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Digestive utilization of Sa

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Digestive utilization of Sahelian ed with cowpea haulms (*Vingna unguiculata*) and blood profile in A

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Abstract

Digestive utilization of sahelian forages associated with *Vingna unguiculata* and blood profile study was conducted in scientific garden of the University of Sciences and Technology, Ati (JSUSTA). Three forages were used to assess *in vivo* digestibity in eighteen (18) rams weighing around 31.83±3.02 kg and displayed individually in metabolic cages in six (6) groups of three (3) animals. Control groups received 1000g of feed made up of *Brachiaria deflexa*, *Dactyloctenium aegyptium* and *Echinocloa colona.* While, experimental groups received basal feeds associated with 30% of *Vingna unguiculata*. The experiment was preceded by 14 days adaptation and 7 days of data collection during which, hundred (100g) grams of feeds and feces as well as urine (10 ml) were collected for chemical analysis and digestibility assessment. At the end of experimentation, two (2) ml of blood was collected from each animal before and after feeding for blood profile analysis. The results showed that the association of 30% *Vingna unguiculata* have significantly ($p<0.05$) increased intake of *D. aegyptium* and *B. deflexa* in Arab rams. *In vivo* digestibility of *E. colona* was significantly ($p<0.05$) higher in rams when associated or no with 30% of *Vingna unguiculata*. Blood profile analysis showed that *E. colona* associated with 30% of *Vingna unguiculata* induced significant ($p<0.05$) increase in blood protein, globulin and cholesterol concentration in Arabic rams.

Keywords: Digestive utilization; Sahelian; Forages; Cowpea haulms; Rams

1. Introduction

About 113, 56 million animals with almost 57 million of small ruminants was registered in Chad (MERA, 2018; Azoutane *et* al., 2019). Livestock production brings about 53% of row nation income (RNI), and enhances the survival of almost 40% of active population (MERA, 2018). Being the main source of protein and food security, small ruminants produce milk, meat and several services to the populations (Tendonkeng *et al*., 2010). They are means of treasure and social equilibrium for breeders (Ardjoun, 2011; Escarènô *et al*., 2013). In fact, an agreement of payment of borrowed fund (hundred million dollars) with seventy five thousand of cows (75000) was signed between Chad and Angola (Alwida, 2020). These animals depend on natural pasture with little grass biomass production ranging from 300 to 1500 kg/ha (Gongnet *et al*., 1990; MERA, 2016). Nutritive values of forages decrease with the evolution of season (Pamo *et al.,* 2008). In this region, grazing system is characterized by the use of scarce forages resources of the Pasture (Azoutane *et* al.

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2023). This system is risky because of high mortality of animal kids and conflict generation between farmers and breeders (Azoutane *et al*. 2023). Considering the fast population growth, high demand for animal proteins and negative impacts of climate changes on food insecurity in Sahel region, alternatives solutions need to be found to improve animal feeding in dry season (Soumana *et al.,* 2016; BRACED, 2019). Furthermore, nowadays pressure over the land, periurban-farming needs to be encouraged by breeders. The aim of study is to assess the palatability of sahelian forages.

Specifically it was to study:

- Chemical composition of some sahelian forages;
- Comparative effects of *Vingna unguiculata* association on digestive utilization of *Brachiaria deflexa, Dactyloctenium aegyptium* and *Echninocloa colona* in Arabic rams;
- Effect of *Vigna unguiculata* association to *Brachiaria deflexa, Dactyloctenium aegyptium* and *Echninocloa colona* on serum profile in Arabic rams.

2. Materials and methods

2.1. Location of study Area

This study was conducted in October 2018 in the Scientific Garden of the University of Sciences and Technology of Ati (USTA), province of Batha in Chad (Figure 1). Extended between 12th and 16th North, Batha is about 88800 km^2 (Bechir and Mopaté, 2015) about 561177 citizen, making 4.7% of national population (Mbatbral *et al*., 2019). Ati city accounts approximately 62,383 citizens with 57% of youths, population density of 6 people per km^2 with annual growth rate of 3. 84% (Beatriz, 2013). Geographically, Ati is in between 13°12'30" and 13°14'00" North altitude and 18°19'00" and 18°21'00" of the East, with 21 km^2 of surface area (Mbatbral et *al*., 2019). Climate is of sub-saharian type in the North, and semi- arid to sahelian type in the South, with average temperature ranging from 14 to 42°C (Bechir *et* Mopaté, 2015). The main breeders ethnic groups are Arab (26%), Bilala (15%) and Kouka (16%) people (Beatriz, 2013. Azoutane *et al*,.2019).

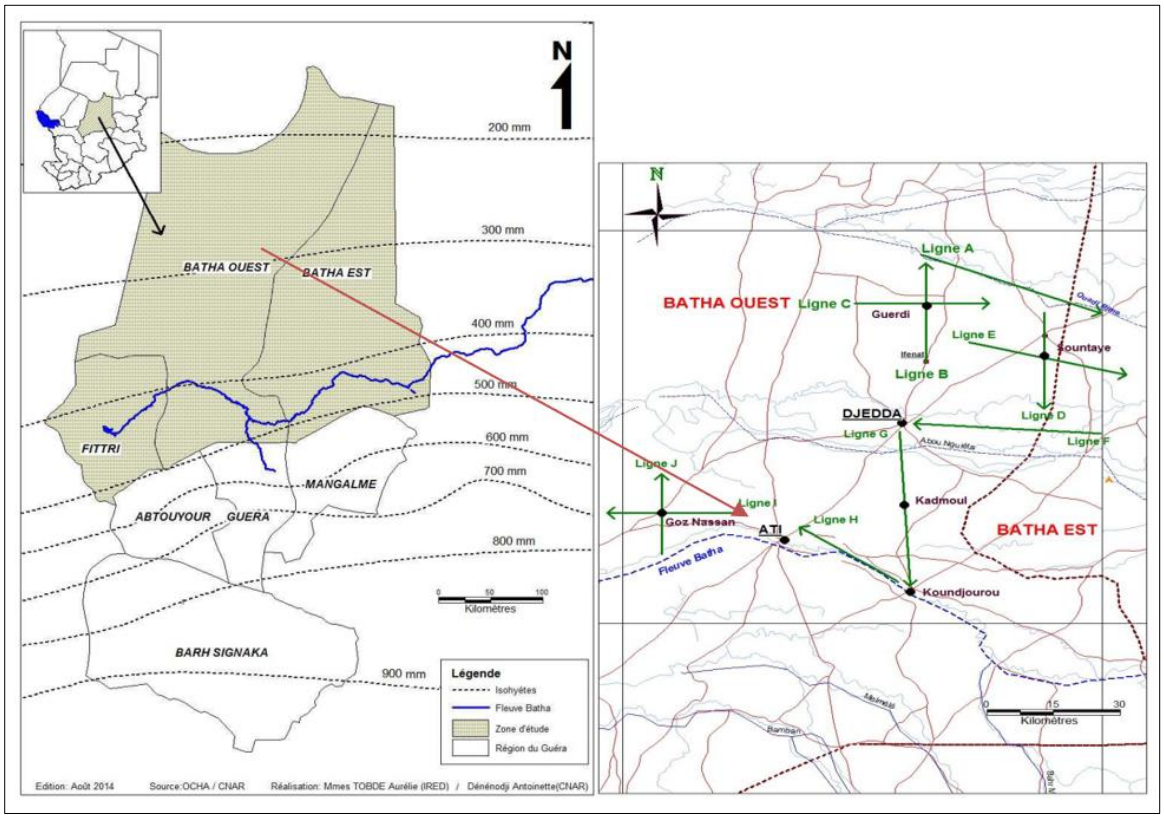

Figure 1 Location of Ati in the district of West-Batha in Chad (Béchir and Mopaté, 2015)

2.2. Animals and feeds formulation

Arabic rams weighing 31.83±3.02 kg were administered oxytétracycline 10%, and Ivermectine 1% for preventive treatments and deworming. Natural forages such as *Brachiaria deflexa, Dactyloctenium aegyptium* and *Echninocloa colona* (Figure 2) were harvested at graining stage as described by Theau *et al.* (2010). Six (6) diets were formulated with each forage. Each Forage was served either alone, or supplemented with 30% of *Vigna unguiculata* for digestibility (*in vivo*) test in Arabic rams. Experimental diets were: R1- *Dactyloctenium aegyptium L* (wild) alone (D+F_0); R2- *Dactyloctenium aegyptium L* (wild) suplmented with 30% of *Vigna unguiculata* (D+F_{30}); R3- *Brachiaria deflexa* alone (B+F_0); R4 - *Brachiaria deflexa* associated with 30% of Cowpea haulms (B+F_{30}); R5- *Echninocloa colona* only (E+F_0) and R6- *Echninocloa colona* associated with 30% of *Vigna unguiculata* (E+F_{30}).

a- Brachiaria deflexa (schumucher)

b- Dactyloctenium. aegyptium L. (Wild)

c- Echinicloa colona

Figure 2 Experimental forages

2.3. Experimental design

Eighteen (18) rams with approximate weight (31. 83±3.02 kg) were displayed in six (6) groups of three (3) animals in individual metabolic cages following the procedure described by Mubi *et al*. (2011). For feeds intake and *in vivo* digestibility trials, three experiments preceded simultaneously 14 days of adaptation period and 7 days of data collection.

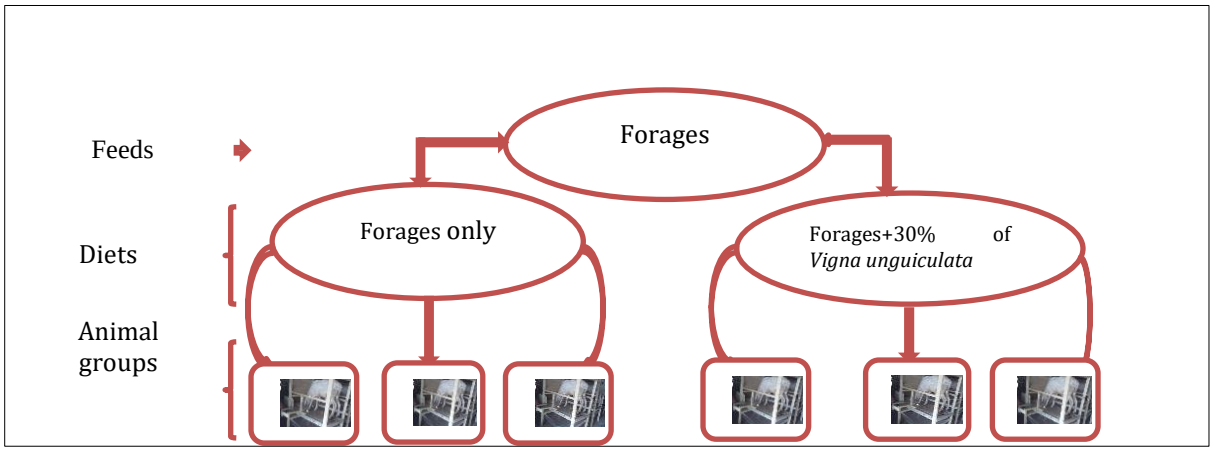

Figure 3 Experimental design for *in vivo* digestibility trials

One thousand (1000g) of diets were offered to control groups twice a day at 8 AM and 2 PM. Feeds offered and the left over were weighed every morning before new offer with electronic balance of 3 kg maximum and 0,1 g sensitive precision.

2.4. Data collection

2.4.1. Feeds intake and in vivo digestibility

Experimental groups received in addition to 1000g of basal feed, 30% of *Vigna unguiculata* twice a day. Feeds intakes were obtained by the difference between the feed offered and the left over the next day.

Ingestion = Diet day N- Left over day N+1

Apparent digestive utilization coefficients (CUDa) of chemical compounds was calculated using the method described by Roberge and Toutain (1999). For each component of feeds, the following formula was applied.

CUDa X (%) = (X ingested-X excreted) / (X ingested) × 100.

For nitrogen utilization assessment, 10 ml of urine was collected and stabilized with 10 ml of sulfuric acid (H_2SO_4) per 100 ml of urine, and stored at 4°C in refrigerator for residual determination of nitrogen. Likewise, organic matter (OM), crude protein (CP) and carbohydrates digestibility were deducted by the methods described by AOAC (2000). While gross energy (GE), energy for milk (UFL) and energy for meat (UFV) production were calculated using the formulas described by Jarrige (1980) and Van Soest (1994).

2.4.2. Chemical analysis of feeds

Hundred grams (100g) of all forages and supplement (*B. deflexa, D. aegyptium, E. colona* and *Vigna unguiculata*) were collected for chemical analysis. Before that, feeds samples were oven dried at 60°C in ventilated oven and grinded with hammer mill sieved to 1mm size for chemical analysis. In addition, 10 ml of urine stabilized with sulfuric acid (H_2SO_4) was collected for residual determination of nitrogen at Quality Control Center of foods (CECOQDA) in N'djamena. Dry matter (DM) content and ash concentration were also determined using AOAC (2000) methods. While Crude protein (CP) and crude fiber were analyzed using respectively Kjeldahl and Weende methods (AOAC, 2000).

2.4.3. Biochemical parameters

Prior to the end of digestibility trials, 2 ml of blood were collected from each subject through jugular vein in labeled test tubes. A serum obtained from blood centrifugation were stored at -20°C in the freeze as described by Skeggs et Hochstrasser, (1964) and Audege *et* al. (1983) for blood protein and energy parameters analysis.

2.5. **Statistical analysis**

Data from intakes and *in vivo* digestibility of diets were submitted to two-way analysis of variance according to general linear model and completely randomized block design. Separation of means was done by Duncan's multiple range tests, when there was a significant difference at 5%. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) 20.0 software according to the following model.

$$Yij = \mu + \alpha ij + \beta ij + eij, \text{ where}$$

Yij = observation on animal j having received ration I,
μ = General average,
αi = effect of ration i,
βj = effect of ration j,
eij = residual error on animal j having received ration i.

3. Results

3.1. Chemical analysis of feeds

Table 1 shows chemical composition of experimental forages (*D. aegyptium*; *B. deflexa*; *E. colona* and *Vigna* unguiculata) of Sahel.

relatively closer, except for *E. colona* (92.92%) which is lower. Fiber concentration in *D. aegyptium* (38.51g) and *B. deflexa* (36.98g) was higher, while that in *E. colona* (31.27g) and *Vigna unguiculata* (26.9g) were the lowest. Organic matter form *D. aegyptium* (90. 97%) and *Vigna unguiculata* (90.27%) were more elevated than in *B. deflexa* (87.54%) and *E. colona* (80.17%). Ether extraction was higher in *D. aegyptium* (3.09%) than in others forages.

Table 1 Chemical composition of experiments forages

Forages				
Parameters	***D. aegyptium***	***B. deflexa***	***E. colona***	Vingna unguiculata
DM (%)	96.00	94.21	92.92	95.25
CF (%MS)	38.51	36.98	31.27	26,9
OM (%MS)	90.93	92.33	87.25	90.29
Lipid (%MS)	3.07	1.27	1.00	1.40
Ash (%MS)	9.07	7.67	12.75	9.71
Nirogen (%MS)	9.75	6.50	4.80	10.6
dOM (%MS)	82.37	85.68	85.39	56.49
GE (%MS)	75.02	75.08	61.71	75.48
DN (g/Kg MO)	25.26	20.44	17.50	26.42
UFL /kg MS	0.58	0.60	0.71	0.79
UFV/kg MS	0.45	0.47	0.59	0.83

Where DM : Dry matter ; BC : crude fiber ; OM : Organic matter; dOM : Digestible organic matter ; GE : Global energy; DN : Digestible nitrogen ; UFL : Energy for milk ; UFV : Energy for meat.

This table shows that dries matters of *D. aegyptium* (96%), *B. deflexa* (94. 21%) and *Vigna unguiculata* (95%) are While *E. colona* presented a higher level of ash (12.75%) than *Vigna unguiculata* (9.71%) and *D. aegyptium* (9.07%). Though, *Vigna unguiculata* presented the highest level of nitrogen (10. 60%) compare to *D. aegyptium* (9.75%) and *B. deflexa* (6. 50%). However, digestible organic matters (dOM) were relatively closer, with minor decrease observed in *D. aegyptium* (82. 37%). Global energy of forages (*Vigna unguiculata* (75. 48%), *D. aegyptum (*75. 08%)*, B. deflexa* (75. 02%) were almost similar,, except for *E. colona* (61.71%) that was lower. While, a digestible nitrogen (DN) of *Vigna unguiculata* (26. 42g), *D. aegyptium* (25. 26g) and *B. deflexa* (20.44g) were higher than that of *E. colona* (18.40g). In fact, the energy for milk (UFL) and energy for meat (UFV) generated by ***Vigna unguiculata*** (0.79; 0. 83) were higher than in basal diets.

3.1.1. Compared effects of Vigna unguiculata association on chemical components intakes of forages in Arabic rams

Table below (2) shows that, *Echinocloa colona* fed alone to rams enhanced a significant (p<0, 05) intake of dry and organic matters, followed by *B. deflexa* (Tableau 2).

Table 2 Compared intake of chemical components of forages alone or associated with *Vigna unguiculata* in rams

Intakes	**Diets**	**Forages**			**SEM**	***p***
		B. deflexa	***D. aegyptium***	***E. colona***		
DM	$G+F_0$	612.25^{bc}	557.33^{c}	704.48^{a}	23.25	0.003
	$G+F_{30}$	800.8^{cb}	962.26^{a}	816.45^{b}	26.39	0.000
OM	$G+F_0$	537.26^{bc}	489.46^{cb}	577.72^{a}	14.86	0.000
	$G+F_{30}$	437.93^{bc}	834.31^{a}	525.14^{c}	63.62	0.000
CF	$G+F_0$	233.88^{a}	194.17^{c}	204.96^{bc}	6.89	0.018
	$G+F_{30}$	247.53^{b}	335.24^{a}	237.23^{cb}	15.67	0.000

a, b, c: Means carrying different letters on the same line are significant (p<0.05) at 5% ; DM: Dry matter ; OM: Organic matter ; CF: crude fiber ; $G+F_0$: Grass alone ; G+F30,: Grass + 30% of *Vigna unguiculata*; SEM : standard Error of Mean ; P: Probability

The association of *Vigna nguiculatas* to forages have significantly (p<0.05) increased intake of chemical components of *D. aegyptium* and *E. colona*. When feeds were served alone, DM of *E. colona* and CF of *B. deflexa* intake were significantly (p<0.05) increased in rams

3.1.2. Compared effects of Vigna unguiculata association on in vivo digestibility of experimental forages in Arabic rams

A study of forages digestibility alone show that dry matter (DM) and organic matter (OM) of *E. colona* were significantly ($p<0.05$) more digested in rams than *B. deflexa* (Table 3). Though the association of 30% of *Vigna unguiculata* enhanced a significant ($p<0.05$) digestibility of DM and OM of *E. colona* and *B. deflexa* in Arabic rams, except crude fiber.

Table 3 Digestibility of *B. deflexa, D. aegyptium* and *E. colona* alone or associated with *Vigna unguiculata* in rams

CUDa	Diets	Forages			SEM	*P*
		B. deflexa	***D. aegyptium***	***E. colona***		
MS	$G+F_0$	55.62^{b}	47.63^{c}	65.19^{a}	2.85	0.000
	$G+F_{30}$	60.27^{b}	55.23^{c}	68.91^{a}	1.99	0.030
MO	$G+F_0$	40.56^{c}	57.06^{b}	63.36^{a}	3.55	0.000
	$G+F_{30}$	61.03^{b}	52.51^{c}	66.99^{a}	1.99	0.027
CB	$G+F_0$	69.98	68.92	71.51	1.28	0.279
	$G+F_{30}$	73.79	76.11	74.55	0.29	0.480

a, b, c: Means carrying different letters on the same line are significant ($p<0.05$) at 5% ; DM: Dry matter ; OM: Organic matter ; CF: crude fiber ; G+F0: Grass alone ; G+F30; Grass + 30% of *Vigna unguiculata*; SEM : standard Error of Mean ; P: Probability

3.1.3. Nitrogen balance of B. deflexa, D. aegyptium and E. colona alone or associated with Vigna unguiculata in Arabic rams

Regardless of diets, nitrogen intake and retention from *E. colona* were significantly ($p<0.05$) high in Arabic rams, followed by *B. deflexa* with a slight variation noticed (Table 4).

Table 4 Nitrogen balance of *B. deflexa*, *D. aegyptium* and *E. colona* alone and associated with *Vigna unguiculata* in rams

Nitrogen balance	Forages				SEM	*P*
	Diets	***B. deflexa***	***D. aegyptium***	***E. colona***		
N intake	$G+F_0$	5.29^{b}	7.40^{a}	4.10^{c}	0.47	0.003
	$G+F_{30}$	4.75^{b}	12.72^{a}	4.75^{b}	1.20	0.000
Fecal N	$G+F_0$	3.32^{a}	2.28^{cb}	2.46^{b}	0.2	0.052
	$G+F_{30}$	3.27^{ba}	3.85^{a}	2.26^{c}	0.25	0.002
urine N	$G+F_0$	1.08	1.78	0.82	0.20	0.142
	$G+F_{30}$	2.61^{a}	2.16^{ba}	0.83^{c}	0.29	0.004
retained N	$G+F_0$	1.08^{bc}	3.15^{a}	0.76^{c}	0.39	0.000
	$G+F_{30}$	1.25^{c}	6.39^{a}	1.54^{bc}	0.86	0.000
CUDa N	$G+F_0$	35.02	45.77	37.76	3.03	0.339
	$G+F_{30}$	61.23^{a}	50.99^{c}	58.68^{ba}	1.85	0.024

a, b, c: Means carrying different letters on the same line are significant ($p<0.05$) at 5% ; DM: Dry matter ; OM: Organic matter ; CF: crude fiber ; G+F0: Grass alone ; G+F30,: Grass + 30% of *Vigna unguiculata*; SEM : standard Error of Mean ; *P*: Probability

The association of 30% of *Vigna uguiculata* to *B. deflexa* and *D. aegyptium* induced a significant ($p<0.05$) excretion of feces and urine (nitrogen) in rams. While, the associated of 30% of *Vigna unguiculata* enhanced a significant ($p<0.05$) utilization of nitrogen of *B. deflexa* (61.23%) followed by *E. colona* (58.68%) in rams.

3.1.4. Effects of feeding experimental diets on blood profile in Arabic rams

This study shows that, before consumption of *B. deflexa* alone, no significant ($p>0.05$) difference was observed in blood profiles in Arabic rams; but the rate of protein of this feed was increased significantly ($p<0.05$) (Table 5).

Table 5 Effects of *Vigna unguiculata* association to experimental diets on biochemical parameters in Arabic rams

Diets	Period	Glucose (g/l)	Cholesterol (g/l)	Protein (g/l)	Albumin (g/l)	Globulin (g/l)
B+F_0	before	0.53±0.06	0.59±0.04	64.00±2.29[a]	42.33±0.88	21.66±5.85
B+F_0	after	0.74±0.05	0.46±0.05	71.00±6.08	39.33±0.88	31.66±7.09
B+F_{30}	before	0.50±0.03	0.59±0.17	64.00±7.00	37.33±0.57	26.67±7.23
B+F_{30}	after	0.50±0.06	0.64±0.11	72.67±8.50	31.00±3.60	36.67±11.59
D+F_0	before	0.51±0.08	0.61±0.08	65.67±6.65	37.00±4.58	28.67±4.04
D+F_0	after	0.69±0.11	0.62±0.07	74.33±5.85	37.67±2.30	36.66±2.51
D+F_{30}	before	0.50±10.00	0.42±0.04	66.00±11.20	38.33±4,16	27.67±7.37
D+F_{30}	after	0.60±0.02	0.46±0.09	69.33±3.21	35.33±0.57	36.00±6.08
E+F_0	before	0.42±0.07	0.49±0.04	55.67±6.35	35.33±1.52	23.33±7.23
E+F_0	after	0.42±0.07	0.44±0.10	62.00±6.24	30.00±6.25	32.00±6.24
E+F_{30}	before	0.47±0.02	0.43±0.07	64.00±6.00	39.50±1.5	24.50±4.50
E+F_{30}	after	0.55±0.05	0.57±0.03[a]	86.33±2.08[a]	36.33±5.68	50.00±4.00[a]

a, b, c: Means carrying different letters on the same line are significant ($p<0.05$) at 5%; B+F0: *Brachiaria* alone : B+F30 *: Brachiaria* + 30% of *Vigna unguiculata*; D+F_0 : *Dactyloctenium* alone ; D+F_{30} : *Dactyloctenium* +30% of *Vigna unguiculata*; E+F_0 : *Echinocloa* alone ; E+F_{30} : *Echinocloa* +30 % of *Vigna unguiculata* ; SEM : standard error of mean ; *p: Probability*

The association of *B. deflexa* and *D. aegyptium* with *Vigna unguiculata* had a comparable effect ($p>0.05$) on blood profiles in Arabic rams. Meanwhile, the level of cholesterol, protein and globulin have significantly ($p>0.05$) increased with *E. Colona* associated with *Vigna unguiculata* in these animals. However, the rate of glucose remained similar ($p>0.05$) regardless of diets.

4. Discussion

The dry maters of expérimental diets (*Brachiaria deflexa* (94. 21%), *Echinocloa colona* (92. 92%) and *Vigna unguiculata* (95%) were relatively lower than those reported by Tendonkeng F. *et al*. (2018) and Azoutane Julien et al. (2020) on *Pennisetum clandestinum* (96%) and *Dactyloctenium aegyptium* (96%) respectively. But, greater than the observation of Lemoufouet J. *et al*. (2014) on mays through (94.9%) treated by urea. The variation of dry mater could be linked to forages species and their stage of harvest that had influences on chemical composition of feeds. In fact, the variation of dry matter in this study could be du to the status of forages asserted by Lemoufouet *et al.* (2014) that, the rate of treatments and heterogeneous incorporation of supplement could lead to Bromatologic variation of feeds. The crude fiber concentration (CB) of forages (*B. deflexa* (36. 98%), *E. colona* (31.27%) and *Vigna unguiculata* (26. 9%)) was inferior to a study realized on mays through (77, 3%) treated with urea by Lemoufouet J. *et al*. (20214), but closer to the report of Tendonkeng *et al.* (2018) on *Pennesetum clandestinum* (30,42%). According to Jarrige (1980), the concentration of crude fiber varies with growth stage of the plant and its different parts. The tenure of organic matter of experimental feeds (*Vigna unguiculata* (90. 27%), *B. deflexa* (87.54%) and *E. colona* (80.17%)) corroborate those reported by Azoutane J. *et al.* (2020) and Tedonkeng *et al*. (2018). However, lipid contained in *B. deflexa* (3.07 %) was superior to that obtained by Lemoufouet J. *et al*. (2014) with mays through and Tendonkeng *et al*. (2018) on *Pennisetum clandestinum*, except for *Vigna unguiculata* (1.27%) that was lower. This result coincides with the observation of Klein *et al*. (2014) who stipulated that organic matter of tropical forages vary from 80.82 to 94.74%. They mentioned that the temperature, the light and sol characteristics seem as the main factors of nutrient uptake variations in the plants. However, digestible organic matter was higher in *B. deflexa* (85. 58%) and *E. colona* (85.38%); while, energy concentration in diets (*Vigna unguiculata* (75. 48%) and B. deflexa (75. 08%) than in *E. colona* (61. 71%) was high. This observation corroborates that of Azoutane J. *et al*. (2020) on *Dactyloctenium aegyptium* (82.37) which was relatively higher than the report of Tendonkeng *et al.* (2018) on *Pennisetum clandestinum* (32.91%). However, we retain that, the rate of nitrogen in the plant and soil fertility influence the digestibility of feeds. However, Ether extract accumulation in *D. aegyptium (*3.07%), seems as a result of plant maturity and the proportion grains in a collected sample. In fact, forages were harvested at graining stage that could have induced high level of Ether extract, and relatively lower rate of lipid in *Vigna unguiculata* that was crop residue. Mineral proportion in experimental forages (*Vigna unguiculata* (9. 71) and *Brachiaria deflexa* (7.67%)) was relatively lower than the observation of Tendonkeng *et al*. (2018) (15, 19%), but, the rate of mineral observed in *E. colona* (12, 75) was higher than the report of Lemoufouet J. *et al*. (2014) (11, 4%).

This could be explained by unequal distribution of the rainfall in the area, where mineral elements were not well absorbed in cell walls of plants (Archimede *et al*., 2009). Meanwhile, nitrogen_concentration of forage grasses (*Vigna unguiculata* (10. 60), *B. deflexa* (6.50%) and *E. colona* (4.80%) was lower than the report of Ngoutane *et al*. (2011) on *Echinocloa pyramidalis* (15.6%). This result agrees with the assertion of Khan *et al*. (1999) who stipulated that crude protein of native grasses vary from 9.53 to 10.32% with seasons. Indeed, some authors reported a variation of nitrogen concentration in the hay and its different organs; this variation could be du to soil types and its fertility levels (Sawa *et al*., 2018; Mouchili *et al*., 2018). However, energy for milk (UFL) and for meat (UFV) production of *B. deflexa* (0.60; 0.47) and *E. colona* (0.71; 0.59) were considerably higher than that reported by Lemoufouet J. *et al*. (2014), and similar to the finding of Azoutane J. *et al*. (2020) on tropical forages, except those of *Vigna unguiculata* (0.76), (0.79) that were higher. These results corroborate the assertion that, forage association with supplement enhances increase it energy contains and relatively, its uses by the animals for ultimate production (Matumuini *et al.* 2013; Lemoufouet J. *et al*. 2014). Chemical components intake of *E. colona* alone was significantly ($p<0.05$) higher in Arabic rams followed by that of *B. deflexa*, and *E. colona*. When forages were associated with 30% of *Vigna unguiculata*, DM, OM and CB of *D. aegyptium* and *E. colona* were significantly ($p<0.05$) ingested. This result corroborates the hypothesis of Azoutane *et al*. (2020) and Oumar M K. *et al*., (2023) who stipulated that, leguminous supplementation enhance feeds intake and digestibility of poor forages in small ruminants. This statement is in agreement with the work of Pamo *et al*. (2008) who reported that the improvement of forage utilization through supplementation with *Calliandra calothyrsus* who was not only economical, but also enhanced better use of basic forages by the animals, then, covering their nutritional needs (Miégoué E. *et al*., 2023). The satisfaction of nutritional needs of animals could be linked with rumen microbial proliferation that was induced by 30% of *Vigna unguiculata* supplementation to basal diets. Tin fact, Dulphy *et al*. (1995) reported that physicochemical stability of the rumen favors high synthesis of microbial proteins (29 to 31g of nitrogen per kg organic matter) in the rumen of cow and sheep, with better digestibility of cellulose. Indeed, a high synthesis of ruminal proteins could have induced a significant increase of blood protein (86.33±2.08g), globulin (50.00±4.00g) in Arabic ram fed *E. colona* supplemented with 30% of *Vigna unguiculata*. However, several authors reported that protein supplements stimulate sufficient proliferation of gut microorganisms that are involved in digestive utilization of feeds in herbivores (Kouakou *et al.,* 2010; Miegoué E. *et al.,* 2023). This could have probably promoted increase in diet fermentation and transit with subsequent feed intake increase in Arabic rams. Indeed, forage digestibility is the degree of use of nutrients from the feeds (Rivière R., 1991) and it concentration in blood for multiple synthesis of animal products such as milk, muscles and fetus.

5. Conclusion

Brachiaria deflexa and *Dactyloctenium aegyptium* associated with 30% of *Vigna unguiculata* induced a significant ($p<0.05$) ingestion of their nutrients in Arabic rams. These animals have significantly ($p<0.05$) digested DM and OM of *E. colona* associated with 30% of *Vigna unguiculata*. Thus, the ingested and retained nitrogen from *D. aegyptium* and *E. colona* were significantly ($p<0.05$) higher in Arabic rams when feeds were associated with 30% of *Vigna unguiculata*. Comparatively, nitrogen of *B. deflexa* associated with 30% of *Vigna unguiculata* was significantly ($p<0.05$) digested in rams followed by *E. colona*. Likewise, the association of *D. aegyptium* and *E. colona* with 30% of *Vigna unguiculata* stimulated a significant ($p<0.05$) conversion of blood nutrients in energy parameters in rams. Biochemically, the association of *E. colona* with 30% of *Vigna unguiculata* stimulated a significant ($p<0.05$) synthesis plastic elements (protein and globulin), as well as energetic parameters (cholesterol) in Arabic rams. This phenomenon could be induced by feed fermentation and transit with subsequent increase of intake of nutrients and their digestibility, that is the degree of nutrients uses and it concentration in blood for ultimate synthesis of milk, meat and fetus.

Compliance with ethical standards

Disclosure of conflict of interest

This study has no conflict of interest because it is in line with doctorate research. Therefore, official testimonial was delivered by Dschang Doctorat school of Agronomy and agricultural sciences in Cameroon. Moreover, the ministry of livestock production, through it provincial delegate at Ati approved this document. Also, for the promotion as an assistant lecturer and researcher in high institutions in 2021, ethic codes and deontology was a subject of engagement signed in-between CAMES (African Conceal and Malgache for High Institutions) and the candidate.

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