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Purine Derivatives in The Plasma and Urine and Tissue Xanthine Oxidase (XO) in Sudanese Camels (*Camelus dromedarius*)

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Abstract: The present study was conducted to examine urinary and plasma purine derivatives in light to different feeding protocol; to assess tissue xanthine oxidase activity in plasma, liver and intestine in relation to breed. Breed-related differences in tissue xanthine were observed. Arabi camels have higher figures compared to Anafi. Xanthine oxidase activities in Arabi plasma, liver and intestine were 0.9±0.1, 0.18±0.09 and 0.10±0.03, whereas in Anafi were 0.4±0.09 unit/L, 0.06±0.01 unit/gram wet tissue, 0.09±0.02 unit/gram wet tissue, respectively. Total urinary purine derivatives as a function of feed intake (11.43 vs. 15.09 mmol/d). Allantoin and uric acid compared 75.6 and 15.4% of total purine derivatives, in both fed and fasted camels, but hypoxanthine plus xanthine was 9%.

Key words: Camel, purine derivatives, xanthine oxidase

INTODUCTION

Camels, though posses a three compartmental rumen, they have similar digestive and fermentative patterns to those of ruminants. As a sequel of adenine and guanine catabolism, Purine Derivatives (PD) such as allantoic, uric acid, hypoxanthine and xanthine are excreted in the mammalian urine. Single-humped camels showed lower plasma and liver Xanthine Oxidase (XO) activities than other species and excreting three times hypoxanthine than uric acid in their urine[1]. In ruminants, the microbial purines are synthesized in the gastrointestinal tract comprising 80-90% of the total PD excreted in urine[2]. Measurements of PD were proposed as a metabolic marker of microbial synthesis in ruminants[3]. The present study was conducted to assess PD in the urine and plasma of Sudanese camels (Camelus dromedarius) adopted different dietary regimes and to measure XO in the plasma, liver and intestine in relation to breed.

MATERIALS AND METHODS

Urinary excretion of purine derivatives at different feeding levels: Four Arabi camels (Camelus dromedarius) were used, two females and two males in a crossover esign. The mean body weight was 398±37 kg and of age 4.5 years. The diet composed of typical desert vegetation; *Acacia mellifera*, *Acacia nilotica*, *Blepharis perisca* and *Aristida funiculata*. The desert vegetation on DM basis contained 10.3 CP; 51.7 NDF; 5.7 ash; 42.7 ADF and 10.7 ADL.

Xanthine oxidase activity: Samples of plasma, liver and intestine were collected at the slaughterhouse at Tambul area, south east of Khartoum, from the same animal and the plasma taken prior slaughtering. The camels were aged 2-5 years and from Arabi and Anafi breeds. Samples were taken randomly with feeding status, age, sex information obtained for each animal. Fifty apparently healthy, free of parasites from each breeds were sampled during the rainy season.

Samples collections and analysis: Liver and intestinal samples were prepared as described by Furth-Walker and Amy[4]. Urine and samples were analysed for allantoin levels by Chen et al.[5] and uric acid and hypoxanthine[6]. Xanthine and hypoxanthine were determined collectively as uric acid after treatment with xanthine oxidase. For allantoin, urine samples were deprotenized with similar volume of 19% tricholoroacetic acid (TCA), whereas xanthine plus hypoxanthine and uric acid in the plasma were analysed directly without deprotenization.

Statistical analysis: Repeated measures were used for the analysis of variance (ANOVA) differences in the urinary PD excretion between two levels of feed intake were tested by paired t-test students. Data are presented as means±SE. Significance was detected at $p<0.05$.

RESULTS AND DISCUSSIONS

The mean urinary excretion of allantoin, uric acid, hypoxanthine plus xanthine and the total PD of the last 4

Table 1: Activities of xanthine oxidase (XO) in plasma, liver and intestine of Arabi and Anafi camels (*Camelus dromedarius*)

Measurement	Arabi	Anafi
Plasma (unit/L)	0.9±0.01[a]	0.4±0.09[b]
Liver (unit/g wet tissue)	0.18±0.09[a]	0.06±0.01[b]
Intestine (unit/g wet mucosa cell)	0.10±.03[a]	0.09±0.02[b]

Values are expressed as means±SE, [a,b]Means on the same column having different superscripts are significantly different at $p<0.05$

Table 2: Urinary PD excretion (mmol/L) in four Arabi camels (*Camelus dromedarius*) when fasted and when fed at two levels of feed intake (9.5 and 4.5 kg as fed/day)

PD mmol L^{-1}	Fasted (mean feed of 4 days)	Feed intake 4.5 as fed	Feed intake 9.5 kg as fed	P*
Allantoin	3.48±0.21	9.94±0.56	13.36±1.42	0.29
Uric acid	0.71±0.19	0.63±0.07	0.92±0.23	0.47
Hypoxanthine plus xanthine	0.91±0.16	1.12±0.10	1.37±0.34	0.99
Total PD	4.74±0.23	11.43±1.56	15.09±2.01	0.24

Values are expressed as means±SE, *The differences between the two levels of feed intake were tested by paired student's t-test

days of fasting are shown in Table 1. The proportions of allantoin, uric acid and hypoxanthine plus xanthine ion the total PX excretion were 75.6, 15 and 9%, respectively. They did not change as a function of feed intake. When the camels were fed higher level of intake, they excreted 25, 31 and 18% more allantoin, uric acid and hypoxanthine plus xanthine, respectively. Xanthine oxidase activities in the plasma, liver and intestine of Arabi and Anafi camels are presented in Table 2.

The study clearly demonstrates that the activities of XO in the plasma, liver and kidney were lower that those reported in the buffaloes[7], sheep and cattle[6] and rabbits[8]. It is suggested that the species differences in the endogenous purine derivative excretion were probably due to the different profiles of XO activity in tissues and particularly in the blood. The present study indicated breed-related differences in XO.

Urinary excretion of PD may be a useful tool to estimate the duodenal PB input and the microbial protein intake[8]. Species differences in PD may be attributed to liver oxidase activity, as reported in the camels[1]; sheep[8] and buffaloes[7]. Oxidation of hypoxanthine appears to be the limiting factor of purine metabolism in camel liver[1]. In young fed camels, plasma uric acid was 160-273 μmol L^{-1}[9]. However, in fed and fasted llamas (217 μmol L^{-1})[2].

The influence of diet and fasting on PD has been described[10-12]. However, the urinary excretion of purine derivatives was not significantly affected by dietary component. The study indicated that allantoin and uric acid comprised 75.6 and 51.4% of the total purine derivatives, respectively, in both fed and fasted states, but hypoxanthine plus xanthine was 9%. With increasing food intake, the rate of PD excretion in the urine increased linearly by about 11.1 mmol PD kg^{-1} Digestible Organic Matter Intake (DOMI), equivalent to 95 g microbial protein/kg DOMI[13].

The study revealed that urinary total purine derivatives excretion responded to feed intake. Similar findings were obtained in llama[2] and buffaloes[7] and cattle[12]. Llama is unique in maintaining a higher concentration of uric acid the plasma, which could be part of the llama's adaptation to their environment[2]. The differences in purine levels as a function of breed couldn't be easily explained. Significantly higher hypoxanthine over uric acid ratios was found in camel plasma and urine, with respect to the amounts of purines entering the small intestines in free or bound form[14].

It could be concluded that PD excretion in camels responded according to the level of feed intake and to fasting. XO plasma, liver and kidney activities were lower than sheep, cattle, buffaloes and slightly higher than llama.

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