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Effect of Level of Desmodium Uncinatumincorporation in the Diet on Growth Performance of Clariasjaensis (Boulenger, 1909) in the Highlands of west Cameroon

Efole E.T.*[1], Tchouante T.C.G.[1], Miegoue E.[2], Tsoupou K.S.G.[1], Nana T. A.[1], Tedonkeng F.[2],Pouomogne V.[3], Mikolasek O.[4]and Tcthoumboue J.[5]

[1]*Department of forestry, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Cameroon*
[2]*Department of animal production, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Cameroon*
[3]*Department of aquaculture, Institute for Agronomic Research for Development, Station of Foumban, Cameroon*
[4] *ISEM, CIRAD, University of Montpellier1, France*
[5]*Department of animal production, Faculty of Agriculture and veterinary science, « Univesitérté des Montagnes » Bagangte, Cameroon*

Abstract: *In Sub-Saharan Africa, particularly in Cameroon, fish is one of the main sources of animal proteins for human consumption. However, its emergence is facing many constraints feeding being one of the main ones. Commendable tests for manufacturing food using local byproducts are developed, but are facing stiff competition from other speculation of prolific breeding (chickens) vis-à-vis certain essential ingredients (crab soy); hence the need to seek new alternative sources. Thus, the study of the effect of the incorporation of D. uncinatum in the diet on growth performance of Clariasjaensiswas conducted at the Application and Research Farm of the University of Dschang from May to September 2014. Soybean meal substitution rates by D. uncinatum 0% (T0); 10% (T10) and 20% (T20) were tested in triplicate and in traps following a completely randomized system for 120 days. It appears from this study that, total protein levels were increased with the level of substitution. The best growth performance was the highest with treatments T10 ($P<0,05$). Cholesterol levels (8.56 ± 1.93%) and food production costs (0,044FCFA / g) remained the same.ultimately, flour of D. uncinatum can be incorporated into the Clariasjaensisfood up to 10% without adversely affecting the production performance.*

Keywords*: Feeding; Growth; Desmodium uncinatum; Soy bean cake; Clariasjaensis*

I. Introduction

Recent trends in the world, indicate a decline in landings from capture fisheries, indicating that fish stocks have reached or even exceeded the maximum efficiency point [1]. Furthermore, faced with the rapid population growth, this contribution is stillnot sufficient to meet protein needs in general and the needs offish in particular [2]. Aquaculture is the only viable alternative for increasing fish production in order to meet the needs of populations in terms of proteins [3].However in Sub-Saharan Africa, particularly in Cameroon, fish farming emergence is facing many constraints, law number of species and feeding being one of the main ones [4,5].In fish farming, food represents a great part of the production cost. Soybean meal which is generally the most used element in animal feeding after cereals [6], is the major component of fish feed [7]. This source of protein is 49.0% of the total protein in standard food for fish farming [7] and remains in high demand in other farms, particularly in dairy farming [8], piggery and poultry [4] which is the most developed sector in our country. Faced with scarcity, competition and the high price of soybean meal in fish feed, several alternatives have been developed [9, 10, 11]as in the case of substituting soybean meal by chicken manure [12]and by vegetable proteins, especially those which are not directly suitable for human consumption [13, 14]. This done,*D. uncinatum* flour, widely used in animal production [15] could be a source of protein in the diet of fish in general and*C. jaensis* in particular. The aim of this study is to contribute to the productivity of fish production bydetermining the effect of the level of incorporation of *D. uncinatum* flourin diet of *C. jaensis*on growth parameters, and cholesterol.

II. Material And Methods

• Study Zone

The study was conducted in the Application and Research Farm (FAR), Animal Physiology (PA) and Applied Ichthyology and Hydrology Laboratories (LABIHA) of the University of Dschang located at 5 ° 36 '- 5 ° 44" NL, 9 ° 94 '- 10 ° 06' EL and at an altitude of 1400 m in the Western region of Cameroon. The climate is

Soudano-Guinean altitude type and includes a rainy season (mid-March to mid-November) and a dry season (mid-November to mid-March). Annual average temperature and rainfall are 22 ° C and 1800 mm respectively.

•Animal and vegetalmaterials

270 fingerlings of*Clariasjaensis* average size and weight 16.7 ± 2 cm and 30 ± 2g, were harvested from the Santchou rivers between 5 ° 10 '- 5 ° 25' NL and10 ° 16' - 10 ° 21' EL, at an average altitude of 700 m. They were divided into three batches (L1, L2 and L3) comparable in terms of number, size and body weight, each with three replicates of 30 fish. *D. uncinatum*introduced in the food was harvested around the FAR, chopped, dried and ground (five kg of this powder was used).

• Test performance

09 traps of 2.25 m² surface area and a depth of 0.70 m each were instore with 0.5 mspacing in a pond of 102.20 m² and 0.90 m depth. The water supply was drained from the University dam pond a PVC pipe and constantly renewal(0,894l / s). The three batches L1, L2 and L3 constituted were fed with three rations R0, R1 and R2 containing 0%, 10%, 20% of *D. uncinatum* flour respectively as compositions and bromatological characteristics shown in Table 1. It is noted that after the substitution of soybean meal by*D.uncinatum*flour, each ration was balanced by calculation to obtain anisoproteiticand isoenergitic food.

Table 1: Composition of the food and bromatological characteristics

Ingrédients	**Ration0 (0%)**	**Ration1 (10%)**	**Ration2 (20%)**
Corn	5	5.25	4.2
D. uncinatum	0	10	20
Cassava	1.5	0.5	0.5
Wheatbran	11	7	6
Cotton seedmeal	14	14	7
Soybeanmeal	36.5	26.5	16.5
Blood meal	6	7	10
Fish meal	18	23	30.3
Shell	1.5	1.2	0.5
Bonemeal	1	0.3	0
Palm Oil	3	3.75	4
IodizedSalts	0.5	0.5	0.5
CMAV (2%)	2	1	0.5
Total	100	100	100
Bromatologicalfeatures			
Crudeproteines (%MS)	40.29	40.13	40.20
Metabolizeenergy kcal/g	2710.15	2703.57	2708.58
Calcium g/kg	2.17	2.16	2.25
Phosphorus g/kg	1.13	1.13	1.28
Sodium g/kg	0.22	0.21	0.21

Mineralnitrogen and vitamincomplex(MNVC) : **Vit A**: 3000 000UI,**Vit D** 3 600 000UI,**Vit E**: 4 000mg , **Vit K**: 500mg, **Vit B**1:200mg, VitB2 : 1000mg , Vit B6: 400mg, Vit B12: 4mg, Iron: 8000mg , Cu : 2000mg , Zn : 10 000mg , Se: 20mg, Mn: 14000mg ,Methionine : 200 000mg , Lysine : 78000mg .

The daily ration representing 5% of each ichtyobiomasse was distributed in two equal meals at 8 am and 18 pm throughout the trial (120 days). This were readjusted monthly after abiometrical control carried out on a sample of at least 10 fish of each treatment. These were taken at random and weighed individually with a OHAUS DIAL-O-GRAM balance with 2610 g capacity and 0.1 g precision, measured using a ichtyometer. In order to avoid food dispersion and maximize its use, a floating frame was placed in each trap. Uneaten food was collected in a basin under the floating frame. At the end of the trial, all fishes were counted, weighed, measured and 10 fishes from each batch were randomly selected and sacrificed and the meat pieces were stored in a freezer (-2 ° c) for biochemicalanalyses. The physicochemical parameters of the water (temperature, pH, dissolved O_2, conductivity) were observed weekly in situ between 6:30 and 8:00 am using a thermopHmeter Eutech instruments No 555 690, an oxymeter Eutech instruments No 540003 and a conductivity meter Hanna HI 99300 No SN08274423. The nutrients (ammonia, nitrate, nitrite and orthophosphate) were analyzed in the laboratory on samples of water collected from traps by colorimetry method using aHacch DR / 2500 spectrophotometer.

- **Growth parameters**

The following production parameters were determined:

- Food Consumption (g)

$FC = Fd - Re$(1)

FC: food consumption, Fd: food distributed, Re: refusal

- Weight gain (g)

$wg = wf - wi$ (2)

Wf: final average weight, Wi: initial average weight;

- Average daily gain (g.d^{-1})

$ADg = {}^{wg}/_{T}$ (3)

Wg: Weight gain (g), T: duration of the assay (day);

- Specific growth rate (%. d^{-1})

$SGR = \frac{[\ln(wf) - \ln(wi)]x100}{T}$ (4)

wf: final average weight, wi: initial average weight, T: duration of the assay (day);

- Consumption Index

$CI = {}^{FC}/_{wg}$ (5)

FC: food Consumption, wg: weight gain

- Survival rate (%)

$Sr = \frac{Nf}{Ni} x\ 100$ (6)

Nf: final number of fish, Ni: Initial number of fish;

- Condition K factor (%)

$K = \left({}^{W}/_{L^3}\right) x\ 100$(7)

W : fishweigth, L : total length

- **Biochemical analysis**

The total tissue proteinand the total cholesterol wereanalyzed by the [16] method and CHOD-POD method from a commercial kit CHRONOLAB respectively.Economic evaluation was made based on the cost of food productioncalculated from the unit price of the ingredients obtained in the local market, with the exception of *D. uncicatum*flour whose price was estimated from a case study. The cost of food has been determined from the amount of food consumed to produce 1 kg of fish.

- **Statisticalanalysis**

The growth and biochemical parameters were expressed as mean ± standard deviation and percentages.Analysis of variance (ANOVA) at one factor were used to test the effects of treatment and the Duncan test at 5% threshold to separate the medium when there was a significant difference using SPSS 20.0.

- **Results**

3.1.1. Effect of the level of incorporation of *D. uncinatum* on the water physicochemical parameters

3.1.1.1. Effect on the pH of water

Fig. 9 shows the evolution of the water pH under different treatments throughout the test. It appears that the pH has evolved in sawtooth regardless of the treatment. Indeed, a decrease in the pH was noted after the first month before an increase in the third month. The highest value (8.56) was observed in the T0 treatment and lowest(7.34) in the T20 treatment.

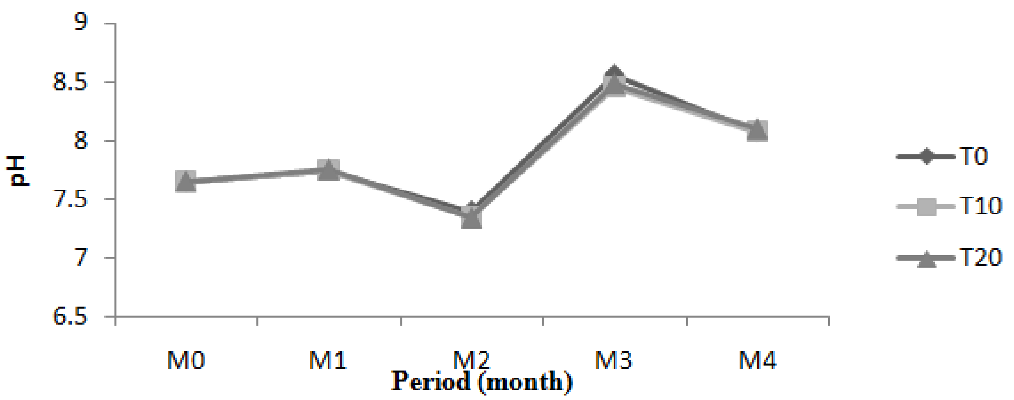

Figure 1: Water pH evolution in different treatments over time

3.1.1.2. Effect on the dissolved oxygen content of water

The evolution of the oxygen content of the water in the various treatments throughout the study is presented in FIG. 10. It emerges that, in general, the oxygen content increased during the second month of the study, and decreased from the beginning to the end of the first month on the one hand and on the other hand from the third month to the end of the study whatever the treatment. The highest dissolved oxygen concentration (6.64mg / l) was obtained in T20 treatmentinthe second monthand lowest (2.66mg / l) in the T10 treatment in the fourth month.

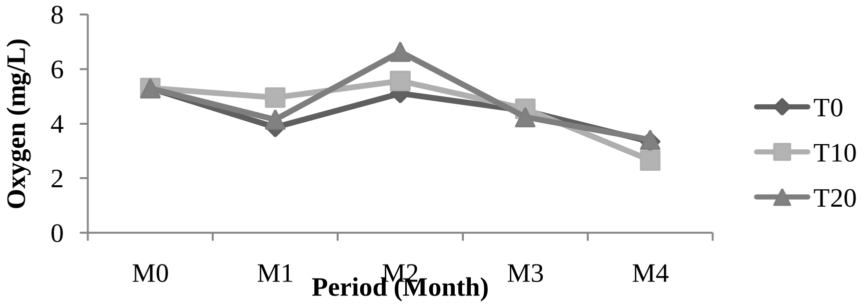

Fig.2: Water oxygen evolution according to the various treatments over time

3.1.1.3. Effect on the water temperature

Fig. 11 shows water temperature evolution for the different treatments. It follows that in general, the evolution of the temperature was similar for all treatments. Indeed, it decreased the first two months of the test; then rose sharply between the 2nd and the 3rd months, before declining slightly the last month. The highest water temperature (22.28 ° C) was obtained in treatment T10 and the lowest (19.95 ° C) in T20 treatment.

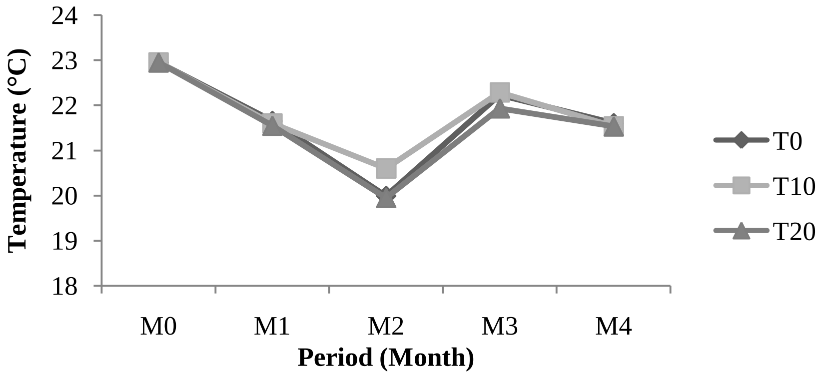

Fig. 11: Water temperature evolution according to the different treatments over time

3.1.1.4. Effect on the conductivity of water

Fig. 12 describes the evolution ofwater conductivityaccording to different treatments throughout the test. It shows that in general, the conductivity decreased slightly the first and the last two months of the trial. However, it rose sharply to form a peak in the second month. Thehighest water conductivity(41,67µs / cm) was obtained in the T20 treatment and the lowest (12,33µs / cm) in the T0 treatment.

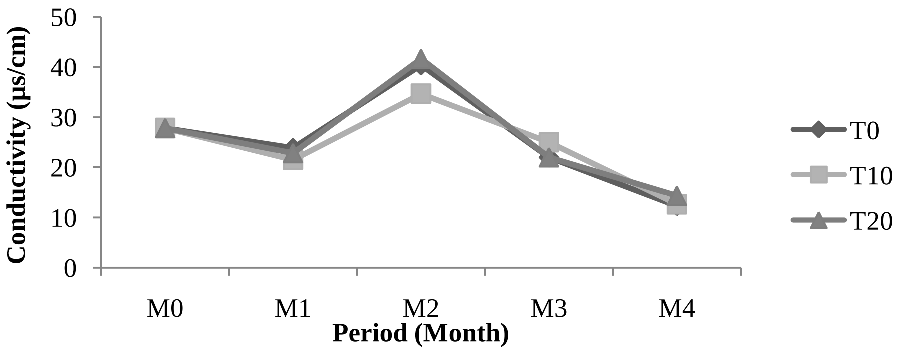

Fig.3: Water conductivity Evolution according to the various treatments over time

3.1.1.5. Effects of the level of incorporation of *D. uncinatum* on the water mineral salt content

The change in the mineral content of water with respect to the level of inclusion of *D. uncinatum* over time (Fig. 13) shows that, a month after the start of the test, the content of ammonia, nitrate, nitrite and phosphate showed no significant variation in the level of *D. uncinatum*. However, one month later, the ammonia content of water in treatment T20 increased (from 0.42 to 0.50mg / l). The Nitrate content however, increased regardless of the level of incorporation of *D. uncinatum*, the highest value (0.40mg / l) and the lowest (0,22mg / l) were obtained with the T0 and T20 treatments respectively. The nitrite content, remained almost constant in the diets containing 0 and 10% of *D. uncinatum* and dropped in the T20 treatment (0.10 to 0.06 mg / l). The phosphate content, decreased significantly regardless of the treatment.

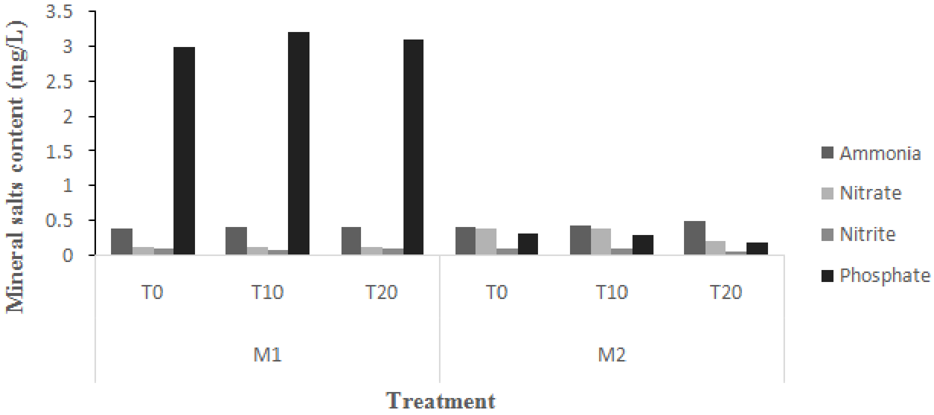

Fig. 13: Change in the water mineral salt contentwith the level of *Desmodium*incorporation over time

3.2 Effect of the level of incorporation of *D. uncinatum* on growth parameters of*Clariasjaensis*

The effect of the level of incorporation of *D.uncinatum* on growth parameters of*Clariasjaensis* (Table 2) shows that body weight, weight gain, average daily gain and specific growth rate were higher in batches that had received*D. uncinatum* Meanwhile no significant difference (P> 0.05) was observed between treatments. However, the incorporation of 10% of *D. uncinatum* yielded the highest valuesfor these parameters and the T0 treatment gave the lowest values. The total standard length was significantly (P<0.05) higher in fishes fed with rations containing *D. uncinatum*. The highest values (21,24 and 19,21cm) were obtained with the treatment T10 and lowest (18,96 and 16,98cm) with T0 treatment.The K condition factor, was higher at T0 (1.04) than T10 (0.88) and T20 (0.86). K condition factors obtained with T10 and T20 treatments were comparable and significantly (P <0.05) lower than that obtained with the T0 ration.

Table 2: Change in growth parameters values based on the level of D. uncinatum

Growthparameters	Treatments		
	T0(n=30)	**T10(n=30)**	**T20(n=30)**
Finalbody weight(g)	72,75± 25,19[a]	84,80± 19,99[a]	79,77± 32,45[a]
Totallength (cm)	18,96± 2,25[b]	21,24± 2,35[a]	20,88± 3,55[ab]
Standardlength(cm)	16,98± 1,98[b]	19,21± 2,25[a]	18,90± 3,34[a]
Weight gain (g)	43,31± 26,92[a]	53,80± 20,83[a]	50,96± 35,40[a]
Averagedaily gain(g)	0,36± 0,22[a]	0,45± 0,17[a]	0,42± 0,29[a]
Specificgrowth rate (%)	0,73± 0,37[a]	0,87± 0,34[a]	0,84± 0,49[a]
KFactor	1,04± 0,15[a]	0,88± 0,13[b]	0,86± 0,16[b]

a, b : on the same line , the meanswith the same letter are not significantly different (P>0,05), (n):number of animals

3.1.1.6. Effect of the level of incorporation of *D. uncinatum* on food consumption

Food consumption steadily increased in all treatments during the entire test period (Fig. 14). In general, this increase was earlier in the T10 treatment. However, the highest food consumption was noticed with the animals on treatmentsT0 and T20 in the last month of the Study.

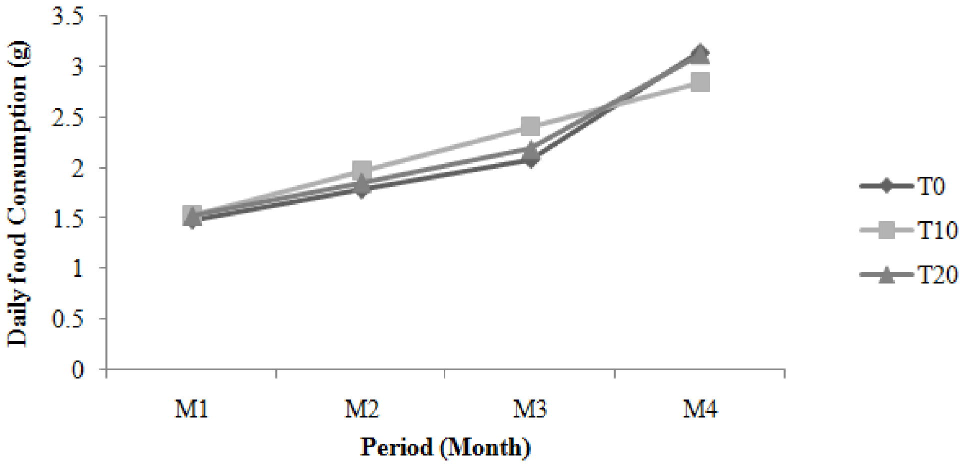

Fig.14: Evolution of food consumption with treatment over time

Effect of the level of incorporation of *D. uncinatum* on the evolution of the consumption index The Evolution of consumption index in the various treatments over time (Fig.15) shows that the consumption index increased steadily early in the third month of the study, before falling until the end of the test. The highest value (18.07) was obtained with diet containing 0% *D. uncinatum* the third month and the least (3.73) was observed with the diet containing 20%of the *D. uncinatum*.

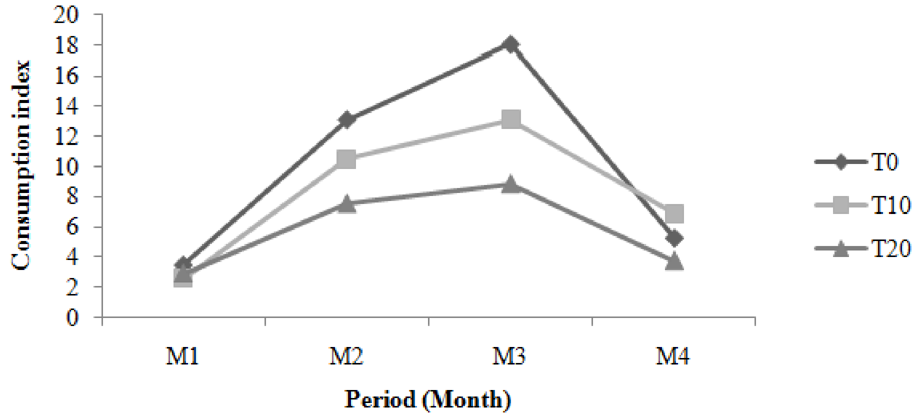

Figure 15: Evolution of the consumption index for the different treatments over time

Effect of the level of incorporation of *D. uncinatum* on some biochemical parameters of the flesh of *Clariasjaensis*

The change in total protein and total cholesterol with the level of incorporation of *D. uncinatum* in rations (Table 3) shows that the protein content was higher (34.16 and 30%) respectively in the flesh of fishes fed with 20 and 10% of *D. uncinatum*. Unlike protein levels, cholesterol levels were higher (9.91%) in fish tissue from the control group. However, no significant difference (P> 0.05) was observed for these two parameters regardless of the treatment.

Table 3: Change in total protein content and total cholesterol in fish flesh according to the level of incorporation of *D. uncinatum*

Biochemicalparameters	Treatments		
	T0(n=5)	**T10(n=5)**	**T20(n=5)**
Total protein (g)	0, 26± 0, 04 [a]	0, 30± 0, 07 [a]	0, 34± 0, 06 [a]
Total protein (%)	25, 83± 4, 32 [a]	30, 00± 7, 45 [a]	34, 16± 6, 00 [a]
Total cholesterol (g)	0, 09± 0, 02 [a]	0, 09± 0, 02 [a]	0, 09± 0, 01 [a]
Total cholesterol (%)	9, 91± 2, 00 [a]	8, 56± 1, 93 [a]	9, 42± 1, 41 [a]

a on the same line, the means with the same letter are not significantly different (P>0,05), (n): number of animals.

Economic cost of the food according to treatment

The economic cost of the ration per 100 kg of feed (Table 4) shows that the cost of the food decreased with the level of *D. uncinatum*. The lowest value was 415.56FCFA with the T20 treatment and the highest value was 430.5FCFA with T0 treatment. As for the price of a gram of food with *D. uncinatum*, the lowest value was obtained with treatment T10 (0,044FCFA).

Table 5: Economic cost of food

Price (FCFA)/kg	**Treatments**		
	T0	**T10**	**T20**
Total without*D.uncintum*	43050	38158	33245
Kg de *D.uncintum*	0	350	350
Kg of food with *D.uncinatum*	430, 50	427,49	422,56
Biomass (g)	72, 75	84, 80	79, 77
1g of food with*D. uncinatum* /1g of fish produced	0, 050	0, 044	0, 046

1FCFA= 0.0016USD

III. Discussion

The highest final live weight recorded was noted with the incorporation rate of 10%. This was low compared with that obtained by [17] with*Clariasgariepinus*.This could be explained by the low water temperature recorded during the test and the species. Furthermore, the specific growth rate (SGR) (0.87% / J) remains higher than 0.04 to 0.18% / day obtained by [18], and yet less than (1.9 and 3.4%/day) obtained by [19] and (4.14 and 5.80% / day) by[20] with*Clariasgariepinus*, in Benin and (3.60% / day) obtained by [20] with fingerlings of the same species.This could be justified by the density and size of fish used by them in their trials. However, these values were higher than those of [21]. Lower values of SGR from this study could be explained by the presence of tannins in the leaves of *D. uncinatum*. Indeed, tannin is more concentrated in the leaves of *D. uncinatum* than in the stem [22]. The high tannin content can reduce the palatability and digestibility of the feed. Reducing these anti-nutritional factors may be important for the plant materials as ingredients in fish feed [23]. It is therefore essential to check the content of tannins in *D. uncinatum*andanti-nutrients in general especiallybecause tannin content varies with plant products. The effects can be noticed at different levels such as gripping, protein digestion and other nutrients or metabolism, as an inhibitor of enzymes or as anti-vitamins [24, 25]. The mechanisms action of most of them are not known in fish.[26] had obtained very low and negative growth rates at the end of experimentswith*C.gariepinus*fingerlingsfed with diets containing 30% of coffee pulp. But one could believe that *D. uncinatum* yielded good results despite the tannin content of leaves.

The recorded weight gain was higher than (28,44g) obtained by [27]. This could be explained by the quality of *D.uncinatum*, the high content in crude protein and the rearing system. The rise in highest average daily gain with T10 incorporation rate was significantly (P<0.05) lower than (3 g/d) obtained by [28]. But it remained comparable (P> 0.05) to (0.47 g/d) obtained by [27]and (0.45g/d) reported by [20] with*Clariasgariepinus*fingerlings. However, it remains higher than (0.19 g / d) with Moringa leaves incorporation [29]. So*D. uncinatum* can be a good alternative source of protein for *Clariasjaensis* diet. K condition factor which gives overweight fish was variable with treatment. The values obtained (0.86 to 1.04) were similar (P> 0.05) than those (0.62 to 1.86) reported by [30] in *Protopterusaethiopicus*, greater than (0.79 0.83%) and 0.06 to 0.74% reported by [30, 20] with *C. gariepinus*. According to [31], these values show that *C. jaensis* was overweight. The difference between these values is linked to the optimal use of plant resources in farming. The results of the analysis of the protein content in the fish flesh varied from one treatment to another. The highest value (34.16%) was much higher than (20.29%) obtained by [32] with.*C. gariepinus*. This could be due to the low fiber in *D.uncinautm*. In fact, [33] showed that the high fiber content of the food interferes with the processing of the food in the fish intestine, thus reducing the digestibility of food and contributing to the loss of proteins. Unlike the protein content in the fish flesh, the total cholesterol was higher in the diet incorporated with T0%. This could be due to the fact that diets rich in plant material causes a reduction in lipid content of blood and muscles. Similar results were observed by [34] in the Nile Tilapia and [35] in the common carp fed with diets containing raw materials of plant origin at fairly high levels. Ingredient prices are those on the market at the time of the test. Food costs have ranged from 422.56 FCFA for the cheapest ration (T20), to 430.5 FCFA for the most expensive ration (T0). During the test, the cost necessary to produce 1 g of fish were low for T10 rations (0,044 FCFA) and high for rationT0 (0,050 FCFA).

IV. Conclusion

At the end of our study, no significant difference (P> 0.05) was found between the experimental diets for growth parameters like weight or length. The highest value of K condition factor was obtained with the treatment containing 10% *D. uncinatum* flour. The consumption index was better in the batch fed 20% of *D.*

*uncinatum*flour and the amount of total protein higher. While the highest value of the total cholesterol was obtained in animals fed with 0% *D. uncinatum* flour. The level of incorporation of *D. uncinatum* affected the cost of the ration. In view of the above, the use of 10% *D. uncinatum* in the ration may be a good alternative protein source for the production of *Clariasjaensis*. However, it is still advised to examine the influence of this rate on reproductive parameters and organoleptic qualities of the flesh of *C. jaensis*.

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