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Effects of supplementation with *Acacia albida* leaves on haematological and biochemical parameters of Arab sheep on natural range

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ABSTRACT

Aim: Main purpose of the study was to explore the effects of *Acacia albida* leaf supplementation on haematological and biochemical parameters of Arab ewes on natural rangeland.

Method and materials: The basic ration consisted of R0 (300g *Dactyloctenium aegyptium* + 300g *Cenchrus ciliaris* + 600g *Panicum maximum*); R1: R0 + 400g *Acacia albida* leaves; R2: R0 + 600g *Acacia albida* leaves at the end of growth, 5 animals per batch, aged 24 weeks, were taken at random from each batch and fasted for 12 hours, then sacrificed and blood collected directly into heparin tubes for assessment of haematological parameters and into non-heparin tubes for assessment of biochemical parameters.

Results: Results revealed that supplementation had no significant effect on haematological parameters, but for biochemical parameters, serum levels of glucose, total protein, creatine and ASAT significantly increased with increasing supplement levels in young sheep.

Conclusion: It was concluded that 400g of *Acacia albida* leaves can be used with good results as a protein supplement in Arab ewes.

Keywords: *Acacia albida,* arab ewes, haematological parameters, biochemical parameters.

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Introduction

Sahelian Africa in general, and in Chad in particular, small ruminants play an important role in most domestic livestock production. In addition to being a considerable source of animal protein, they also play a well-recognized socio-economic and cultural role (in rites, traditional and religious cults) (Pamo and Tankou, 2000; Pamo *et al.*, 2001; Tendonkeng *et al.*, 2013). Despite this importance, the productivity of these animals remains low due to numerous feeding constraints resulting from low rainfall, which leads to a drastic drop in animal production.

Feeding small ruminants throughout Chad depends essentially on natural grazing, which, under the influence of the seasons, offers a low-quality forage stock during the bad season, making it impossible to satisfy the livestock's maintenance needs, as the nutritional value deteriorates rapidly with age and the advance of the dry season (Pamo *et al.*, 2006; Pamo *et al.*, 2007; Tendonkeng *et al.*, 2009; Tendonkeng *et al.*, 2011 and Douffissa, 2012). This situation exposes small ruminants to food shortages, leading to a drop in animal performance. The drastic shortage of fodder during the dry season affects pregnant ewes and especially lambs, unlike goats, which can adapt to harsh conditions. In this difficult context, improving ruminant production and productivity requires a good assessment of potential local feed resources. The use of less costly non-conventional resources in animal feed has been increasingly explored in recent years. Among these sources, the leaves of *Acacia albida* are proving to be an important source of protein in animal feed. *Acacia albida* is a very leafy plant in the dry season, and is palatable to small ruminants. Its leaf biomass is

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estimated at 200 kg of leaves for the pruned tree (Safiétou *et al.*, 1997). Its protein content ranges from 17-20% MS and its tannin content from 0.6% MF to 2.7%MS. The work of Lemoufouet *et al*. (2019) showed that organic matter digestibility (OMD) (35.43; 35.55; 35.85 and 37.10%MS) and digestible nitrogen matter (DNM) content (4.68; 5.47; 5.76 and 6.97 g/100Gmod) increased with the addition of *Acacia albida* pods in proportions of 0.10, 15 and 20% of the maize stubble-based ration respectively. Although studies have been carried out with *Acacia albida* pods in ruminants, very little information is available on the use of its leaves as a feed supplement. Therefore, the study was initiated to explore the effects of *Acacia albida* leaf supplementation on haematological and biochemical parameters of Arab ewes on natural rangeland.

Materials and Methods

The study was conducted at the small ruminant station of Livestock Research Institute for Development (LRID) in N'Djaména, Chad. LRID is located in the district of N'Djaména. The city of N'Djamena lies in the Sahelo-Sahelian zone, with a dry tropical climate. The year has two seasons: the dry season and the rainy season.

The rainy season extends from June to September, with average rainfall varying from 400 to 800 mm along the north-south gradient (Doutoum *et al*., 2020). The dry season, which lasts 8 to 9 months, is marked by the harmattan, a hot, dry wind that sweeps across the region along a north-east to south-west axis. Temperatures oscillate between 20°C and 40°C.

Vegetation was characterized by the shrub savannah in the southern part, dominated by *Acacia* and Balanite, depending on soil type, with an herbaceous carpet of Andropogonaceae; the steppe (or pseudo-steppe) in the northern part, characterized by very open woody formations and a grassy carpet dominated by Aristidae. Fauna is abundant and varied.

Animal stock and health protection

A total of forty eight (48) Arabian sheep (45 non-pregnant females and 3 males) were purchased from local markets and used for the sheep breeding trials. Their average age, determined by the dentition analysis method (Corcy, 1991), varied between 24 weeks and they weighed an average of 20.3 ± 1.2 kg. The animals were identified by a neck collar and housed in a stilted building constructed of planks (3 x 2.5 m).

Plant material

The plant material consisted of the basic forage grasses most abundant in the rangeland *(Dactyloctenium aegyptium, Cenchrus ciliaris, Panicum maximum*) and *Acacia albida* leaves.

Ration formulation

Three rations were formulated and control ration (R_0) consisted solely of basic forages (300g *Dactyloctenium aegyptium* + 300g *Cenchrus ciliaris* + 600g *Panicum maximum*). From the control ration, two other rations were created (R_1 and R_2), to which were added 400g and 600g of *Acacia albida* leaves respectively. The rations were as follows:

- R0: 300g of *Dactyloctenium aegyptium* + 300g of *Cenchrus ciliaris* + 600g of *Panicum maximum*;
-R1: R0 + 400g of *Acacia albida* leaves;
-R2: R0 + 600g of *Acacia albida* leaves;

The different forages (Fig. 1) and chemical composition of the forages used was recorded (Table 1).

During breeding, animals in the control group returning from the grazing land received no supplement, while those in the supplemented groups received 400g and 600g of *Acacia albida* leaves respectively.

Trial conduct and data collection

Evaluation of the effects of Acacia albida leaf supplementation on hematobiochemical parameters in young sheep: At the end of growth, 5 animals per batch, aged 24 weeks, were taken at random from each batch and fasted for 12 hours, then transported to IRED animal production laboratory and sacrificed by cervical dislocation followed by bleeding at jugular vein. Blood was drawn directly by cardiac puncture and collected in heparin tubes for evaluation of haematological parameters and in non-heparin tubes for evaluation of biochemical parameters. Recovered sera were frozen at -20°C until the day of analysis. These parameters included creatinine, total protein, triglycerides, total cholesterol, urea, albumin, aspartate amino transferase (ASAT) and alanine amino transferase (ALAT). The instrument used was a British-made Thermo Electron Corporation ultra-violet spectrophotometer. Hematological parameters were determined using an automated system at N'Djamena University Hospital laboratory.

Fig. 1: *Acacia albida* (A); *Cenchrus ciliaris* (B); *Panicum maximum* (C); *Dactyloctenium aegyptium* (D)

Table 1: Chemical composition of forages used

Chemical composition (%DM)	Forage			
	P. maximum	*D. aegyptium*	*C. ciliaris*	*A. albida*
Dry matter	91.16	93.75	95.79	95.60
Ash	11.91	7.11	4.22	6.62
Organic matter	79.24	86.63	91.56	88.98
Crude protein	13.12	9.5	16.06	21.85
Crude fiber	33.08	27.25	39.06	23.01
Fat	2.67	3.07	3.45	2.76

Mean corpuscular volume, mean corpuscular hemoglobin concentration, mean corpuscular hemoglobin content, hemoglobin, and hematocrit, mean corpuscular hemoglobin content, white blood cells and granulocyte were calculated or evaluated.

Data analysis

Data on haemato-biochemical parameters were subjected to one-factor analysis of variance (feed intake) using the general linear model (GLM). Where there were significant differences between treatments, Duncan's test was used to separate means at the 5% significance level (Steel and Torrie, 1980). SPSS 20.0*(Statistical Package for Social Sciences*) was used for these analyses,

Results and Discussion

Effect of Acacia albida leaf supplementation on biochemical parameters of young sheep: The effect of *Acacia albida* leaf supplementation on serum levels of some biochemical parameters (Glucose, Cholesterol, Triglyceride, Total Protein, Albumin, Creatinine, Urea, ASAT and ALAT) in young sheep was recorded (Table 2).

Serum concentrations of biochemical parameters were not significantly (P>0.05) influenced by Acacia albida leaf supplementation in any of the batches, with the exception of glucose, cholesterol, total protein, creatinine and AST. Indeed, serum glucose, total protein, creatinine and AST levels increased significantly (p<0.05) with increasing level of supplementation in young sheep batches. On the other hand, the opposite trend was observed for serum cholesterol levels.

Effect of Acacia albida leaf supplementation on hematological parameters in young sheep: Effect of *Acacia albida* leaf supplementation on haematological parameters in young Arab sheep was observed (Table 3). It was showed that supplementation with *Acacia albida* leaves had no significant effect (P>0.05) on haematological parameters in any of the batches considered.

Serum concentrations of biochemical parameters were not significantly influenced by supplementation with *Acacia albida* leaves in the rations, with the exception of glucose, cholesterol, total protein, creatinine and AST. Serum glucose, total protein, creatinine and AST levels increased significantly with increasing supplementation levels in ewe rations. The significant increase in serum protein may be explained by the effect of *Acacia albida* leaves on rumen microorganisms, specifically proteolytic and ammonia-producing bacteria, leading to a reduction in protein degradation and inhibition of the degradation of ammonia which will be used efficiently in the gut, thereby increasing the protein available to the animal (Hart, 2008; Mekuiko *et al.*, 2018). The results thus obtained were similar to those obtained by Mekuiko *et al.* (2018) when they incorporated the essential oil of *Callistemon viminalis* into the rations of Guinea dwarf goats.

Table 2: Effect of *Acacia albida* leaf supplementation on biochemical parameters of young sheep

Biochemical parameters	Lot 0	Lot 1	Lot 2	p
Glucose (g/l)	0.52±0.03[b]	0.65±0.08[a]	0.72±0.06[a]	0.006
Cholesterol (g/l)	0.54±0.09[a]	0.53±0.13[a]	0.36±0.02[b]	0.019
Triglycerides (g/l)	0.14±0.03	0.13±0.01	0.13±0.02	0.646
Total Protein (g/l)	71.65±2.92[c]	75.28±1.29[b]	80.01±1.74[a]	0.001
Albumin (g/l)	24.04±0.92	26.74±1.98	24.36±2.59	0.239
Creatinine (mg/l)	11.80±0.09[b]	12.60±0.70[a]	12.79±0.62[a]	0.007
Urea (g/l)	0.27±0.10	0.27±0.12	0.32±0.10	0.859
ASAT (UI/l)	81.37±1.05[c]	83.10±0.60[b]	87.00±1.05[a]	0.001
ALAT (UI/l)	25.33±2.12	26.84±2.53	25.93±2.43	0.865

a, b, and c: Values assigned the same letter on the same line do not differ significantly (p>0.05). Lot 0 (control) = dominant rangeland forage without Acacia albida Lot 1 = dominant rangeland forage + 400g Acacia albida; Lot 2= dominant rangeland forage + 600g Acacia albida; P = Probability, IU=International Unit.

Table 3: Effect of *Acacia albida* leaf supplementation on haematological parameters of young sheep

Haematological parameters	Lot 0	Lot 1	Lot 2	p
Ht (%)	49.83±1.98	48.69±1.69	48.60±1.96	0.728
GR(10^{12}/l)	5.05±0.09	5.03±0.08	5.03±0.07	0.697
Hgb (g/l)	112.22±3.40	105.34±3.09	109.38±3.92	0.191
CCMH (g/l)	274.14±0.27	274.11±0.19	274.52±0.29	0.062
VGM (fl)	80.05±0.08	80.06±0.06	80.07±0.12	0.843
TCMH (p/g)	22.70±0.81	21.88±1.26	21.98±0.72	0.603
GB (10^9l)	9.86±0.23	9.16±0.35	9.62±0.83	0.156
GN (10^9l)	4.37±0.10	4.61±0.19	4.42±0.14	0.167

a, b: Values assigned the same letter on the same line do not differ significantly (p>0.05). Batch 0 (control)= dominant rangeland forage without Acacia albida Batch 1= dominant rangeland forage + 400g Acacia albida ; Batch 2= dominant rangeland forage + 600g Acacia albida ; P = Probability; P = Probability;MGV: Mean Globular Volume; MBCC: Mean Corpuscular Hemoglobin Concentration; TGMH: Mean Globular Hemoglobin Content; Hgb: Hemoglobin; Ht: Hematocrit; TCMH: Mean Corpuscular Hemoglobin Content GB: white blood cells; GN: granulocyt

Blood parameters were considered to be the main pathophysiological (Etim *et al*., 2014) and nutritional (Hoon *et al*., 2012) indices for assessing the state of an organism. Any change in blood constituents compared with normal values was an important clue for interpreting the physiological or metabolic state of the animal, but also and above all the quality of the diet (Antunovic *et al*., 2011). Decreased red blood cell count is usually associated with poor-quality feed. Hemoglobin determines an animal's ability to withstand a certain level of respiratory stress, and hematocrit was the proportion of red blood cells in a blood pellet (N'diaye *et al*., 1994). When their values were high, the characterizes polycythemia and when they were low was called of anemia (Yasar *et al*., 2016). In the present study, supplementation had no significant effect on hematological parameters regardless of the ration used. Nevertheless, the values of the various haematological parameters obtained in this study were similar to those obtained by Ndoutamia and Ganda (2005) on the determination of haematological and biochemical parameters of small ruminants in Chad.

Conclusion

It was concluded that effect of supplementation with *Acacia albida* leaves in the diet of Arab ewes on natural rangelands in the peri-urban area of N'Djamena, Chad, showed that the supplement had no significant effect on haematological parameters. However, with regard to biochemical parameters, serum levels of glucose, total protein, creatine and ASAT increased significantly with increasing levels of supplementation in young sheep.

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