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Urinary excretion of purine derivatives in dry buffalo and Fresian cows

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ABSTRACT: Aim of this paper was to compare urinary purine derivatives (PD) excretion in Italian Mediterranean dairy buffaloes and Fresian dairy cows during dry period. Six buffalo and six dairy cows at about 60 days to delivery were housed in individual cages and fed the same diet. Feed intake was monitored daily. After a period of adaptation, total daily urine was collected, weighed, sampled in test-tubes and frozen up to HPLC analysis. During the urine recovery period the daily feed intake was higher for dairy cows (kg/DM 9.0 *vs* 7.6) even if differences were not significant due to the high individual variability. Urine excretion was significantly ($P<0.01$) higher in buffaloes than in cow. Total urinary excretion of PD in buffalo was 11% of that of dairy cow (23.707 mmol/l *vs* 2.711 mmo/l in dairy and buffalo cows, respectively), however the incidence of uric acid was similar in both species. In order to explain the low concentrations of PD in the urine of buffaloes, we investigated also the presence of allantoic acid, final product of purine degradation in several fish species. However it was not detected.

INTRODUCTION - Urinary purine derivatives (PD) excretion rate has been used as an index to predict rumen microbial protein production in ruminant livestock. Topps and Elliott (1965) were among the earliest to suggest that urinary allantoin and uric acid excretion rates reflect the magnitude of microbial protein flow into the small intestine. Consequently, prediction equations for microbial protein supply based on the relationship between duodenal input and urinary output of purine compounds were developed for cattle (Verbic *et al.*,1990) and sheep (Chen *et al.*, 1990; Fujihara *et al.*, 1991; Balcells *et al.*, 1991; Perez *et al.*, 1996; Yu *et al.*, 2001). However, there is a problem in using this method for prediction of microbial protein production in buffaloes. This because the excretion of PD in buffaloes is less than 50% of that from other species (Makkar, 2004; Liang et al, 1999; Moscardini *et al.*, 1999; Soejono *et al.*, 1999). As indicated by Thanh and Ørskov, 2005) the low PD excretion in buffaloes could be the result of two possibilities: either that glomerular filtration rate is lower in buffaloes than cattle leaving more time in the blood thus more time for recycling to the rumen and metabolism by bacteria, or that the permeability from the blood to the rumen is greater in buffaloes than cattle. An other hypothesis was formulated by Chen *et al.* (1996); they suggested that the differences in PD excretion between buffaloes and cattle were probably due to the higher xanthine oxidase activities in buffaloes than cattle. As a

consequence the proportion of plasma PD that was disposed of in the urine should be lower in buffaloes than cows. Aim of this paper was to compare urinary PD excretion in Mediterranen dairy buffaloes and Fresian dairy cows during dry period.

MATERIAL AND METHODS - Six Italian Mediterranean buffalo (average LW 593 ± 22 kg) and six Fresian dairy cows (average LW 645 ± 37 kg) at about 60 days to delivery were utilised. All animals were housed in individual cages for the experimental period (30 d) and fed a diet composed by corn silage (12 kg), commercial concentrate (1.7 kg) and wheat straw (6 kg). Feed intake (DFI) was daily monitored. After 15 d each animal was equipped with an harness (Susmel *et al.*, 1994) in order to recover daily urine and after a 5 d of adaptation, total daily urine was recovered in tanks (15 l) containing 500 ml of sulphuric acid 5 M. Once a day the urine was weighed, sampled in test-tubes and frozen up to the analysis. The urine, diluted (1:1) with a monobasic phosphate potassium 0.02 M were analysed by HPLC (Chen *et al.*, 1993). All data were analysed by Student's t test.

RESULTS AND CONCLUSIONS - During the urine recovery period the DFI was different between species (kg/DM 9.0 ± 0.53 *vs* 7.6 ± 0.62, respectively in cattle and buffaloes), even if due to the high individual variability, it was not statistically significant. All the subject were in good health throughout the experiment and no substantive modification of live weight (LW) was registered, indicating that energy requirements were satisfied. Urine excretion (table 1) was significantly ($P<0.01$) higher in buffaloes than in cattle.

As depicted in table, total urinary excretion of PD in buffaloes was 11% of that of cattle (23.707 mmol/l *vs* 2.711 mmo/l in dairy and buffalo cows, respectively). However the incidence of uric acid resulted similar in both species (12.4 *vs* 12.0 % of total PD in dairy and buffalo cows, respectively). The differences between species were higher than those reported by Thanh and Orskov (2005). In fact, these authors found similar amounts of PD excretion in buffaloes (0.26 mmol/$LW^{0.75}$) but lower amounts in cattle (0.69 mmol/$LW^{0.75}$).

Table 1. Amount of urine(l/d) Daily excretion of urinary PD in urine of dairy and buffalo cows.

		Cow		Buffalo	
		x	s.e.	x	s.e.
Urine	l/d	8.540^{B}	1.319	10.840^{A}	1.612
Allantoine	mmol/l	20.777^{A}	3.678	2.297^{B}	0.165
Uric acid	mmol/l	2.930^{A}	0.574	0.314^{B}	0.053
Total PD	mmol/l	23.707^{A}	4.197	2.711^{B}	0.195
Allantoine	mmol/$LW^{0.75}$	1.386	0.214	0.207	0.031
Uric acid	mmol/$LW^{0.75}$	0.196	0.030	0.028	0.004
Total PD	mmol/$LW^{0.75}$	1582	0.244	0.245	0.036

The daily excretion of PD registered for buffaloes in the present trial (29.38 mmol/d) was close to that obtained by Pimpa *et al.* (2003) after the infusion of 95 mmol/d of exogenous purine (24.08 mmol/d) in 4 male swamp buffaloes (LW 244 kg), while that of bovine agree with the results of Cetinkaya *et al.* (2005) in Yerly Kara crossbred cattle (LW 209 kg) fed 95% of voluntary intake, which was previously estimated as 6 kg DM/day.
In order to explain the low concentrations of PD in the urine of buffaloes, we investigated also the presence of allantoic acid, final product of purine degradation in several fish species. However this purine derivatives was not detected.

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