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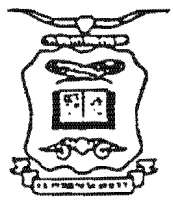

Object

To advance the scientific study of animal production in southern Africa.

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SESSION 1: REGULATION OF FOOD AND WATER INTAKE 1

Urinary allantoin in lactating cows during heat exposure

*Agung Purnomoadi[1], Nomachi, K. Higuchi, O. Enishi and F. Terada
National Institute of Animal Industry, Tsukuba Norinkenkyudanchi POBox 5, Tsukuba, Ibaraki 305-0901, Japan
[1] Shizuoka pref. Agric. Exp. Sta., Fujinomiya-shi, Inogashira 1945, Shizuoka-ken 418-01, Japan
*Present address : Diponegoro University, Semarang, Indonesia

Introduction

Studies on allantoin excretion for estimating microbial protein synthesis have been done to achieve a suitable feeding regime and to optimize the nutrient utilization. Many studies indicated that dry matter intake (DMI), nitrogen intake (NI) and its interaction with energy intake (EI) affect allantoin excretion (Susmel *et al.*, 1994, Chen *et al.*, 1995). However, the effect of environmental temperature on allantoin excretion still needs further investigation. It is generally accepted that DMI will decrease and consequently also energy and nitrogen intake when animals are exposed to heat stress. This condition may disturb rumen fermentation and decrease microbial synthesis in the rumen, passage of amino acid to the small intestine and milk production by dairy cows (Clark *et al.*, 1992). This study was conducted to investigate the effect of environmental temperature on urinary allantoin excretion and possible correlation with nutrient intake.

Materials and methods

Spot samples of urine and blood were collected from four multiparous Holstein cows (average liveweight 576 kg). Cows were kept in a temperature controlled room for four weeks with temperature settings at 18°C during the first two weeks and 28°C during the last two weeks. Samples were collected from week-2 to week-4. Feeding was adjusted to meet the ME requirement for maintenance and milk production (AFFRCS-Jpn, 1994), the cattle were fed four times a day at 0800, 1000, 1600 and 1830h. Daily DMI and protein intake were measured by collecting the orts and drying in an air-draft oven.

Cows were milked twice daily at 0830 and 1800h and production recorded. Urine and blood samples were collected before morning and evening milkings. Blood samples were taken from a cathether permanently inserted in the jugular vein. Urine was analyzed to determine the allantoin and creatinine concentration, using the procedures of Young and Conway (1942), and the Jaffe method using commercial kit (Wako pure chemical, Ltd) with Clinical Chemistry Analyzer CL-7000 (Shimadzu, Japan), respectively. Total excretion of urinary allantoin was calculated from urinary creatinine concentration based on total collection carried out in the d -6 to -3 (18C) and the d 8 to 11 (28C). Daily excretion of creatinine (per kgW) was used as correction factor for allantoin excretion based on the assumption that creatinine excretion rate is relatively constant and a function of the metabolic weight of the animal (Chen *et al.*, 1995). Liveweight was measured at the d -6, 1, 6, 10 and 14 of temperature elevation. Daily liveweight gain for calculating allantoin and creatinine excretion was calculated using the average daily gain between the measurements. Blood samples were analyzed for urea N (BUN) concentration by means of the Urease Indophenol method and using a commercial kit (Wako pure chemical, Ltd., Japan). Daily measurements of allantoin and BUN were obtained from the average of morning and evening samples.

Results and discussion

The liveweight of cows decreased from 576 to 534 kg during the study. As expected, DMI decreased sharply and was accompanied by a decreased NI, EI, milk yield ($r = 0.98$) and allantoin concentration in urine ($r = 0.76$) starting from d 3 of temperature elevation. The decrease in allantoin concentration was also correlated with NI ($r = 0.76$) and much less with EI ($r = 0.60$), but the correlation would be higher if the N/E ratio of 0.82 is taken into account. The BUN was inversely correlated with DMI ($r = -0.79$), NI (r

= -0.75), EI (r = -0.62) and N/E ratio (r = -0.76).

This study showed that heat exposure decreased allantoin excretion in urine which can be contributed to decreased DMI and NI (Chen *et al.*, 1995). However, the increase of BUN while DMI and NI were decreased, is probably a result of body protein catabolism due to the energy restriction (Hayden *et al*, 1993), because the concentration of BUN will not change when the N/E ratio is relatively constant (Oltner & Wiktorsson, 1983).

Conclusion

The decrease in microbial synthesis can not be attributed to the effects of changes in N utilization in the rumen because the ratio of allantoin excretion and NI (A/N ratio) was highly variable. Therefore, further studies need to be conducted to clarify the mechanisms involved in altering microbial synthesis in the rumen during heat exposure.

Acknowledgement

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