gain; SGR: Specific growth rate; FCR: Feed conversion ratio; K: condition factor.

Survival rate

Analysis of variance revealed no significant difference ($p>0.05$) between treatments (Figure 4). However, an increasing trend is observed when the feed is supplemented or not with *A.lepidophyllus* seed powder. The lowest survival rate was recorded with the subjects fed with the T_{0+} feed and the highest (82.67±12.22) with the feed supplemented with 0.3% of *A.lepidophyllus* seed powder.

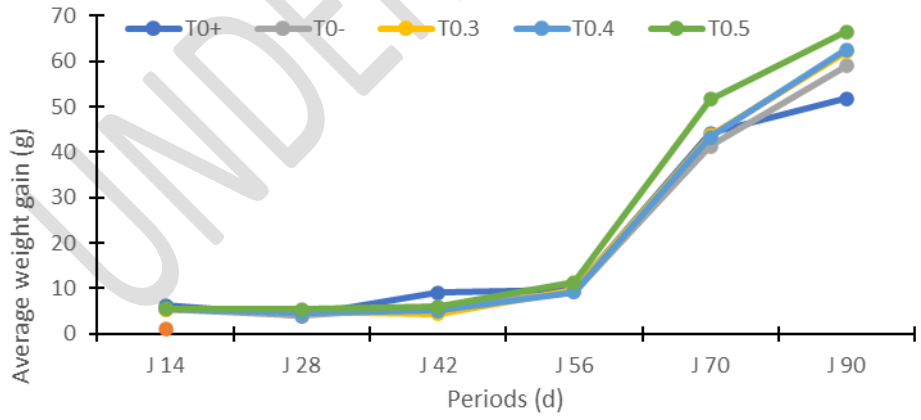


T $_{0+}$: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*

Figure 4: Variation in the survival rate over the entire trial period depending on the treatments.

Average weight gain

Weight gain increased significantly (P<0.05) with increasing levels of *A.lepidophyllus* seed powder supplementation in the feed (Figure 5). However, with supplementation rates, weight gains were significantly higher compared to the commercial feed-fed treatment (T_{0+}), but otherwise comparable between treatments supplemented with *A.lepidophyllus* seed powder in the feed. Furthermore, with the supplementation rate of 0.5%, the highest value of weight gain was recorded (61.05±5.82g) but not significant compared to other treatments including the T_{0-} treatment.

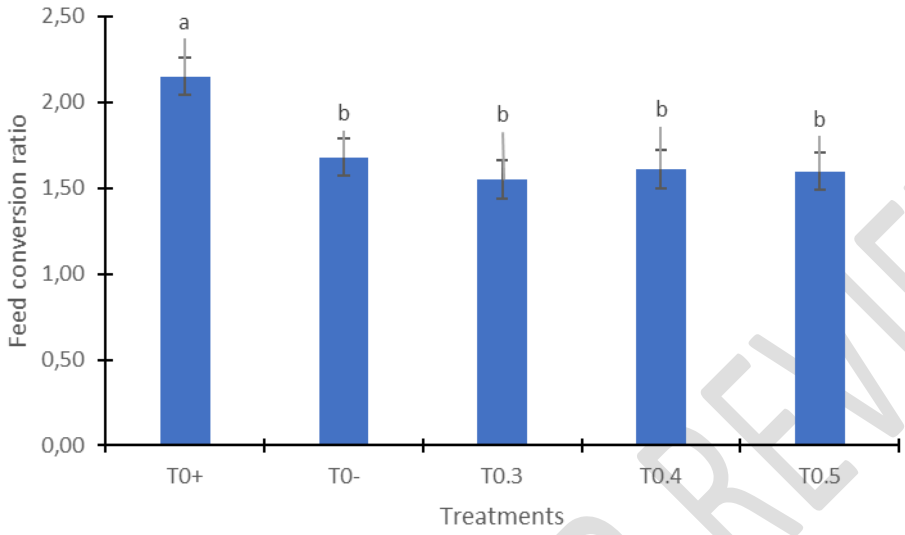


T $_{0+}$: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*

Figure 5: Evolution of average weight gain as a function of the trial period

Feed conversion ratio

It appears from Figure 6 that the feed conversion ratio at the end of the experiment was significantly affected ($p<0.05$) by the supplementation of the feed with *A. lepidophyllus* seed powder compared to the ration witness T_{0+}. The lowest conversion index (1.5±0.05) was recorded with the ration supplemented with 0.3% *A. lepidophyllus* seed powder compared to the three other treatments (T_{0-}; $T_{0.4}$ and $T_{0.5}$).

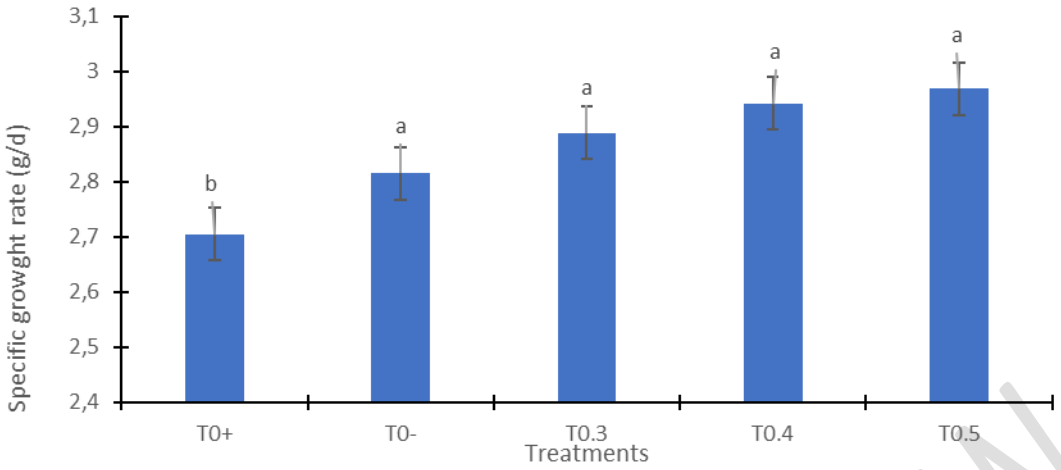


a,b:($p>0.05$) histograms with the same letter are not significantly different. T_{0+}: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*

Figure 6: Variation in the consumption index depending on the treatments over the entire trial period

Specific growth rate

The specific growth rate increased significantly ($p<0.05$) with increasing levels of *A.lepidophyllus* seed powder supplementation in the feed (Figure 7). However, with increasing rates of supplementation in the feed, growth rates were significantly higher compared to the commercial feed treatment (T_{0+}), but otherwise comparable between treatments supplemented with A seed powder A. lepidophyllus in feed. With the supplementation rate of 0.5%, the highest value of the specific growth rate was recorded (2.77±0.02%/d) but not significant compared to the other treatments including the T_{0-} treatment.



a,b:(p>0.05) histograms with the same letter are not significantly different. T_{0+}: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*;

Figure 7: Variation in specific growth rate depending on the treatments over the entire trial period

Bromatological compositions of fish flesh

The bromatological compositions of the flesh obtained by treatment after 90 days are recorded in Table 2. It appears from this table that the protein level increases with supplementation. The highest rate (63.2%) compared to other treatments including the T_{0+} control was recorded in the carcass of subjects fed with feed supplemented with 0.4% of *A.lepidophyllus* seed powder. The lipid level shows a slight increase in the other treatments compared to the initial one, with the exception of treatment $T_{0.3}$ where this rate remained constant (12.6%). The highest rate was recorded with the carcass of subjects fed imported feed.

Table 3: Bromatological composition of fish flesh

Caracteristics	**Initial composition**	**T_{0+}**	**T_{0-}**	**$T_{0,3}$**	**$T_{0,4}$**	**$T_{0,5}$**
Dry matter (%)	97	95	95	95	96	96
Humidity rate (%)	3	5	5	5	4	4
Proteins (%)	44.4	61.0	45.7	58.3	63.2	56.6
Lipids (%)	12.6	13,5	13.1	12.6	13.2	12.8
Ash (%)	14.9	12.7	14.3	13.5	14.4	11.9
Fibers (%)	7.8	7.6	9.3	10.2	10.0	7.0
Energy(kcal)	361.00	367.10	349.54	348.10	353.84	372.59

T_{0+}: Skreting; T_{0-}: local without additive; $T_{0.3}$): Local feed plus 0.3% *A.lepidophyllus*; $T_{0.4}$: Local feed plus 0.4% *A.lepidophyllus*; $T_{0.5}$: Like local plus 0.5% of *A.lepidophyllus*;

Discussion

Survival refers to the ability of fish to stay alive in the face of fluctuations in the physicochemical parameters of the rearing water [13]. During the entire experimental period, no significant difference ($p>0.05$) in the survival rate which varied from 66.67±4.62 to 82.67±12.22%. These values were lower than those obtained by [14] who had a higher survival rate of fry of *Oreochromis sp*. by 97%. The survival rate recorded is also lower than that obtained by [15] who obtained survival rates of 77 and 87% of *Oreochromis niloticus* fry by incorporating tomato flour into their feed. The survival rate could be attributed to the immune-boosting characteristics of the spice of *Afrostyrax lepidophyllus*.

According to [16], the use of *Afrostyrax lepidophyllus* bark powder has a positive effect on the well-being and growth of chickens.

The weight gain was significant ($p<0.05$), evolving increasingly with the increase in the supplementation rate of *A.lepidophyllus* and this gain varied between 46.46±6.9g and 61.05±5 .82g. These gains are much higher than those obtained by [14] who obtained a weight gain of between 6.06 ±2.84g and 7.97 ±3.43g using foods supplemented with 20% and 40% Panicum. virgatum in their feed and to those obtained by [15] after 75 days of experiment which had obtained the final average weight gains of between 98.62 g and 129.77 g depending on the treatments. The increase in progressive weight gain induced by the inclusion at increasing levels of *A. lepidophyllus* compared to the performance of those fed with control diets could emanate from the presence of sulfur phyto-additive and phenylpropanoid (eugenol) which have the ability to stimulate the function of pancreatic enzymes (lipases, amylases and proteases) and increase the activity of digestive enzymes of the gastric mucosa. According to [16], the use of *Afrostyrax lepidophyllus* bark powder has a positive effect on the well-being and growth of chickens. The significant daily weight gain ($p<0.05$) was between 0.51±.012g/day and 0.68±0.64g/day. These values are much higher than those obtained by [14] who obtained a daily weight gain of between 0.096g/d and 0.094g/d using feeds supplemented with 20% and 40% of *Panicum virgatum* in their feed. This gain would be due to the action of bioactive compounds which would have an effect on the secretions and the activity of digestive enzymes of the gastric mucosa.

The specific growth rates (2.52±0.17 and 2.77±0.02) observed during the experiment varied significantly ($p<0.05$) with the treatments. They were higher with the feed supplemented with 0.5% *Afrostyrax lepidophyllus* seed powder 2.77±0.02g/day. These values are higher than those obtained by [14] who studied the effect of the introduction of *Panicum virgatum* into the food of red Tilapia fry (*Oreochromis Sp*.). After 70 days he obtained a specific growth rate of between 0.8 and 2.4. Likewise [15] after 75 days of experience obtained a lowest specific

growth rate of 2.46%/d with an incorporation rate of 10% of tomato flour. The increasing increase in the specific growth rate would be due to the effect of supplementing *A.lepidophyllus* seeds in rations because this rate increases with the level of supplementation. Low variant values of 1.55±0.05 to 1.68±0.19 a were obtained for the treatment supplemented with 0.3; 0.4 and 0.5% compared to other treatments. These feed conversion ratios are higher compared to those obtained by [14] who had better feed conversion ratio of around 1.03 and 1.04 on *Oreochromis sp.* and lower compared to those recorded by [17] and [17] which was 1.5 and 2.5. The low feed conversion ratio in the other treatments compared to the positive control will demonstrate the good level of digestibility of the feed.

Conclusion

At the end of the test which focused on the effect of supplementing powdered bark and seeds of *Afrostyrax lepidophyllus* in food on some zootechnical performances of fry of *Oreochromis sp* (red tilapia) in concrete tank, It appears that the zootechnical performances were more relevant with the fish fed with food supplemented with *A. lepidophyllus* seed powder whatever the supplementation rate. But the rate of 0.5% made it possible to register the highest values.

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