Urinary purine derivatives excretion as an index for rumen microbial protein production in zebu cattle and swamp buffaloes

Liang Juan Boo, Pimpa Opart, Zainal Aznam Mohd Jelan & Norhani Abdullah

Faculty of Agriculture
Universiti Putra Malaysia
43400 UPM, Serdang, Selangor
Malaysia

Telephone Number of Corresponding Author: 03-89466898
E-mail of Corresponding Author: jbliang@agri.upm.edu.my

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Introduction

Urinary purine derivatives (PD) excretion rate has been used as an index to predict rumen microbial protein production in ruminant livestock. Equation using urinary PD excretion rate to predict ruman microbial protein synthesis for European cattle has been developed. However, relationships established for European animals may not be applicable for tropical cattle and water buffaloes. It is important that equations developed with European cattle be validated with and for tropical zebu cattle and swamp buffaloes. This study reports the excretion rates of urinary PD in Malaysian zebu Kedah-Kelantan cattle and swamp buffaloes. The objective was to determine if a relationship between urinary excretion of PD and purine input to the small intestine of Kedah-Kelantan cattle and swamp buffaloes occurs

Materials and Methods

Three Kedah-kelantan cattle with an initial body weight (BW) of 178kg and 4 swamp buffaloes of 244 kg, each fitted with a ruminal and a polyvinyl chloride (PVC) T-shaped duodenal cannula were used for the study. The animals were kept in individual metabolism crates and fed at maintenance energy levels of 1% dry matter (DM) of BW. The oil palm based diet used for the study contained a calculated energy content of 8.4 MJ ME/kg DM, 12.9% crude protein. The animals were infused with various level of purine bases via the duodenal cannula in a 3 (animals) x 4 (infusion levels) incomplete Latin-Square design for the cattle, while a 4 (animals) x 5 (infusion levels) incomplete Latin-Square design was used for the buffaloes. Each infusion lasted between 6 to 7 days. Total daily urine output of each animal was determined and a sample was collected in H2SO4 to maintain a pH of less than 3 and stored for PD analysis using High Pressure Liquid chromatography (HPLC). Relationships between the excretion of urinary PD and total purine base was established using linear regression procedure for cattle and buffaloes.

Results and Discussion

The animals remained in good health throughout the study. There were no substantive changes in their BW, indicating that maintenance energy intake was maintained. Allantoin was the principal PD detected in urine of cattle and buffaloes, followed by uric acid. Hypoxanthine and xanthine concentrations were negligible. Total PD (allantoin, uric acid, hypoxanthine and xanthine) excretion (mmol per day) was linearly correlated with purine supplied (mmol per day) as described by the equation $Y = 0.847X + 7.146$ ($r^2 = 0.50$, $P < 0.001$) for Kedah-Kelantan cattle, suggesting that 0.85 of the supplied exogenous purine base were excreted in urine, with an endogenous excretion of 7.15 mmol per day. Urinary PD excretion rates of zebu cattle are similar to those of European cattle. On the other hand, the relationship between daily urinary PD excretion and duodenal purine base infued was $Y = 0.12X + 12.78$ ($r^2 = 0.45$, $P < 0.001$, suggesting that only 0.12 of the supplied exogenous purine base were excreted in the urine with an endogenous excretion at maintenance energy of 12.8 mmol per day. Urinary PD excretion rate of swamp buffaloes was much lower than those reported for cattle. We postulated that the discrepancy between the two species of ruminants could be due to a lower rate of PD absorption in the small intestine and or recycling of plasma PD in buffaloes.)

Conclusions

The relationship between urinary PD excretion and estimated duodenal purine base flow in Kedah-Kelantan cattle was linear, with an estimated urinary excretion rate of 0.85, consistent with values reported for European cattle by several groups. Although the relationship between urinary PD excretion and duodenal purine base flow in swamp buffaloes was also linear, the estimated urinary excretion rate was only 0.12 This value is much lower than that reported for European and Zebu cattle (averaged 0.85).

Benefits from the study

Generally, rumen microbial protein provides the major component of the total protein needs of tropical ruminant livestock. It is therefore important that farmers and producers can quantify this important source of nutrient in order for them to apply the appropriate feeding strategy to improve the productivity of their animals. The results of this study had provided simple technique of estimating rumen microbial protein supply for cattle and buffalo in the tropics.

Patent(s), if applicable:
Not applicable

Stage of Commercialization, if applicable:
Not applicable

Project Publications in Refereed Journals

1. Pimpa, O., J.B. Liang, Z.A. Jelan and N. Abdullah. 2001. Urinary excretion of duodenal purine derivatives in Kedah-Kelantan cattle. *Animal Feed Science and Technology*. 92:203-214

2. Pimpa, O., J.B. Liang, J. Balcells, Z.A. Jelan and N. Abdullah. 2003. Urinary purine derivative excretion in swamp buffaloes after duodenal purine base infusion. *Animal Feed Science and Technology*. 104:191-199

3.Pimpa, O., J.B. Liang, J. Balcells, Z.A. Jelan and N. Abdullah. 2003. Absorption of nucleic acid in the small intestines of swamp buffaloes and Kedah-Kelantan cattle. *Animal Feed Science and Technology* (in press)

Project Publications in Conference Proceedings:
Nil

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Pimpa Opart	Urinary purine derivatives excretion as a method for estimation of rumen microbial protein production in swamp buffaloes and zebu cattle	Animal nutrition	PhD	2002

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