Clinical biochemical parameters of Burkinabese local donkeys' breeds

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The study allowed establishing values of certain biochemical parameters in 87 donkeys selected from 2 agropastoral zones of Burkina Faso. Values found in donkeys of Burkina were within the range of those found in European and Latino American donkeys unless creatinine and AST which had lower values in Burkinabese donkeys. Values of biochemical markers varied according to age groups, and nutritional status, and geographical localization of the donkeys. Thus, the mean value of AST was higher in animals with BCS3 than the ones with BCS2 (*p*=0.035). There was significant difference between values of creatinine (*p*=0.000) and magnesium (*p*=0.046) according to age groups (foal, young and adult). Significant variation was noted too in the values of ALT, and urea, and phosphorus in donkeys from one agropastoral zone to the other (*p*=0.012). The results of this study would help veterinarians to improve the diagnosis of the diseases of donkeys by good interpretation of biochemical analyses.

Keywords: Agro pastoral zone, Biochemical parameters, Burkina Faso, Donkeys.

INTRODUCTION

In the past in West Africa, donkey was a privileged companion for trader during commercial expeditions. Before the introduction of modern motorized machines, donkeys were used in the salt draft, the transportation of cola nuts, cotton fabric and various goods. Nowadays, donkeys still play an important socioeconomic role in Burkina Faso and other West African countries. Donkeys' population in Burkina Faso was estimated at 1,009,615 individuals, with an annual growth rate of 2% (MRA, 2008).

Because of the low mechanization of the agriculture in the country, donkeys are essential for crop production farms in Burkina Faso. They are used in the harnessed ploughing, transportation of harvests, and domestic works (water drudgery, provision of woods). Almost all rural Burkinabese households possess a donkey. In some wedged zones, donkey makes the transportation of people and goods and contributes to animate the weekly markets between villages. Asin carts serve to transport diseased people towards health care centers. In urban Area, donkeys are equally used for the distribution of wood, transportation of various goods, especially building materials (cement, building blocks, ions, etc.). In addition of their socioeconomic and cultural importance, donkeys are slaughtered, and the annual production of asin meat was estimated at 800 tons according to the official statistics of the Ministry of Animal Resources of Burkina (MRA, 2008).

In spite of the socioeconomic role played by donkeys, they are neglected in terms of veterinary cares and veterinary research. Besides, donkeys suffer from many parasitic and infectious diseases (Kaboret, 1984; Karangwa, 1998) and especially the mistreatment by the owners. In Burkina, only 3% of donkeys have access to veterinary health care (MRA, 2008). To our knowledge, no study was carried out concerning with the biochemical plasmatic parameters of donkeys in West Africa.

The biochemical values obtained in European or Latino American or Asian donkeys may not be fully applicable under the conditions of Burkina Faso. These values would be influenced by multiple factors including donkeys' breeds, and environmental factors especially diet intake as well as veterinary care availability. Therefore, this paper aims to establish normal ranges for

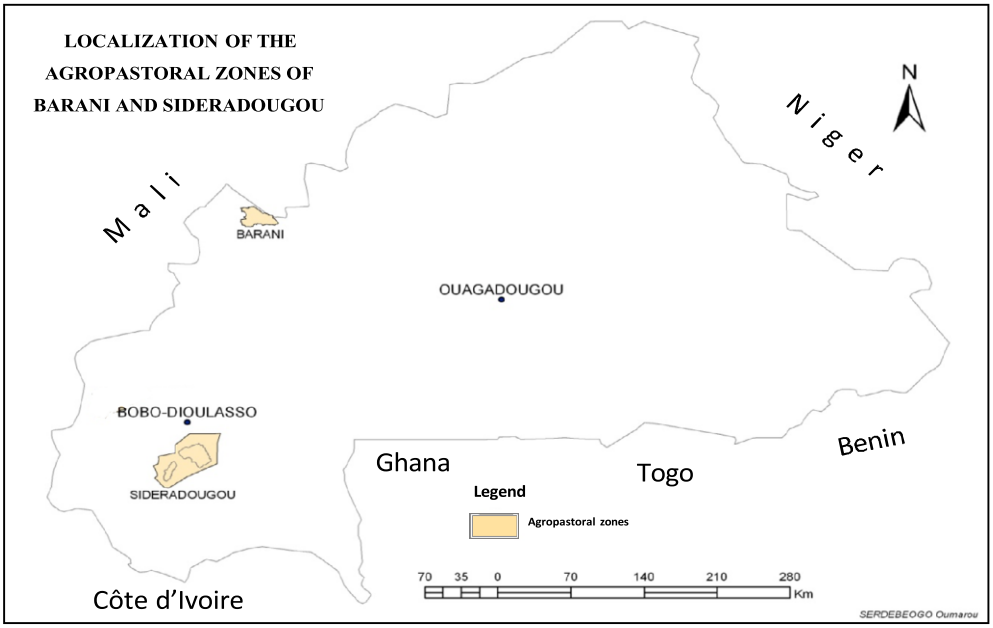

Figure 1 The agro pastoral zones of Barani and Sideradougou

a number of biochemical parameters in Burkinabe's local donkeys' breed from two agro pastoral zones. The study determined the influence of sex, and age groups, and body condition scores (BCS), and geographical localization on these biochemical parameters.

MATERIAL AND METHODS

Study area

This study was carried out in two agro pastoral zones (APZ) in the west and the south of Burkina Faso. Agro pastoral zones were created in Burkina Faso after the big drought occurred in the 1970's. The goal of these zones was to alleviate poverty by the improvement of livestock and crop production. In the other hand, the agro pastoral zones aimed the settlement of transhumant livestock keepers in the view of the improvement of local animal breeds by a good management of natural pasture.

The agro pastoral zone of Sideradougou is the first area concerned with this study. It is situated in the south of Bobo-Dioulasso and it covers a surface of 3 500 km^2 and it corresponds the basin the Koba River. The agro pastoral zone of Sideradougou is a sub-humid zone with an annual rainfall of 1200 mm. The second agro pastoral zone is located at the east of the District of Barani and situated at the west of Burkina Faso. Its surface is 489.23 km^2 (figure 1). In both zones, donkeys are used in the farm works as well as domestic works, the transportation of people and goods.

Animal sampling

Donkeys were selected in 16 villages of both agro pastoral zones during the rainy season (July 2010). A total 39 and 48 donkeys sampled in Barani and Sideradougou respectively, which totals up 87 subjects of which 38 males (43.68%) and 49 females (56.32%). All animals underwent blood sampling by jugular vein puncture in vacuated glass tubes. Blood samples were allowed to clot and serum was separated by centrifugation at 1500 g for 10 min and stored at -20°C till biochemical analyses were made.

For each animal, nutritional status was recorded based on body condition score (BCS) according to Vall et al. (2001). The age of donkeys was estimated according to the technique based on specific dental features (examination of incisor teeth) described by Muylle et al. (1999).

Biochemical analyses

Biochemical analyses were concerned metabolites (total serum proteins, albumin, cholesterol, creatinine and Urea), enzymes (aspartate aminotransferase (AST) and

Table 1 Distribution of donkeys of 2 agro pastoral zones of Burkina according the BCS

Agropastoral Zone	Number villages	Number donkeys	BCS 2	BCS 3	Age (years)
Sideradougou	7	48*	35	13	5.42±2.7
Barani	9	39#	21	18	6.44±3
Total	16	87	56	31	5.87±2.9

21 males (43.75%) and 27 females (56.25%), # 17 males (43.59%) and 22 females (56.41%)

alanine aminotransferase (ALT)), and ions (Calcium, Magnesium and Phosphorus). Biochemical analyses were carried out using commercial kits (BIOSYSTEMS® S.A., Barcelona, Spain) the experimental protocols were provided by the manufacturer. The colometric reactions were measured using spectrophotometer (BIOSYSTEMS® S.A., Barcelona, Spain).

Statistical analyses

Data were computed on Excel® and analyzed using STATA SE 9.2® software. The means and standard deviations were calculated for each biochemical parameters. Student t-test and ANOVA were used to compare values of biochemical parameters in different groups of donkeys such as age group (foal, young and adults), sex (males versus females), body condition score (BCS2 versus BCS3) and the localization (Sideradougou versus Barani). Differences were considered to be statistically significant with values of $p<0.05$.

RESULTS

Characterization of sampled donkeys

The average age of the donkeys was 5.87±2.9 years. They had a good nutritional status, there were not too fatty (BCS 4) nor cachectic (BCS 1) donkeys. Indeed, 64.37% of the sampled donkeys had a BCS 2 and the remaining (35.63%) had a BCS 3 (Table 1). According to age groups, the sample counted 13 foals less than 2 years, 12 young donkeys less than 4 years (3.66±0.49 years) and 62 adults more than 4 years (7.16±2.36 years).

Biochemical parameters

Biochemical parameters values of the Burkinabese donkeys were within the range of the reference values found in donkeys elsewhere unless creatinine and AST which had lower values compared to literature values. The values of the different biochemical parameters are summarised in table 2.

Variation of biochemical parameters according to Sex, age, BCS and agro pastoral zone

There were no significant differences between mean values of the various biochemical parameters in both sexes (table 3). Regarding the biochemical parameters according to age groups, there were significant differences in the values of creatinine and magnesium between the different age groups. The plasmatic creatinine concentrations increased significantly according to age (p=0.000). Whereas the values of magnesium in foals and adults were higher than the value in young donkeys (p=0.046) (table 3).

Concerning the values of biochemical parameters according the BCS, significant variation were noticed in the values of AST between BCS 2 and BCS 3 (p= 0.035). Donkeys with BCS 3 got higher value of AST than the ones with BCS 2 (table 3).

Biochemical parameters varied much from one agro pastoral zone to another. Indeed, values of ALT, urea and plasmatic phosphorus were significantly higher in donkeys of Barani than the values of the donkeys of Sideradougou (p< 0.05) (Table 3.). Similarly, the mean PCV of donkey of Barani (33.43±4.73%) was greater than the donkeys from Sideradougou (30±6.71%) (p=0.008).

DISCUSSION

The donkeys' population was composed in majority of adult subjects (71.26%) with an average age of 5.9 years. The sampled donkeys were in good nutritional status, the BCS was equal to 2 or 3. This could be explained by the period of the survey. Indeed, the study was carried out in July, the rainy season in Burkina Faso, period when pasture was abundant although many intercurrent diseases and trypanosomosis threat donkeys' population.Excepted the mean values of creatinine and AST, all the mean values of the other biochemical parameters analyzed were very close to the reference values

Table 2 Mean values of biochemical parameters and PCV of donkeys from 2 agropastoral zones of Burkina

Biochemical parameters	Mean values	reference Values
PCV[#] (%)	31.54± 6.12	25–38 [a]
Total Proteins (g/l)	74.17±9.15	58–82 [a]
Albumin (g/l)	24.98±6.31	20–34 [a]
AST (UI/l)	132.7±50.1[*]	295.81 ± 62.79 [b]
ALT (UI/l)	13.90±3.25	15.7 ± 1.4 [c]
Urea (mmol/l)	2.38±0.72	1.9-7.6 [a]
Creatinine (µmol/l)	101.2± 22.9[*]	159.13±12.37 [b]
Cholesterol (mmol/l)	2.10±0.46	2.28±0.26 [b]
Calcium (mmol/l)	2.44±0.51	2.13±0.04 [b]
Magnesium (mmol/l)	1.09±0.25	1.25 ± 0.15 [c]
Phosphorus (mmol/l)	1.74±0.83	0.90±0.12 [b]

[a] (French et al., 1995), [b] (Mori et al., 2003), [#] Packed cell volume, [c] (AL-Busadah and Homeida, 2005), [*] Values lower than the ones Found in the literature

established for European, and Latino American donkeys as well as Hassawi donkeys from the Kingdom of Saudi Arabia (Pitel et al., 2006; AL-Busadah and Homeida, 2005; Mori et al., 2003; Jordana et al., 1998; French et al., 1995). The mean plasmatic creatinine concentration and the mean value of AST in donkeys of Burkina were lower than the values of European, Saudian Hassawi and Latino American donkeys (Pitel et al., 2006; AL-Busadah and Homeida, 2005; Mori et al., 2003). This fact could find explanation by the difference in live weight between Burkinabese local donkeys breed and European donkeys. The average weight of adult local donkey is about 140 kg (Béré, 1981), whereas, some European donkeys breeds such as the Poitou donkey can weigh between 350 and 500 kg (Raveneau and Daveze, 1996). Indeed, creatininemiae and the value of AST varie according to muscles abundance (Kaneko, 1989). This corroborated the values of creatinine which varied significantly according to age groups. The values in foals were lower than the values in young, which had themselves values less than those found in adult donkeys (p=0.000). However, no significant difference was found in creatinine values between males and females. Similarly, the values of creatinine did not vary according the nutritional status. Although, values of AST were significantly higher in donkeys with BCS3 than the ones with BCS2 (p=0.035). Indeed in equids abundance of muscle and physical efforts influence significantly the values of AST (Padalino et al., 2007). The nutritional status could explain the muscle abundance, but we did not find enough data to support the impact of physical effort in one group or in the other, thus the variation of AST values was surely due muscle abundance. The even though the difference was not significant. This was mean value of AST was higher in females than males noticed too by Mori et al. (2003) in Brazilian local donkeys' breeds.

The values of magnesium varied significantly between the different age groups (p=0.046). Magnesium is an essential component of animal diet, and green plants contain great amount of magnesium because of its abundance in chlorophylls and in the seeds of cereals (Finco, 1997, Smith et al., 2006). The plasmatic variation of magnesium values could be due to dietary intake. Notwithstanding, no data were available on the dietary complementation of the donkeys during this study, it may be possible that adult working donkeys, used permanently in farm works were granted with complement diet and minerals (Seeds of cereals and salt).

There was no significant variation in the mean values of plasmatic phosphorus concentration within the different age groups. However, many studies mentioned that plasmatic phosphorus was usually higher in foals and young donkeys than adult subjects (Jordana et al., 1998; Mori et al., 2003). Although in this study, all animals were aged more than a year, we considered as foal animals aged less than 2 years and which still had milk intake from their mother. "Hence, the average age of the foals was 1.47±0.43 years. " In European donkeys' breeds, these subjects would be considered as young donkeys instead (Pitel et al., 2006).

Some biochemical parameters significantly varied in donkeys according to the agropastoral zone. These variations concerned with the values of ALT, urea and phosphorus. Phosphorus is provided by dietary intake,

Table 3. Mean values of biochemical parameters in donkeys of Burkina according to sex, age groups, body condition score and agropastoral zones

Biochemical parameters	Sex		Age groups			Body condition score		Agropastoral zones	
	Males (n=38)	Females (n=49)	Foals (n=12)	young (n=13)	Adults (n=62)	BCS 2(n=56)	BCS 3 (n=31)	Barani (n=39)	Sideradougou (n=48)
Total Proteins (g/l)	74.99±9.67	73.53±8.78	70.27±7.62	72.24±13.61	75.35±8.24	74.40±9.29	73.73±9.03	76.49±1.36	72.27±1.34
Albumin (g/l)	24.42±5.68	25.40±6.79	25.52±5.43	24.65±5.62	24.92±6.68	25.59±6.22	23.85±6.42	28.63±4.31	27.83±5.99
AST (UI/l)	123.6±42.0	139.7±54.9	118.5±34.9	110.9±35.7	139.9±53.7	130.0±31.6[c*]	188.7±83.3 [c*]	127.3±7.0	137.1±7.9
ALT (UI/l)	13.13±5.63	14.49±1.21	12.52±3.07	13.89±1.12	14.19±3.84	12.24±1.24	16.9±3.26	17.83±2.72[d*]	10.70±1.15[d*]
Urea (m/l)	2.38±0.82	2.39±0.64	2.24±0.67	2.39±0.57	2.41±0.76	2.33±0.68	2.43±0.78	2.74±0.12[e*]	2.08±0.08[e*]
Creatinine (µmol/l)	103.9±24.2	104.2±18.9	69.3±10.8[a*]	105.7±13.2 [a*]	110.2±18.7[a*]	105.8±20.0	100.1±25.2	99.8±29.1	105.2±19.4
Cholesterol (mmol/l)	2.05±0.45	2.17±0.46	2.19±0.61	1.87±0.33	2.17±0.43	2.14±0.07	2.02±0.39	2.07±0.48	2.12±0.45
Calcium (mmol/l)	2.38±0.55	2.48±0.47	2.31±0.62	2.36±0.57	2.48±0.47	2.45±0.50	2.41±0.51	2.5±0.076	2.38±0.07
Magnesium (mmol/l)	1.11±0.28	1.07±0.22	1.00±0.13[b*]	0.97±0.23[b*]	1.13±0.26[b*]	1.06±0.17	1.13±0.34	1.12±0.04	1.059±0.03
Phosphorus (mmol/l)	1.73±0.78	1.76±0.88	1.57±0.90	1.39±0.52	1.83±0.85	1.71±0.12	1.80±0.81	2.15±0.12[f*]	1.362±0.11[f*]

*Significant difference $p < 0.05$

[a] ANOVA (F=20.95, *p*=0.000); [b] ANOVA (F=3.19, *p*=0.046); [c] t-test (t=1.86, *p*=0.035); [d] t-test (t=2.57, *p*=0.011); [e] t-test (t=4.69, *p*=0.000); [f] (t=4.82, *p*=0.000)

according to the abundance of this mineral in soil, plants could accumulate it in big amount and therefore, animals which feed upon these plants may have enough higher plasmatic values than their counterparts living in zone with poor phosphorus concentration in soil and plants (Calvet et al., 1972). In the same way, the higher values of urea in donkeys of Barani compared to donkeys of Sideradougou could also depend of the components of dietary intake regard to the abundance of nitrogen-containing basic organic Compound in natural pasture, especially proteins as already reported by Kaneko et al. (1997). However, the variation of ALT although significant from on zone to the other could be due to unspecific factors. We did not find valuable scientific references to explain clearly this fact in donkeys.

This study provided invaluable reference values of biochemical parameters of Burkinabese donkeys. These results would help veterinarians to improve the diagnosis of the diseases of donkeys by good interpretation of biochemical analyses.

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REFERENCES

Al-Busadah KA, Homeida AM (2005). Some physical variables, biochem. and hematol. parameters in Hassawi ass. Sci.J. King Faisal University (Basic and Applied Sci.), 6: 145-152

Béré A (1981). Contribution à l'étude de la traction bovine au Sénégal. Thèse Méd. Vét. Dakar, 129p.

Calvet H, Friot D, Chambon J (1972). Influence des supplémentations minérales sur le croît et sur certains témoins biochimiques du métabolisme minéral chez des bovins tropicaux. Revue Elev. Méd. vét. Pays trop. 25: 397-408.

Finco DR (1997). Kidney function. In: Kaneko JJ, Harvey JW, Bruss ML; Eds. Clin. biochem. of domestic animals. Academic Press Inc, 441-480.

French JM , Patrick VH (1995). Reference values for physiol.ogical, hematol.ogical and biochem.ical parameters in domestic donkeys (*Equus asinus*). Eq. Vet. Educ. 7: 33-35.

Jordana J Folch P, Cuenca R. (1998). Clin. biochem. parameters of the endangered Catalonian donkey breed: normal values and the influence of sex, age, and management practices effect. Res. Vet. Sci. 64: 7-10.

Kaboret YY(1984). Contribution à l'étude du parasitisme gastro-intestinal chez les asins en République de Haute-Volta. Thèse Méd. Vét., Dakar, 304p.

Kaneko JJ (1989). Clin. Biochem. of Domestic Animals. 4th ed. San Diego, Academic Press Inc. Chapters 6 and 18, and Appendix VII.

Kaneko JJ, Harvey JW, Bruss ML (1997). Clin. biochem. of domestic animals. San Diego, Ed. Academica Press.

Karangwa C(1998). Contribution a la lutte contre l'œstrose, la gasterophilose et les helminthoses gastro-intestinales chez les asins au senegal : essai thérapeutique comparatif de la Doramectine (DECTOMAXND) et du Closantel (SEPONVER ND). Thèse méd. vét., Dakar, 98p.

Mori E, Fernandes WR., Mirandola RMS, Kubo G, Ferreira RR, Oliveira JV, Gacek F(2003). Reference values on serum biochem. parameters of Brazilian donkey (*Equus asinus*) breed. J. Eq. Vet. Sci. 23: 358-364.

MRA (Ministère des Ressources Animales du Burkina Faso) (2008). Les Statistiques du Secteur de l'Elevage au Burkina Faso. Ouagadougou, 124 p.

Muylle S, Simoens P, Lauwers H, Van Loon G (1999). Age determination in Mini-Shetland Ponies and donkeys, J. Vet. Med. 46: 421-429

Padalino B, Rubino G, Centoducati P, Petazzi F (2007). Training versus Overtraining: Evaluation of Two Protocols. J. Eq. Vet. Sci. 27 (1): 28-31.

Pitel Ph, Moulin M, Valette J-P, Dumontier S, Petit L, Fortier G, Couroucé- Malblanc A. (2006). Approche des valeurs hématologiques et biochimiques chez deux races asines. Pratique Vét. Éq. 38: 19-25.

Raveneau A, Daveze J (1996). Le livre de l'âne, son histoire, sa famille, son éducation, toute sa vie. Rustica Ed. Paris France, 128 p.

Smith C., Marks AD, Lieberman (2006). Marks' Basic Med.ical Biochemistry: A Clin . Approach, 2nd Ed. New York; Lippincott, Williams & Wilkins, 922p.

Vall E, Ebangi AL Abakar O(2001). Mise au point d'une grille de notation de l'état corporel des ânes de trait au Nord Cameroun, Revue Elev. Méd. vét. Pays trop., 54: 255-262