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Effect of Fertilization Level on Chemical Composition, Intake and in Vivo Digestibility of Moringa Oleifera Cutting at 4 Months in Guinea Pig

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Abstract **– In order to contribute to a better use of *Moringa oleifera* in guinea pig's diet, tests were conducted at the University of Dschang between March and July 2018. The study focused on the chemical composition and *in vivo* digestibility of *Moringa oleifera* fertilized at different levels with chicken droppings in guinea pig (*Cavia porcellus*). *Moringa oleifera* used in this trial was fertilized at doses of 0, 50, 100, 150, 200 and 250 kg N/ha and harvested when the plants were 4 months old. The harvested *M. oleifera* was dried and then crushed with a hand grater. Similarly, 60 adult guinea pigs of local breed, including 30 males and 30 females, were purchased from stock farmers in the town of Dschang and the surrounding area. These animals were 5 months old and had an average weight of 450 ± 50 g. After 2 weeks of acclimation in the farm rearing lodges and 10 days of adaptation in the individual digestibility cages, the animals were randomly divided into 2 groups of 6 batches having 5 animals in each batch. Each group was subjected to 6 rations of *Moringa oleifera* fertilized at different doses with chicken manure (0, 50, 100, 150, 200 and 250 kg N/ha) and 200g *Trypsacum laxum* as basic fodder. During the digestibility test which lasted 7 days, each diet was repeated on 10 guinea pigs; 5 males and 5 females. The main results showed that Crude protein (CP) and ash increase with fertilization levels while non-nitrogen extract (NNE) and sugar decreased with fertilization levels. Fertilization had no effect on the dry matter (DM), organic matter (OM) and crude fiber (CF) content of *Moringa oleifera*. Ingestion of *M. oleifera* and nutrients in animals were comparable (p > 0.05) with fertilization levels. Regardless of fertilization level, digestibili--ty of all nutrients was comparable (p>0.05). Digestibility of crude fiber in males was HIGHER THAN THOSE OF FEMALES FOR 100, 150, 200 and 250 Kg N/ha diets. This study showed that 100, 150, 200 et 250 kg N/ha has resulted in the highest fiber digestibility of *Moringa oleifera* at 4 months.**

Keywords **– Chemical Composition, Guinea Pigs, *In Vivo* Digestibility and *Moringa Oleifera*.**

I. Introduction

Food is the main factor limiting the expression of production potential in tropical animals [1]–[2]. According to [3], animals ingest food to meet their energy and nutrients requirements. Thus, more food is able to [4]–[5]–[6] release its nutrients, better it allows to achieve good animal performance at a lower cost. In addition, according to, food consumption of plant origin by herbivores slows digestion and consequently allows a good absorption of food and a more favourable balance of nutrients by calories due to good cell growth management. Thus, improving the productivity of monogastric herbivores like guinea pig can be by improving their diet and above all, by making available to them fodder rich in protein. Among the alternative sources of high-protein forage in Cameroon, we can quote the plant of *Moringa oleifera* which in addition to minerals contains vitamins in high quantity. Leaves of *Moringa oleifera* are an excellent source of protein whose grades range from 19 - 35% DM [7]. The amino acid content of the *M. oleifera* leaf meal is comparable to that of soybean meal [8]–[9] with a digestibility of 79.2% [10]. Its metabolizable energy content ranges from 2273- 2978 kcal/kg. DM [9]. The leaves of *M. oleifera* contain a very high concentration of vitamins A (6.8 mg), B (423 mg) and C (220 mg); minerals (Iron, Calcium, Zinc, Selenium) and are rich in *B*-Carotene [11]–[12]. Despite this good protein content, the use of this plant in animal feed is not very popular. In addition, its chemical composition and digestibility vary according to geographical areas, fertilizer type, fertilization levels and cutting age [13]–[14]. The work of [13] showed that *Moringa oleifera* fertilized with urea at different doses (0, 30, 60, 90 and 120 kg/ha) affected their chemical composition. Likewise, digestibility of nutrients from *M. oleifera* fertilized with poultry manure and cuttings at 90 days were comparable in rabbits. This digestibility increased with the inclusion level of *M. oleifera* (5 to 20%) [15]. On the other hand, the work of [16] in Guatemala on ruminal degradation of dry matter and fibers of *Cynodon dactylon* fertilized with different levels of nitrogen and harvested at two different periods, has shown that nitrogen fertilization improved the effective degradation of the dry matter and NDF for every 100 kg N/ha. If few works have been done in Cameroon on the fertilization of *Moringa oleifera* [17], none have yet been realized on the effect of different levels of fertilization and cutting age on *Moringa oleifera* digestibility in guinea pig. It is therefore to overcome this gap that the present work was initiated with the aim of evaluating the effect of fertilization level on the chemical composition, ingestion and digestibility of *Moringa oleifera* cut at 4 months on guinea pig.

II. Material and Methods

A. *Experimental Site*

The study was conducted at the Animal Production and Nutrition Research Unit of the University of Dschang. Dschang is located at the 15th degree of the eastern meridian, at latitude 5°26'27" North and longitude 10°26'29" East. The climate of the region is Cameroonian Equatorial type modified by the altitude. Over the commercial activities, the locality is strongly agro-pastoral. The rainfall varies between 1500 and 2000 mm per year. The average annual temperature is around 20°C, the annual total insulation at 1800 hours and average relative humidity is between 40 and 97%. The rainy season corresponding to the cultivation period from mid-March to mid-November. February is generally the hottest month and the coldest one are July and August. Soil, ferralitic type, is well drained and slightly acidic (with a pH of about 4.8). The lands, brown and derived from basaltic rocks have a very heavy (clay) texture and quite a marked deficiency in potash. Natural vegetation carries species whose presence testifies its formerly forest nature [17].

B. *Animal Material*

To carry out this test, 60 guinea pigs of local breed (30 males and 30 females) aged approximately 5 months and average weight 450 ± 50 g were used for the evaluation of feed intake and the digestibility of *Moringa oleifera*. These animals were placed in cages of 10.6 cm^3 screens (76 cm x 46.5 cm x 30 cm), each equipped with a 100 g plastic feeder and 100 ml plastic water trough. The complete cleaning of the building followed by the disinfection of the cages was carried out with a disinfectant at a dose of 125 ml per 15 l of water before the animals were introduced. Anti-stress (Total amine) was given in the drinking water of the animals as soon as they arrived in the livestock building. To avoid a possible vitamin C deficiency, one tablet 240 mg of vitamin C was diluted in 1.5 l of drinking water of the animals for the duration of the test.

C. *Plant Material*

Plant material consisted of *Moringa oleifera* leaves fertilized at different doses (0, 50, 100, 150, 200, 250 kg N/ha). Leaves of *Moringa oleifera* were harvested at 4 months of age. The harvested leaves were dried in the shade, crushed and stored for manufacture of granules. For the basic fodder, 200 g of *Trypsacum laxum* was served every day per animal. This grass was harvested every day in the farm and pre-faded before being served to animals the next day.

D. *Making of Granules*

The harvested and dried leaves were crushed using a grainy manual and served to animals in granular form (Photo1).

(a)

(b)

Photo 1: Dried Moringa leaves (a); Granulated Moringa leaves (b).

Animals were distributed in a completely randomized design. The daily ration served to each animal was constituted as follows:

R0 = 200 g fresh *T. laxum* + 3.46 g dry *M. oleifera* leaves produced with 0 kg N/ha/animal/day;

R50 = 200 g fresh *T. laxum* + 3.46 g dry *M. oleifera* leaves produced at 50 kg N/ha/animal/day;

R100 = 200 g fresh *T. Laxum* + 3.46 g dry *M. oleifera* leaves produced with 100 kg N/ha/animal/day;

R150 = 200 g fresh *T. laxum* + 3.46 g dry *M. oleifera* leaves produced with 150 kg N/ha/animal/day;

R200 = 200 g fresh *T. laxum* + 3.46 g dry *M. oleifera* leaves produced with 200 kg N/ha/animal/day;

R250 = 200 g fresh *T. laxum* + 3.46 g dry *M. oleifera* leaves produced at 250 kg. N/ ha/Animal/day.

E. *Evaluation of the Chemical Composition of Moringa Oleifera*

A 100 g sample of each treatment was harvest, oven-dried to constant weight, crushed and preserved in plastic bags for the evaluation of their chemical composition. The dry matter (DM), organic matter (OM), ash, crude protein (CB), fat and crude fibers (CF) were determined according to the methods described by AOAC (1990). The nitrogen free extract (NFE) and total sugar content were determined by the following formulas:

- NFE = DM - (CP + CF + Ash + Fat)
- Sugar = OM - (Fat + CP)

F. *Evaluation of Ingestion of Moringa Oleifera*

For each treatment, 5 guinea pigs were randomly located to an individual cages and the feed was served only once each day between 8 and 9 o' clock. For the evaluation of the feed intake, the quantities of food served were noted and the refusals were collected daily and weighed before any new distribution.

G. *Evaluation of the Digestibility of Moringa Oleifera*

The digestibility test was preceded by a period of adaptation of the animals to the digestibility cage and granular Moringa, which lasted for 10 days. During the digestibility period which lasted properly for 7 days, each morning before the distribution of the feed, the faeces were collected, weighed and a representative sample of approxi--mately 100 g was then taken and dried at 60°C to constant weight in the laboratory in a ventilated oven. Subsequently, dried faeces were milled using a homemade tri-hammer mill, and kept in plastic bags for evaluation of their dry matter content (DM), organic matter (OM), crude protein

(CP) and crude fiber (CF) according to method described by [18]. The digestibility of Dried Matter (DM), Organic Matter (OM), crude Protein (CP) and crude fibers (CF) were determined according to the formula of [19].

H. *Statistical Analyses*

Chemical composition of *Moringa oleifera* was subjected to a one way analysis of variance (ANOVA) (the doses of chicken droppings used to fertilize the *M. oleifera*). Feed intake and nutrient digestibility were subjected to a two-way analysis of variance (ANOVA) (doses of chicken droppings used to fertilize *M. oleifera* and sex) according to the General Linear Model (GLM) with the statistical software SPSS 20.0. When a significant difference existed between the treatments, the separation of the averages was

III. Result

A. *Effect of Fertilization level on the Chemical com- -position of Moringa Oleifera cutting at 4 months*

Fertilization had no significant effect (p>0.05) on the dry matter (DM), organic matter (OM) and crude fiber (CF) content of *Moringa oleifera* (Table 1). Fertilizer levels affected the fat content. Fat content obtained with 0, 100, 150 and 250 kg N/ha were comparable (p> 0.05) and significantly (p <0.05) lower than those obtained with 50 and 200 kg N/ha. The highest value (3.84% DM) was obtained with plants fertilized at 200 kg N/ha and the lower (1.79% DM) with unfertilized plants. Ash and crude protein content had significantly (p<0.05) increased with fertilization levels.

Table 1. Effect of fertilization level on the chemical composition of whole *Moringa oleifera* plant cut at 4 months.

Fertilization Level (kg N/ha)	**Chemical Composition (%DM)**							
	DM	OM	Ash	CP	CF	Fat	NNE	Sugar
0	89.26a	70.92a	8.76ab	20.66a	25.00a	1.79a	33.03d	27.37c
50	89.04a	70.69a	8.60a	23.87b	26.98a	3.83b	25.74c	24.89b
100	89.99a	72.03a	8.95b	26.76c	27.58a	2.17a	24.50c	25.80b
150	89.54a	70.64a	9.53c	27.44d	27.00a	1.80a	23.75c	24.73b
200	89.78a	71.10a	9.51c	31.91e	25.26a	3.84b	19.24b	23.11a
250	89.78a	70.33a	10.38d	31.49e	30.85b	2.63a	14.49a	24.75b
ESM	0.112	0.178	0.145	0.965	0.576	0.244	1.425	0.332
P	0.106	0.073	0.000	0.000	0.015	0.003	0.000	0.000

a, b, c, d, e: Mean with the same letters on the same column are not significantly different at the 5% level; SEM: Standard Error of the Mean; P: Probability; DM: dry matter; OM: organic matter; CP: crude protein; CF: crude fiber; NNE: Extractive non-nitrogenous.

Crude protein content of plants fertilized at 200 and 250 kg N/ha, however, remained comparable (p>0.05). Nitrogen free extract (NFE) and sugar of *Moringa oleifera* decreased with fertilization levels.

B. *Effect of Fertilization level on Ingestion of Moringa Oleifera Cutting at 4 months in Guinea Pigs*

The fertilization level had no significant influence (p> 0.05) on the intake of *Moringa oleifera* cut at 4 months and *T. laxum* whether in the male, the female or for all sex combined (Table 2). The same trend has been observed for the ingestion of dry matter (DM), organic matter (OM), crude protein (CP) and crude fiber (CF) in males. In addition, ingestion of dry matter in females for R100, R150 and R250 diets was comparable (P> 0.05) and significantly (P <0.05) lower than those of R0, R50 and R200 diets. Dry matter ingestion of the R0, R50 and R200 in females was comparable (P> 0.05). Ingestion of organic matter, crude protein and crude fiber in females for R0 and R200 were comparable (p> 0.05) and significantly (p <0.05) higher than those of R50, R100, R150 and R250. Ingestion of organic matter, crude protein and crude fiber of R50, R100, R150 and R250 in females was comparable (p> 0.05).

Table 2. Ingestion of *Moringa oleifera* fertilized at different levels of chicken droppings and cutting at 4 months.

Intake (g DM/Day/animal)		**Treatments**						**SEM**	**p**
		R0	R50	R100	R150	R200	R250		
Experimental diets									
M. oleifera (DM)	♂(5)	22.06a	24.86a	29.73a	25.93a	21.80a	24.93a	1.138	0.400
	♀(5)	27.80a	23.33a	18.53a	17.13a	20.60a	22.46a	1.145	0.064
	♂♀(10)	24.93a	24.09a	24.13a	21.53a	21.20a	23.69a	1.141	0.232
T. laxum (DM)	♂(5)	101.26a	94.73a	102.66a	100.06a	103.13a	98.40a	3.294	0.988
	♀(5)	96.73a	90.60a	71.26a	86.40a	104.86a	83.33a	3.451	0.059
	♂♀(10)	98.99a	92.66a	86.96a	93.23a	103.99a	90.86 a	3.372	0.523
Total Nutrients									
Dry Matter	♂(5)	113.23a	109.64a	121.59a	115.65a	114.83a	113.27a	3.082	0.952
	♀(5)	114.16b	104.46b	82.50a	95.14ab	115.36b	97.14ab	3.517	0.025
	♂♀(10)	113.69a	107.05a	102.04a	105.39a	115.09a	105.20a	3.299	0.488
Organic Matter	♂(5)	97.24a	93.90a	104.13a	98.94a	98.59a	96.81a	2.676	0.955
	♀(5)	97.65b	89.49ab	70.76a	81.71ab	99.46b	82.94ab	3.088	0.032
	♂♀(10)	97.44a	91.69a	87.44a	90.32a	99.02a	89.87a	2.882	0.493
Crude Protein	♂(5)	17.02a	16.77a	17.33a	17.61a	17.46a	17.33a	0.437	0.843
	♀(5)	17.79b	15.64ab	12.64a	14.04a	17.38b	14.98ab	0.534	0.013
	♂♀(10)	17.40a	16.20a	14.98a	15.82a	17.42a	16.15a	0.485	0.428
Crude fiber	♂(5)	43.42a	41.99a	46.41a	44.31a	44.15a	44.31a	1.252	0.970
	♀(5)	42.98b	40.05ab	31.69a	36.99ab	44.54b	37.90ab	1.349	0.045
	♂♀(10)	43.2a	41.02a	39.05a	40.65a	44.34a	41.10a	1.300	0.507

a, b, c: Averages with the same letters on the same line are not significantly different at the 5% level; SEM: Standard Error on the Mean; P: Probability; ( ) : effective; ♂: male; ♀: female; ♂♀: male and female combine.

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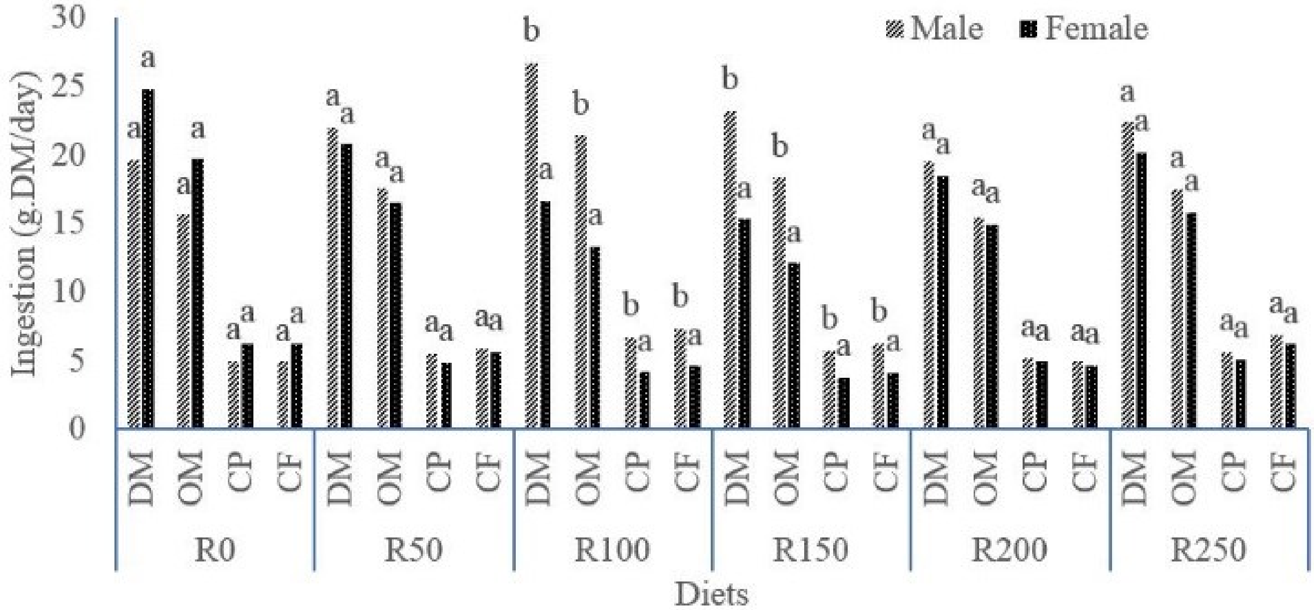
C. Comparative Effect of Fertilization levels on Moringa Oleifera intake at 6 months between Male and Female

Feed intake was comparable (p>0.05) in animals of both sexes for R0, R50, R200 and R250 diets. In contrast, males had a better (p<0.05) ingestion of dry matter, organic matter, crude protein and crude fiber for R100 and R150 diets.

D. Effect of Fertilization level on the Digestibility of Moringa Oleifera Nutrients Cutting at 4 months in Guinea Pigs

The fertilization of *Moringa oleifera* with chicken droppings had no effect (p>0.05) on the digestibility of dry matter and organic matter both in males, females and all sexes combined regardless of ration (Table 3). The same trend was observed with digestibility of crude protein and crude fiber respectively in males, females and all sexes combined.



a, b: Bars with the same letters for the same ration are not significantly different at the 5% level; DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fiber.

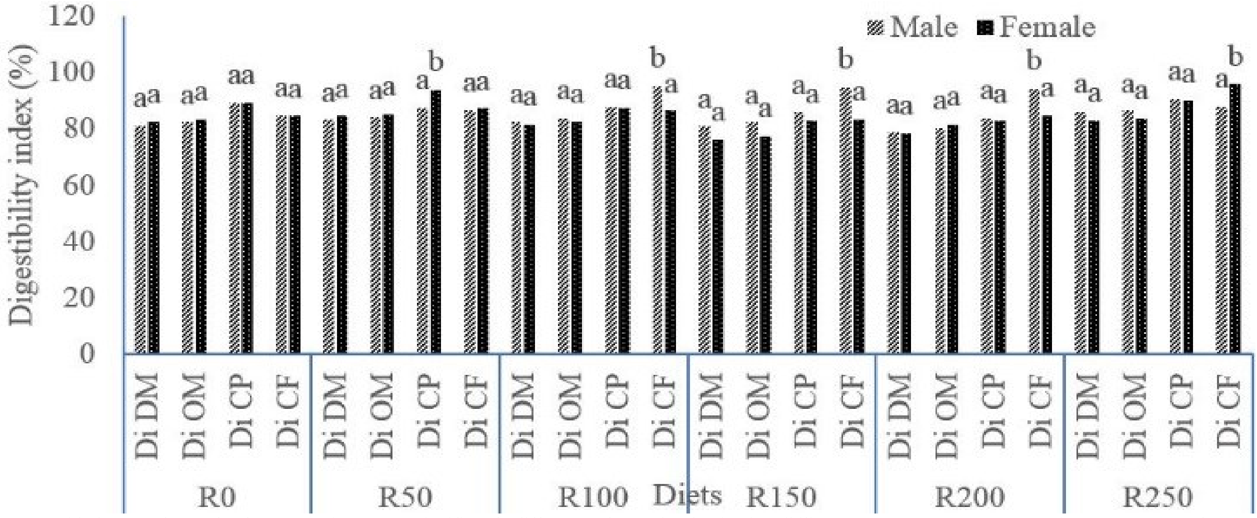
Fig. 1. Comparative effect of fertilization levels on *Moringa oleifera* intake at 4 months between male and female.

Table 3. Digestibility of nutrients in guinea pigs fed on *M. oleifera* cutting at 4 months.

Digestibility (%)		Diets						SEM	p
		R_0	R_{50}	R_{100}	R_{150}	R_{200}	R_{250}		
Dry matter	♂	81.09[a]	83.11[a]	82.50[a]	80.82[a]	78.79[a]	85.99[a]	1.213	0.703
	♀	82.49[a]	84.46[a]	81.43[a]	76.21[a]	78.41[a]	82.84[a]	0.934	0.071
	♂♀	81.79[a]	83.78[a]	81.96[a]	78.51[a]	78.60[a]	84.41[a]	1.073	0.387
Organic matter	♂	82.19[a]	84.06[a]	83.83[a]	82.14[a]	80.12[a]	86.21[a]	1.095	0.759
	♀	83.38[a]	85.10[a]	82.33[a]	77.59[a]	81.65[a]	83.71[a]	0.985	0.353
	♂♀	82.78[a]	84.58[a]	83.08[a]	79.86[a]	80.88[a]	84.96[a]	1.040	0.556
Crude protein	♂	89.14[a]	87.37[a]	87.81[a]	85.79[a]	83.89[a]	90.68[a]	0.961	0.429
	♀	89.25[ab]	93.78[c]	87.55[b]	82.63[a]	82.64[a]	89.91[ab]	1.083	0.001
	♂♀	89.19[a]	90.57[a]	87.68[a]	84.21[a]	83.26[a]	90.29[a]	1.022	0.215
Crude fiber	♂	84.67[a]	87.22[a]	95.06[b]	94.55[b]	94.23[b]	95.86[b]	1.194	0.002
	♀	84.43[a]	86.46[a]	86.25[a]	83.43[a]	84.70[a]	87.94[a]	0.621	0.344
	♂♀	84.55[a]	86.84[a]	90.65[a]	88.99[a]	89.46[a]	91.90[a]	0.907	0.173

a, b: Averages with the same letters on the same line are not significantly different at the 5% level; SEM: Standard Error of Mean; P: Probability; R: Rations; Di: Digestibility; DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fiber.

In females, digestibility of crude protein of the R0, R100 and R250 was comparable (p> 0.05). The same thing was observed with digestibility of crude protein of the R0, R150, R200 and R250. Digestibility of crude protein of the R50 was significantly (p<0.05) higher than those of the others diets. In males, digestibility of crude fiber of R0 and R50 were comparable (p> 0.05) but significantly (p <0.05) lower than those of R100, R150, R200 and R250.



a, b: Bars with the same letters for the same ration are not significantly different at the 5% level; Di: Digestibility; DM: Dry matter; OM: Organic matter; CP: Crude protein; CF: Crude fiber.

Fig. 2. Comparative digestibility of dry matter, organic matter, crude protein, and crude fiber between males and females fed *Moringa oleifera* cutting at 6 months based on dietary diets.

E. *Comparative Effect of the Fertility Levels on Moringa Oleifera Digestibility Cutting at 4 Months between Male and Female*

Females had significantly ($p<0.05$) better digested than males crude protein and crude fiber respectively with R50 and R250 diets. Similarly, the digestibility of crude protein in male was significantly ($p<0.05$) higher than that of female for R0, R50, R200 and R250 diets. In addition, the digestibility of dry matter, organic matter and crude protein of these rations were comparable ($p>0.05$) regardless of the sex.

IV. Discussion

The results of the study on the effects of nitrogen fertilization on the chemical composition of plants showed that dry matter and organic matter content were not influenced by the fertilization levels. These results are consistent with those of [21] and [22]. According to [22], nitrogen fertilization decreases the dry matter content and soluble carbohydrate contents, the total nitrogen content, especially nitric increases, which has the effect of not changing the nutritional value of the feed. The results obtained differ from those obtained by [23] and [24] who found that the use of increasing amounts of mineral nitrogen on pure grass prairies generally causes a decrease in the dry matter content of plants. This difference could be explained by the forage species and/or soil type. Raw protein levels increased with fertilization levels. These results are superior to those obtained by [25] when *M. oleifera* was fertilized by cow bursaries and similar to those obtained by [13] when he applied increasing doses of urea on the chemical composition of *M. oleifera*. Increasing the crude protein content of *M. oleifera* under the effect of nitrogen fertilization is accompanied by a decrease in protein nitrogen in favour of non-protein nitrogen. In fact, the entry of nitrogen into the plant, which takes place essentially in the form of nitrate, increases rapidly with fertilization, which leads in a first step to the accumulation of no-protein nitrogen, followed by nitrate for high fertilization levels [26]–[2].

The levels of nitrogen free extract and *Moringa oleifera* sugar decreased significantly with fertilization levels. These results are similar to those of [27]. Indeed, the results presented showed significant variations whose nitrogen intensification is not the least cause. A decrease of 10 to 20% in the non-nitrogenous extract content of the forage is recorded as soon as one goes from a fertilization of 30 units to 90-120 units of nitrogen. It thus appears that the fodder obtained under these intensification conditions are less rich in non-nitrogen extractives, which does not imply that they are less energetic, because at the same time they are richer in nitrogenous matter. Likewise, the increase in nitrogen content following nitrogen fertilization is often associated with a decrease in the level of soluble carbohydrates (sugars) [28], which is sometimes halved. This significant decrease results from the fact that the development of soluble carbohydrates, limited by leaf area and photosynthesis, is not increased by nitrogen fertilization, contrary to their use.

The total daily intake of *M. oleifera* and *T. Laxum* did not significantly vary with fertilization. It was the same for the ingestion of Dry Matter, Organic Matter and Crude Protein. However, the highest values of these ingestions were obtained with *M. oleifera* fertilized at 200 kg N/ha. These results could be explained by the fact that *M. oleifera* fertilized at 200 kg N/ha would therefore have provided good quality proteins which favoured the ingestion of nutrients. Similarly, the highest gross cellulose intake was obtained with R200 diets. *M. oleifera* contained in this ration is the one with the highest protein content. Indeed, according to many authors, protein supplements promote a sufficient proliferation of intestinal microorganisms involved in digestion in guinea pigs [29]–[30]–[31]. This would promote the increase of feed fermentation and transit with consequent increase in food intake.

The total daily intake of nutrients was higher in the male than in the female with the R100 and R150 diets. This could be explained among other things by the fact that, in general, in adulthood, males have a high weight compared to that of females and are therefore more vigorous. They may therefore be able to eat better because the feed intake is very often correlated with the weight of the animal. According to many authors, males ingest better than females in guinea pigs [29]–[30]. The best dry matter intake recorded in males in this study (29.73 g.DM/animal/d) is greater than the 21.32 g.DM/animal/d observed by [32] in male guinea pigs supplemented with cotton seed cake but lower than the values (58.12 g.DM/ animal/ d) obtained by [29] supplementing *Tithonia diversifolia* in guinea pigs of the same sex fed *P. purpureum*. These differences would be related to the composition of the experimental foods used.

In the present study, no significant difference was observed between the digestibility of dry matter, organic matter, crude protein and crude fiber. On the other hand, digestibility of crude fiber in males increased with fertilization level and the crude protein content. These results are similar to those observed by [30]–[31]. Indeed, an increase even low nitrogen intake improves the digestibility of fiber. In fact, the increase proteins in the leaves of *M. oleifera* with high levels of fertilization would have created in the digestive tract conditions to the proliferation of microflora fiber, which would have accelerated the fermentation process, thereby causing a consequent and/or concomitant improvement in the digestibility of fiber. The digestibility of the *Moringa oleifera* nutrients between the male and the female varies with fertilization level. Indeed, for some diets are the males who digest, for others it is the females who digest better. This can be explained by the fact that the digestibility is more affected by the food than by the animal. Indeed according to [33], food itself is the factor that has the strongest influence on digestibility. The digestibility will therefore be affected by the structure and physical state of the diet that means the form in which the food is presented to the animal. This factors condition the action of the microbial flora and digestive juices. Rations used in this test were in the form of pellets, which favored both ingestion and digestibility.

V. Conclusion

At the end of this study, it appears that Nitrogen fertilization influenced the chemical composition of *M. oleifera*. Fertilization increased with ash and protein content, however, the nitrogen free extract and sugar content decreased with the fertilization level. Fertilization did not affect Dry Matter and Organic matter content. Fertilization and sex aren't effect on the intake and the dig--estibility index of the nutrients.

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