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Evaluation of toxicity effects, hematological parameters and lipid profile of cavies (*Cavia porcellus*) fed on diets containing *Stylosanthes guianensis* and *Ipomea batatas* leaves meal

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ABSTRACT

Aim: The study was aimed to assess the effect of diet on guinea pigs health, a study on the incorporation of *Stylosanthes guianensis* and Ipomea *batatas* leaves meal in guinea pig diet.
Method and materials: 36 guinea pigs of 3 weeks age born at the RAF were sexed, identified and randomly distributed according to a factorial design of 4 diets and sexes. The leaves of each plant were harvested individually, dried, crushed and mixed with others food ingredients in order to constitute different diets: R_0 (control), R_{FP} (20% of *I. batatas* leaves meal), R_{ST} (20% of *S. guianensis* meal) and R_{FP+ST} (10% of *I. batatas* leaves meal + 10% *S. guianensis* meal). Diets were randomly assigned and each animal received 60 g of food corresponding to its lodge every day between 6 and 8 am. The animals were thus fed until 16 weeks of age. At the 16th week, 6 guinea pigs (3 females and 3 males) were randomly chosen from each batch fasted for 12 hours then slighted by cervical dislocation and total bleeding in the throat. Blood sample collected were used for the hematological, lipid and toxicity parameters analysis.
Results: It showed that white blood cells (21.31×10^3/ µl), hematocrit (40.78%) and blood platelets (403.17×10^3 / µl) were significantly elevated in guinea pigs fed with R_{FP} diet. Total cholesterol, HDL and LDL were comparable. R_{FP} diet significantly lowered urea concentration regardless of gender. However, no value exceeded standards for both hematology and other parameters. Sex had no significant effect regardless of the characteristic. R_{FP} diet seems to be most appropriate in guinea pigs.
Conclusion: It was concluded that number of white blood cells, blood platelets and hemoglobin significantly increased with the addition of forages in the diet. The incorporation of forages in the diet significantly increased the weight of the lung, kidneys and heart while remaining within the standards.

Keywords: *Cavia porcellus*, hematology, lipid profile and toxicity indicator.

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Introduction

The intensification of mini-farming like caviaculture (Mettre, 2012) constitutes an efficient approach to resolve the protein needs of the poorest fringes of the population. Indeed, guinea pig breeding has the characteristics of an economically profitable mini-breeding easily practicable by children (Bindelle, 2013). Caviaculture is also an important source of protein and significant income, especially for population whose income does not allow easy access to meat or fish (Noumbissi *et al*., 2014). The guinea pig also offers tender meat rich in protein and its droppings are very popular for fertilizing vegetable plots (Meutchieyé, 2013). Its carcass yield varies between 45 and 70%, resulting in a true meat animal (Kouakou *et al*., 2017; Zougou *et al*., 2017). In Cameroon, the guinea pig is not only part of eating habits, but is also used in certain regions as a sacrificial animal for certain customary rites (Yiva *et al*., 2014). However, intensification of caviaculture and therefore of its participation in protein security remains lower. This low contribution of guinea pig farming to protein security results from several constraints, including diet. Several authors agree to recognize the surrounding of the incorporation of local forages in the diet of guinea pig (Mweugang *et al*., 2016; Miégoué *et al*., 2019 and Mouchili *et al*., 2019). However, this assessment is mostly zootechnical and very little data exist on the effect of diet on hematology, lipid profile and toxicity in guinea pigs. Thus, the main objective of this study is to assess the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on hematological parameters, lipid profile and some toxicity parameters in guinea pigs.

Materials and Methods

Study site

The study was conducted between October 2019 and March 2020 at the Animal Production and Nutrition Research Unit of the Faculty of Agronomy and Agricultural Sciences of the University of Dschang located in the upper lands of West Cameroon. At 15th degree of the East Meridian, at latitude 5 ° 26 '27 "North and at longitude 10 ° 26' 29" East. Precipitation varies between 1,500 and 2,000 mm per year with an average annual temperature of around 20 ° C, total annual insolation of around 1,800 hours and an average relative humidity varying between 40 and 90%. The climate is Cameroonian type modified by altitude with a rainy season that goes from mid-March to mid-November and a dry season that goes from mid-November to mid-March. The original vegetation of the region is a shrub savannah with in places gallery forests (Pamo *et al*., 2005).

Animal equipment and housing

For this study, 36 guinea pigs of 3 weeks age were divided into four groups of 9 animals each. Each group was then divided into two sub-groups according to sex (ie 5 females and 4 males), as to constitute comparable lodges according to live weight. The animals were raised in boxes made of plywood (1m long, 0.8m wide and 0.6m high) each equipped with lighting and electric heating equipped with 2 feeders in wood for the compound feed and two concrete water troughs in one of the livestock buildings made at the Research and Application Farm of University of Dschang. Animals were raised on the ground, on a litter of 5cm thick made up of untreated dry wood chips. The litter was renewed every 3 days to avoid accumulation of feces and urine. The different lodges were equipped with a cover of small mesh to protect animals from mice and other predators that may accidentally enter the livestock building. The complete cleaning of the building followed by the disinfection of boxes was done with bleach at a dose of 125 ml per 15 l of water before the animals were introduced. The anti-stress (amine total at a rate of 1 g per 1 L of water) was administered in the drinking water three days before and after any manipulation. To avoid a possible vitamin C deficiency, a tablet of 240 mg vitamin C was diluted in 1.5 l of drinking water and served *ad libitum* from the introduction of the animal stile the end of the study.

Plant material

Sweet potato leaves (*Ipomea batatas*) were harvested in a farmer farm in Santchou and *Stylosanthes guianensis* was harvested in the FAR forage field. It showed the nutritional value of the forages used (Table 1).

Table1: nutritional value of the forages used

Chemical composition	**Forage**	
	Stylosanthes guianensis	***Ipomea batatas***
Dry matter (%)	95.50	90.70
Organic matter (% DM)	86.32	81.20
Ash (% DM)	6.06	9.93
Crude fiber (% DM)	30.52	16.60
Crude protein (% DM)	13.50	14.40
Fat (% DM)	4.57	4.80
Digestible energy (kcal/kg)	1467.76	1048.00

Diet formulation

The leaves of each plant were harvested individually, dried, crushed and mixed with 10% sugar cane molasses as well as the ingredients (corn, wheat bran, cottonseed meal, soybean meal, palm kernel meal, fish meal. and palm oil) purchased from resellers of agricultural by-products in the city of Dschang to constitute different diets (R_0, R_{FP}, R_{ST} and R_{FP+ST}). A sample of 100 g of each experimental diet was taken, transported in the animal production and nutrition laboratory to be dried in an oven at 60 ^{0}C for 12 hours (until constant weight), then ground using a tri-hammer grinder fitted with a 1 mm mesh sieve and stored in plastic bags for the evaluation of their content of dry matter (DM), organic matter (OM), crude protein (CP), and crude fiber (CF) according to the method described by AOAC, (2000). Table 2 shows the percentage and chemical composition of the experimental rations.

Trial

The piglets were identified (using the number of the loop worn on their ears) then housed according to a factorial device (4x2) comprising the 4 diets (R_0, R_{FP}, R_{ST} and R_{FP+ST}) and the sexes (male and female) and monitored individually in each lodges up to 16 weeks of age. Diets were randomly assigned and each animal received 60 g of feed corresponding to its lodge every day between 6 and 8 hours. At the 16th week, 6 guinea pigs (3 females and 3 males) chosen at random from each lodge were fasted for 12 hours then slighted by cervical dislocation and bleed completely in the throat. After evisceration, each organ was taken separately and weighed using a laboratory balance with a capacity of 7 kg and a precision of 0.5 g. The blood collected was stored in test tubes with anticoagulant (EDTA) and analyzed using an automatic hematimeter to establish the blood count in order to assess the following parameters: white blood cells, hematocrit, hemoglobin, blood platelets and red blood cells. The blood collected in dry tubes was centrifuged at 3500 rpm for 15 min using a Labofuge brand centrifuge. After centrifugation, the serum from each tube was transferred to an ependorf tube and stored at -18 ° C for the determination of serum parameters using Chronolab kits. The activity of transaminases was determined by the method of Reitman *et al*, (1972). The creatinine assay was performed by the colorimetric method as described by Newman (1999).

Table2. Percentage and chemical composition of the experimental rations.

Ingredients (kg)	Experimentales diets			
	R_0	**R_{FP}**	**R_{ST}**	**R_{FP+ST}**
Corn	27	30	29	29
wheat bran	32	11	10	13
Cottonseed meal	7	5	9	5
Palm kernel meal	7	6	6	5
Soybean meal	10	7	6	7
Fish meal.	3	7	6	7
Molasses	10	10	10	10
palm oil	4	4	4	4
Ipomea batatas		20		10
Stylosanthes guianensis			20	10
Total	**100**	**100**	**100**	**100**

Composition chimique

Dry matter (%)	75.80	88.80	73.00	86.00
Organic matter (%DM)	86.20	93.60	92.84	83.48
Ash (% DM)	13.79	6.39	7.15	6.51
Crude fiber (% DM)	10.46	9.76	14.89	14.62
Crude protein (% DM)	16.27	17.76	16.64	17.72
Fat (% DM)	5.83	8.25	7.44	6.18
Digestible energy (kcal/kg)	2777.71	3273.37	2743.27	2724.79

R_0: Control
R_{FP}: diet with 20% of *Ipomea batatas* leaves meal
R_{ST}: diet with 20% of *Stylosanthes guianensis* meal
R_{FP+ST}: diet with 10% of *Ipomea batatas* leaves meal + 10% of *Stylosanthes guianensis* meal.

Statistical analysis

The data collected was subjected to one-way analysis of variance. Student's (T) test was used for comparison between sexes. When differences existed between the treatments, the means were separated by the Waller Duncan test at the 5% significance level. SPSS software version 20.0 was used.

Results and Discussion

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on hematological parameters

It showed the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the hematological parameters of the guinea pig (Table 3). We only observed that the white blood cell of guinea pigs fed with R_0 and R_{ST} diets was comparable but significantly (P ≤0.05) lower than that of the guinea pigs receiving the R_{FP}, R_{FP+ST} diets which was otherwise comparable (P> 0.05) in males and regardless of sex. The same trend was observed for the level of hematocrine in females. The number of white blood cell of females receiving the R_{FP} diet was significantly (P ≤0.05) higher than that of females receiving the R_0, R_{ST} and R_{FP+ST} diets which was otherwise comparable (P> 0.05). The same trend was observed for PLT in females and regardless of the sex. Addition of forages had no effect (P> 0.05) on RBC count, HCT level, MCV in males and regardless of sex. The same trend was observed with Hgb in females and regardless of sex. The number of RBCs from females receiving the R_{FP+ST} diet was significantly higher than that of females receiving the R_0, R_{FP} and R_{ST} diets, which was otherwise comparable. The MCV of animals fed with the R_0, R_{FP} and R_{FP+ST} diets was comparable but statistically (P ≤0.05) lower than that of guinea pigs receiving the R_{ST} diet in females. The same trend was recorded with Hgb in male guinea pigs. However, no value has gone out of the standard.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on the lipid profile of guinea pigs

It showed the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the lipid profile of the guinea pig according to the diet (Table 4).

It appears from Table 22 that the total cholesterol, HDL and LDL were comparable regardless of the diet. The same trend was observed for triglycerides concentration in males regardless of sex and total protein in females and regardless of sex. Females receiving the R_{ST} and R_{FP+ST} rations exhibited higher LDL concentrations than HDL.

The triglyceride concentration of the females receiving the R_{FP} diet was comparable to that of the guinea pigs of the control group but significantly (P ≤0.05) low compared to that of the other lodges. Likewise, the males fed with the R_{FP+ST} diet presented a total protein concentration comparable to that of the guinea pigs receiving the R_{ST} diet but significantly higher than those of the animals of the R_0 and R_{FP} groups which were otherwise comparable (P> 0 , 05). No value, however, exceeded the norm.

Table 3: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the hematological parameters of the guinea pig

Characteristics		**Treatments**				*ESM*	**P**
	Sex	**R_0**	**R_{FP}**	**R_{ST}**	**R_{FP+ST}**		
WBC (10^3/µl)							
	♂	10.00^b	26.90^a	15.00^b	27.00^a	3.22	0.02
	♀	8.33^a	15.73^b	8.03^a	5.80^a	2.68	0.05
	♂♀	9.16^b	21.31^a	11.51^b	16.40^a	2.95	0.03
RBC (10^6/µl)							
	♂	4.52	1.73	2.40	4.65	0.65	0.30
	♀	3.59^a	5.31^a	3.63^a	15.68^b	1.53	0.00
	♂♀	4.05	3.52	3.01	10.16	1.09	0.15
HCT (%)							
	♂	44.43	31.70	41.47	46.43	6.13	0.54
	♀	34.87^a	49.87^b	35.53^a	49.43^b	7.60	0.00
	♂♀	39.65	40.78	38.50	47.93	6.86	0.27
VGM (fL)							
	♂	76.77	76.37	71.63	79.00	9.05	0.60
	♀	77.03^a	74.47^a	80.87^b	72.90^a	2.07	0.00
	♂♀	76.90	75.42	76.25	75.95	5.56	0.30
Hgb (g/dl)							
	♂	11.87^a	12.86^a	15.59^b	12.70^a	1.53	0.02
	♀	10.87	14.20	14.87	16.77	7.20	0.40
	♂♀	11.37	13.53	15.23	14.73	4.36	0.21
CMH (pg)							
	♂	26.50	26.47	22.60	25.20	0.24	0.60
	♀	29.93	26.67	30.87	24.17	1.63	0.24
	♂♀	28.21	26.57	26.73	24.68	0.93	0.42
PLT (10^3/µl)							
	♂	261.00	271.67	282.13	285.20	4.30	0.11
	♀	276.67^a	534.67^b	299.33^a	300.24^a	7.69	0.00
	♂♀	268.83^a	403.17^b	290.73^a	292.72^a	5.99	0.05

a, b: The means bearing the same letters on the same line are not significantly different at the 5% level; Fp: potato leaves; ST: *Stylosanthes guianensis*; ESM: Standard Error of the Mean; P: Probability GB: White blood cells ;; GR: Red blood cells; HCT: Hematocrit; Hgb: Hemoglobin; PLT: blood platelets, MCV: mean blood volume, CMH: mean hemoglobin concentration

Table 4: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the lipid profile of the guinea pig according to the ration

Characteristics	Sex	Treatments				ESM	P
		R_0	R_{FP}	R_{ST}	R_{FP+ST}		
Total cholesterol (mg/dl)							
	♂	35.84	52.88	49.96	57.67	1.50	0.43
	♀	54.85	64.07	57.55	65.45	9.11	0.78
	♂♀	45.34	58.47	53.75	61.56	5.30	0.60
Triglycerides (mg/dl)							
	♂	25.69	29.21	27.13	30.18	6.06	0.84
	♀	34.32[ab]	27.46[b]	40.25[a]	56.42[a]	12.67	0.00
	♂♀	30.00	28.33	33.69	43.30	9.36	0.42
HDL (mg/dl)							
	♂	16.66	26.25	24.02	24.56	6.42	0.29
	♀	22.83	38.78	13.85	21.75	7.06	0.37
	♂♀	19.74	32.51	18.93	23.15	6.74	0.33
LDL (mg /dl)							
	♂	10.85	16.90	16.90	23.05	3.90	0.81
	♀	20.58	16.14	30.29	24.90	5.26	0.76
	♂♀	15.71	16.52	23.59	23.97	4.58	0.78
Total protein (mg/dl)							
	♂	3.92[b]	4.14[b]	4.26[ab]	5.19[a]	0.65	0.05
	♀	4.01	4.44	4.26	4.44	0.57	0.81
	♂♀	3.96	4.29	4.26	4.81	0.61	0.43

a, b: The means bearing the same letters on the same line are not significantly different at the 5% level; Fp: potato leaves; ST: *Stylosanthes guianensis*; ESM: Standard Error of the Mean; P: Probability

Table 5: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the weight of some purifying organs of guinea pigs

Characteristics	Sex	Treatments				ESM	P
		R_0	R_{Fp}	R_{ST}	R_{Fp+ST}		
Weight (g)							
Liver	♂	12.96[a]	12.43[a]	8.58[b]	9.71[b]	9.51	0.00
	♀	12.86	12.88	11.41	11.79	1.88	0.09
	♂♀	12.91[a]	12.65[a]	9.99[b]	10.75[ab]	5.69	0.04
Kidney							
	♂	0.96[b]	2.90[a]	2.63[a]	2.61[a]	1.74	0.00
	♀	0.70[b]	2.28[a]	2.15[a]	2.16[a]	0.45	0.01
	♂♀	0.83[b]	2.59[a]	2.39[a]	2.38[a]	1.09	0.00
Lung							
	♂	1.00[b]	3.67[a]	4.00[a]	3.67[a]	0.37	0.00
	♀	1.00[b]	3.45[a]	4.01[a]	3.72[a]	0.43	0.01
	♂♀	1.00[b]	3.56[a]	4.00[a]	3.69[a]	0.40	0.00
Missed							
	♂	0.33	0.67	1.00	1.00	0.13	0.21
	♀	0.14[b]	0.58[a]	0.72[a]	0.69[a]	0.07	0.00
	♂♀	0.23	0.62	0.86	0.84	0.10	0.10
Heart							
	♂	1.00[a]	1.00[a]	1.33[b]	1.00[a]	0.16	0.00
	♀	0.31[b]	1.06[a]	1.38[a]	1.24[a]	0.14	0.00
	♂♀	0.65[b]	1.03[a]	1.35[a]	1.12[a]	3.48	0.00

a, b: The means bearing the same letters on the same line are not significantly different at the 5% level; Fp: potato leaves; ST: *Stylosanthes guianensis*; ESM: Standard Error of the Mean; P: Probability.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on the weight of some purifying organs of guinea pigs

It showed the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the weight of some purifying organs of guinea pigs (Table 5).

It can be seen that the males of the R_0 and R_{FP} lodges presented a comparable liver weight (P> 0.05) but significantly (P ≤0.05) higher than that of the R_{ST} and $_{RFP + ST}$ lodges, which was otherwise comparable. The same trend was observed regardless of the sex. Females, however, did not show any difference between diets in terms of liver weight. Kidney, lung and heart weights were comparable between diets containing forage meal but significantly (P ≤0.05) high compared to control in males as well as females and regardless of sex. The same trend was observed with regard to the weight of the spleen in females. However, no significant difference (P> 0.05) was observed in males and regardless of sex in spleen weight.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on toxicity indicators

It was illustrated the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on plasma urea and creatinine concentrations in male guinea pigs according to diet (Fig. 1).

From the analysis of this figure, it emerges that the plasma urea concentration of the males fed with the R_0, R_{ST} and $R_{FP + ST}$ diets were comparable but significantly (P ≤0.05) higher than that of the guinea pigs receiving the R_{FP} ration which, however, was comparable (P> 0.05) to that of the guinea pigs of the lodge fed with the $R_{FP + ST}$ diet. The incorporation of the forage meal had no significant effect on the plasma creatinine concentration. No values exceeded standards for both urea and creatinine.

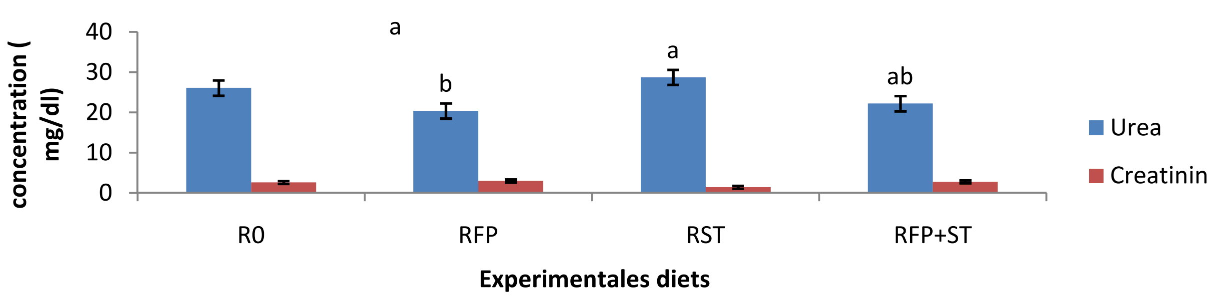
It was illustrated the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on the plasma concentrations of ALT and ASAT in male guinea pigs according to diets (Fig 2). It emerges that diets had no significant effect (P> 0.05) on the concentration of transaminases. Male guinea pigs from the control group exhibited the highest concentrations and those receiving the R_{FP} diet the lowest who, however, remained in the benchmarks for both ALAT and ASAT.

It was illustrated the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on urea and creatinine concentrations in females based on diet (Fig 3). As a result, the addition of forages significantly (P ≤0.05) affected urea while concentrations of creatinine were comparable (P> 0.05) regardless of the diet in females. The highest concentrations were recorded in females from the control group and those receiving the $R_{FP + ST}$ ration for urea and creatinine, respectively. However, no value exceeded the norm.

It was illustrated the effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on ALAT and ASAT concentrations in females according to the diet (Fig 4). It can be seen that the values were comparable between the different diets regardless of the transaminase with the highest recorded in females fed with the $R_{FP + ST}$ diet.

It was illustrated the compared effect of plasma urea and creatinine concentrations in male and female guinea pigs (Fig 5). As a result, sex had no significant effect on these parameters. However, the creatinine level was higher in the males compared to the females.

The effect of sex on the plasma concentrations of ALT and ASAT in the guinea pig was shown (Fig 6). As a result, sex had no significant effect on the concentration of these transaminases although the concentration of ASAT is higher in females than in males.



a, b: The means bearing the same letters on the same line are not significantly different at the 5% level; Fp: potato leaves; ST: *Stylosanthes guianensis*

Fig 1: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on plasma urea and creatinine concentrations in male guinea pigs according to diet.

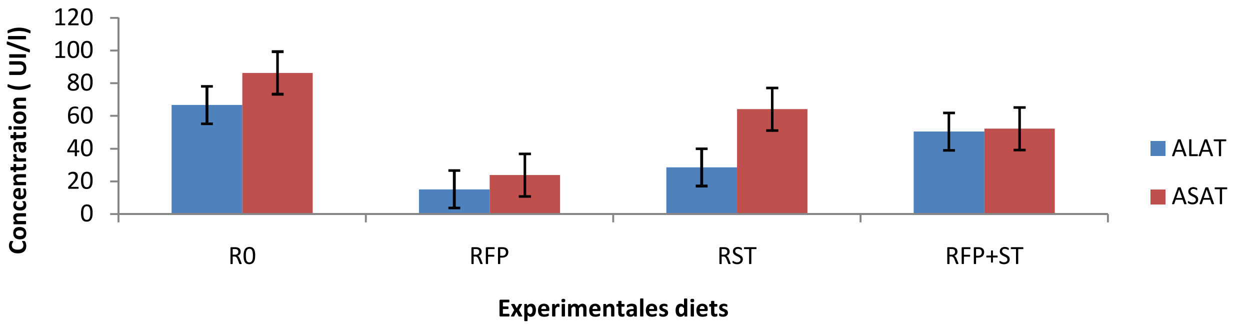


Fig 2: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on ALAT and ASAT plasma concentrations in male guinea pigs according to diet

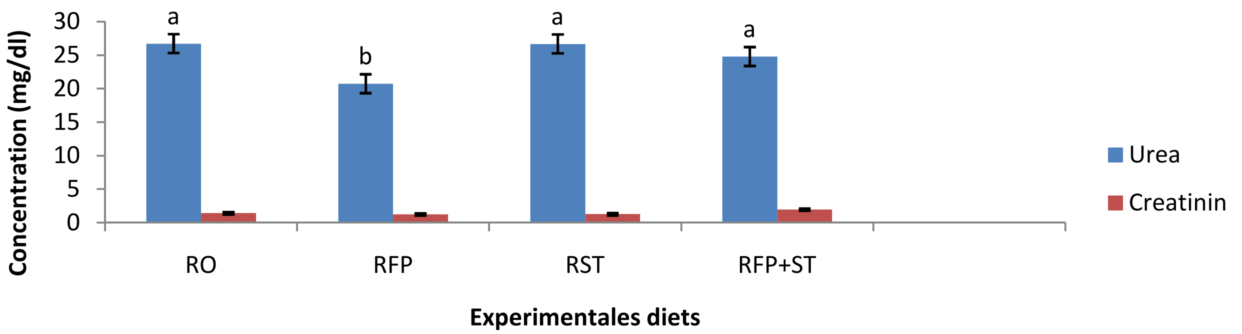


Fig 3: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on plasma urea and creatinine concentrations in females according to the diet

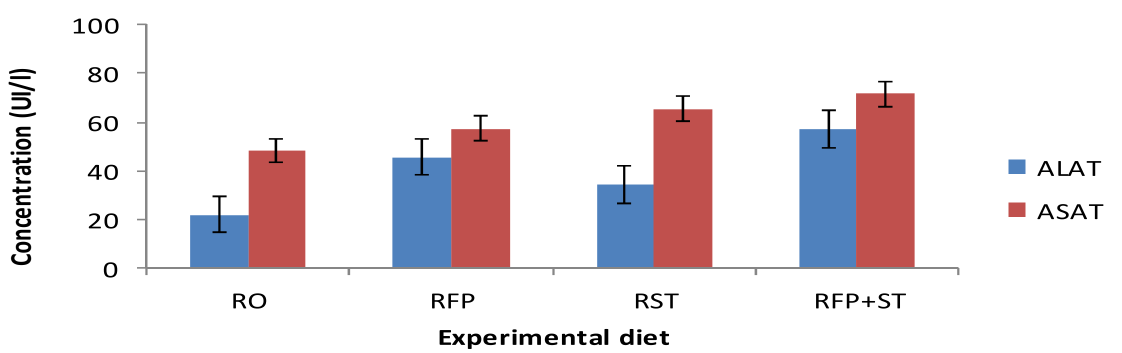


Fig 4: Effect of *Stylosanthes guianensis* and *Ipomea batatas* leaves meal on ALAT and ASAT concentrations in females according to the diet

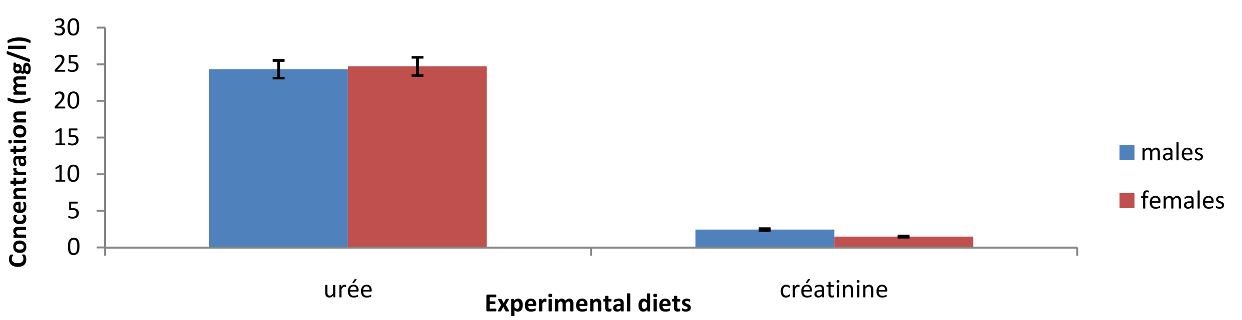


Fig 5: Effect of sex on Plasma Urea and Creatinine Concentrations

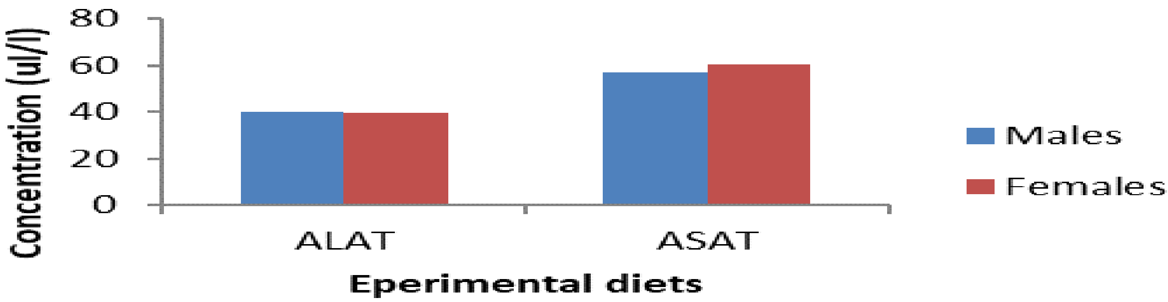


Fig 6: Effect of sex on ALAT and ASAT concentration

B

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on hematological parameters

The number of white blood cells increased significantly with the intake of forages. The highest value obtained in guinea pigs from the R_{FP+ST} lodges could be explained on the one hand by the quality of the amino acids contained in our forages and on the other hand by the compounds present in the potato leaves. Indeed, many authors have studied the pharmacological properties of extracts from potato leaves. This is the case of Kazuko *et al*. (2010) who showed that ipomotaosides A-D (1-4) a glycosidic resin extracted from the dried aerial parts of the leaves of *Ipomea batatas* had anti-inflammatory activity. These results corroborate with those of Osime *et al*. (2008), who observed an increase in the number of white blood cells in rabbits receiving potato leaf extracts. The high level of hemoglobin in the R_{FP} and R_{FP+ST} diets shows their sufficiency in protein content because Roberts *et al*. (2000) showed that a diet containing proteins of high biological value positively affected respiratory gases. The absence of significant variation in RBC, HCT, MGV and MHC indicates that the guinea pigs used the nutrients from the diet without constraint. The significant increase in the number of platelets with the diet containing the forage meal shows that these guinea pigs had a strong ability to resist infections. These ties in with the results of Ngiki *et al*. (2014) who observed a significant variation in the number of platelets in chickens receiving cassava leaf meal as a source of protein.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on the lipid profile of guinea pig

The significant increase in triglyceride levels (TAG) with the R_{ST} and R_{FP+ST} diets in females would be justified by the high fiber content of these rations and by the high conversion capacity of these fibers by the guinea pig, because according to Berger *et al*. (1989) fiber in guinea pigs should be taken into account when estimating digestible energy. The significant reduction in the level of TAG in guinea pigs receiving the potato leaves can be attributed to the presence in these leaves of soluble fiber which promotes the excretion of bile acids and cholesterol which induces a decrease in serum cholesterol level thus reducing the risks associated with cardiovascular diseases. These results agree with those of Zhao *et al*. (2007) who demonstrated that rats consuming sweet potato leaf meal had a lower level of triglycerides and hepatic cholesterol than in control. The different diets had no effect on total cholesterol, LDL and HDL regardless of the sex. The respective decrease in HDL and LDL levels, although not significant recorded with the R_{FP} diet, could be explained by the richness in bioactive molecules of the potato leaves. In fact, potato leaves contain a wide variety of dietary antioxidants including anthocyanins, polyphenols, flavonoids, caffeic acid, and its derived acids. Consumption of potato leaves affects the lipid profile in both animals and humans by reducing the risk of cardiovascular disease (Johnson and Pace, 2010). Sanchez-moreno *et al*. (2007) Suggest that dietary polyphenols exhibit high antioxidant and LDL oxidation inhibitory activities. These results agree with those of Yoon *et al*. (2007) who observed a decrease in TAG, total cholesterol, LDL, VLDL and an increase in HDL concentration in hamsters fed with potato leaf meal. During this study the total protein content was significantly higher in male guinea pigs receiving the R_{FP+ST} diet. This could be explained first of all by the richness in amino acids of *Stylosanthes guianensis* which would have been easily assimilated and then by the richness of the active molecules present in the leaves of *Ipomea batatas*, namely the polyphenols; anthocyanin and jalapine which protect the liver against damage by increasing the synthesis of liver tissue (Suda *et al*., 1998) which would help increase protein synthesis.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on the purifying organs of guinea pig

Kidney, lung and heart weights were comparable between diets containing forage meal but significantly elevated compared to control in males as well as females and regardless of sex. The same trend was observed with regard to the weight of the spleen in females. This difference could be explained by the higher fiber and protein contents in the ration of guinea pigs from the treated lodges compared to the control. The males of the R_0 and R_{FP} groups presented a comparable but significantly higher liver weight than that of the other lots. The highest value (12.96g) obtained in this study is less than 30 g reported by Fuss, (2002) as the average liver weight in an adult guinea pig but greater than 10.7 and 10.20 reported by Zougou *et al*. , (2017), Miégoué *et al*, (2018) in guinea pigs of 8 weeks age respectively. This difference is believed to be due to the age of the animals. Indeed, according to Ayssiwede *et al* (2012), organ development is proportional to the live weight or age of the subjects at slaughter.

Effect of Stylosanthes guianensis and Ipomea batatas leaves meal on toxicity indicators of guinea pigs

Resulting from the transformation of ammonia during protein metabolism, urea is used as a marker of renal pathology. The significant drop in its concentration in guinea pigs receiving the R_{FP} diet is justified by the richness of the potato leaves in polyphenols and in vitamin E. Indeed, the potato leaves are known to be a good source of vitamins (A, B2, C and E; (An *et al*., 2003). These results corroborate with those of Mamoud *et al*. (2017) who observed a non-significant decrease in blood urea level with the inclusion of spirulina (which also contains vitamin E) in young rabbits. The natural function of the vitamin E contained in these leaves is to protect the body against the harmful effects of free radicals. This shows that the kidneys and the liver have been well protected by these antioxidants. These results are in agreement with those of Rafiu and Luka, (2018) who observed a decrease in creatinine and urea levels in rats given extracts of potato leaves. No effect on the plasma concentration of urea was observed. Likewise, the concentration of creatinine was comparable between diets and regardless of the sex. The lack of difference would be due to the fact that our animals were the same age and comparable weight. Because, the plasma creatinine concentration varies depending on muscle mass, age and the intensity of the effort (Marshall and Bangert, 2005).

ASAT is an enzyme produced by the liver as well as by muscles and heart. But the polyphenols present in the extract of the leaves of *Ipomea batatas* are said to have a protective activity on the liver cells by limiting the reabsorption of ALT and ASAT. This is why a decrease, although not significant, in the levels of ALT and ASAT is observed in the male guinea pigs of the R_{FP} group. These results corroborate with those of Nguedia, (2019) who observed a decrease in the ALT and AST levels with the incorporation of spirulina in the guinea pig diet.

Conclusion

The effect of *Stylosanthes guianensis* and *Ipomea batatas* leaf meal on hematology, lipid profile and toxicity indicators in guinea pigs concluded that:

-The number of white blood cells, blood platelets and hemoglobin significantly increased with the addition of forages in the diet.

- The incorporation of forages in the diet significantly increased the weight of the lung, kidneys and heart while remaining within the standards.

-The R_{FP} diet significantly lowered the triglyceride level in females and induced a decrease, although not significant, in ALT and ASAT levels in male guinea pigs. The different rations had no effect on total cholesterol, LDL and HDL. The R_{FP} diet induced a significant drop in urea concentration. However, sex had no effect on the plasma urea concentration. Likewise, the concentration of creatinine was comparable between the diets. The R_{FP} diet would therefore be the most appropriate in guinea pigs.

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