

# The use of purine derivatives/creatinine ratio in spot urine samples as an index of microbial protein supply in Yerli Kara crossbred cattle

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Received 30 September 2004; received in revised form 25 July 2005; accepted 25 July 2005

## Abstract

Three experiments were conducted to evaluate the use of purine derivatives (PD)/creatinine ratio in spot urine samples as an index of microbial protein supply in Yerli Kara crossbred cattle (YK-C). In Experiment I, response of daily PD excretion to feed intake in YK-C at state farm was measured. In Experiment II, spot urine sampling techniques was applied at state farm and four YK-C bulls were used. In Experiment III, spot urine sampling technique was applied at small-holder farms. There were significant correlations ( $R^2=0.99$ ) between PD excretion (mmol/day) and digestible organic matter intake (DOMI) (kg/day) in Experiment I,  $Y=12.5 (\pm 0.5)+19.7 (\pm 3.5)X$  ( $R^2=0.99$ ,  $n=16$ ). The equation obtained from Experiment I could be expressed as:  $Y=-2.3 (\pm 0.3)+0.953 (\pm 0.06)X$ , ( $R^2=0.99$ ,  $n=49$ ) where  $Y$  is PD excretion (mmol/day) and  $X$  is the PDC index. The PDC index was calculated as the molar concentration ratio of PD to creatinine times the metabolic body weight (kg). The corresponding microbial-N values to PDC index of groups I, II and III in developed banding system are 15–25 g/day. Experimentally estimated DOMI was  $2.21 \pm 0.15$  kg/day. Estimated DOMI of groups I, II, and III were  $2.8 \pm 0.6$ ,  $2.6 \pm 0.7$  and  $2.7 \pm 0.7$  kg/day, respectively. In conclusion, the PDC index in spot urine samples could be used under similar farm condition as an indicator of microbial protein supply in YK-C cattle. Estimated DOMI from PDC index in spot urine samples under defined field conditions may help the development of feeding strategies for YK-C cattle held by small holders.

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**Keywords:** Microbial protein synthesis; Purine derivatives; PDC index; Spot sampling

## 1. Introduction

Previous studies in sheep and cattle have demonstrated that urinary excretion of purine derivatives (PD) provides an index of the intestinal flow of microbial protein (Chen et al., 1990). The purine

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derivative technique to measure microbial-N flow to intestine in ruminants is a simple and non-invasive method. There are information and quantitative models for cattle and sheep and, colorimetric methods, which allow the use of this technique (IAEA, 1997). The purine derivative technique has the advantage of using intact animals, but the disadvantage of requiring total urine collection. The use of urine spot samples together with the purine derivatives/creatinine ratio index can be an alternative to replace total urine collection. Since the total urine collection makes the developed models impractical, spot urine PD and creatinine measurement and banding system were suggested (Chen et al., 1995). Yerli Kara crossbred (YK-C) cattle is common in Turkey. It was of interest to establish whether the approach of PD excretion to estimate microbial protein supply is applicable in YK-C cattle. The model which is  $Y=0.695 (\pm 0.053)W^{0.75}+0.81 (\pm 0.03)X$  ( $R^2=0.91$ ,  $n=16$ ) where  $Y$  is PD excretion (mmol/day),  $W$  is live weight of animal (kg), and  $X$  is PD absorption (mmol/day) based on urinary PD excretion for estimating rumen microbial protein production was developed in Yerli Kara cattle (Cetinkaya et al., 1999, 2001).

The aim of the present study is to evaluate the use of purine derivatives (PD)/creatinine ratio in spot urine samples as an index of microbial protein supply in Yerli Kara crossbred cattle.

## 2. Materials and methods

### 2.1. Experiment I. Response of daily PD excretion to feed intake in Yerli Kara crossbred on state farm

Four YK-C bulls with a live weight (LW) of  $209 \pm 39.4$  kg were used. The bulls were housed in metabolism cages and fitted with urine collection aprons. They were fed a mixed diet containing 30% wheat straw and 70% compounded feed on DM basis. The diet contained 90% DM; its CP and OM contents were 124 and 950 g/kg DM, respectively. The diet was offered twice daily at 09:30 and 17:30 h, in equal meals. Fresh water was available freely. The compound feed was consisted of 67% barley, 10% wheat bran, 20% sunflower cake, 1% salt, 1.5% marble dust which contains 38%  $\text{CaCO}_3$  and 0.5%

mineral and vitamin mixture (Tarvan Anonim Company, Ankara). During the preliminary period, the diet was given at an ad libitum level of intake. Voluntary intake was measured for each bull over a period of 2 week. After the preliminary period, bulls were fed at 4 fixed levels as 95%, 80%, 60% and 40% of the voluntary intake. Voluntary intakes were 6 kg DM/day for four bulls. The treatments were allocated according to a  $4 \times 4$  Latin Square design. Each feeding period lasted for 3 weeks.

During the last 3 days of the last week of each feeding period, daily total urine and faeces were collected. Collected urine samples were analyzed for uric acid, allantoin (IAEA, 1997), creatinine (Hawk et al., 1976) and total-N (AOAC, 1990). Faeces samples were analyzed for OM and DM by AOAC (1990).

### 2.2. Experiment II. Spot urine sampling at state farm

Four YK-C bulls with a LW  $211 \pm 41.3$  kg were used. The experimental design, feeding and diet were the same as in Experiment I. The treatments were allocated according to a  $4 \times 4$  Latin Square design.

At each feeding period, spot samples were collected in 2 days. The sampling times were at 09:30 and 11:30 h and 14:30 h. Collected urine samples were analyzed for uric acid, allantoin (IAEA, 1997), creatinine (Hawk et al., 1976) and total-N (AOAC, 1990).

### 2.3. Experiment III. Spot urine sampling at small-holder farms

Thirty YK-C bulls were selected from 12 different small-holder farms. Age, body weight and average feed intake were recorded. Selected farms were divided into three groups (I, II and III) according to received feeds. Feed samples were collected and analyzed for organic matter, dry matter and crude protein. Compound feed containing 65% barley, 25% bran, 6% sunflower seed meal, 3% marble dust which contains 38%  $\text{CaCO}_3$  and 1% mineral and vitamin mixture (Tarvan Anonim Company, Ankara) (120 g CP/kg DM and 950 g OM/kg DM) was offered total in between 2 and 3 kg in two parts one in the morning (07:30 h) and one in the afternoon (17:00 h). Although compound feed ingredients were given to similar in all group (groups I, II and III), animals

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