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คุณลักษณะของ Ruminal ของอาหารข้นที่มีระดับฝักจามจุรีต่างกันโดยใช้เทคนิค gas production

Ruminal characteristics of meal concentrate by rain tree (*Samanea saman*) pods using gas production technique

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Abstract

The objectives of this study were to investigate the replacing meal concentrate with rain tree pods (RTP) on *in vitro* fermentation by using gas production technique. The treatments were without and with the pods at 20, 40, 60, 80 and 100%. Gas production was consecutively recorded at 2, 4, 6, 8, 10, 12, 18, 24, 36, 48, 60, 66 and 72 hr of incubation periods. Also, *in vitro* true digestibility (IVTD) and acetate (C_2), propionate (C_3) and butyrate (C_4) were analyzed. It found that gas production at 4 to 8 hr was significantly different ($P<0.05$) among treatments. IVTD were significantly different ($P<0.05$) among treatments. The groups substituted at 80 and 100% of the pods were found significantly lower ($P<0.05$) IVTD. C_2, C_3 and C_4 were significantly different ($P<0.05$) among treatments. C_2 was lowest in control group while C_3 and C_4 in control group were higher than other groups. Thus, it could be valuable as an alternative feed and possibly replaced meal concentrate up to 60% without any negative effect in the *in vitro* study. It was concluded that the pods could replace meal concentrate in some proportion which could be valuable low feed cost in the future.

Key words: rain tree pods, meal concentrate, feedstuff, digestibility

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาการทดแทนฝักจามจุรีในอาหารข้น 6 ระดับ คือ กลุ่มควบคุม และทดแทนที่ระดับ 20, 40, 60, 80 และ 100% โดยใช้วิธี *in vitro* gas production ทำการวัดปริมาณแก๊สสะสมที่ชั่วโมง 2, 4, 6, 8, 10, 12, 24, 48 และ 72 วัดค่าการย่อยได้แบบ IVTD และ กรดไขมันที่ระเหยได้ ผลการศึกษาพบว่า ปริมาณแก๊สสะสมชั่วโมงที่ 4 ถึง 8 มีปริมาณแก๊สสะสมแตกต่างอย่างมีนัยสำคัญ ($P<0.05$) ส่วนระดับ C_2, C_3 และ C_4 แตกต่างอย่างมีนัยสำคัญ ($P<0.05$) โดยระดับ C_2 ในกลุ่มควบคุมต่ำสุด แต่ระดับของ C_3 และ C_4 ในกลุ่มนี้มีระดับสูงสุด ดังนั้นสามารถทดแทนฝักจามจุรีในอาหารข้นได้ร้อยละ 60 จึงสรุปได้ว่า สามารถใช้ฝักจามจุรีทดแทนในอาหารข้น เพื่อลดต้นทุนค่าอาหารสัตว์ในอนาคตได้

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of this pods replacement. The lowest IVTD may be attributed to presence of tannins although contained high CP. Since it contains in diets could be reduced fiber, protein and some nutrients in rumen (Barry et al., 1986).

Table 1 The gas volume and values of kinetic parameter from fermentation of RTP in meal concentrate replacement

Incubation time (hr)	Percentage of RTP replacement in meal concentrate						SEM
	control	20	40	60	80	100	
Gas volume, ml/200 mg DM							
2	7.63	7.93	10.63	8.47	10.00	10.00	0.77
4	13.73^{c}	13.37^{c}	16.57^{a}	14.70^{abc}	16.13^{ab}	16.33^{ab}	0.79
6	18.63^{b}	18.27^{b}	21.70^{a}	19.77^{ab}	21.27^{a}	20.07^{ab}	0.73
8	21.97^{b}	22.17^{b}	25.67^{a}	23.67^{ab}	25.27^{a}	23.10^{ab}	0.82
10	27.33	26.57	30.23	27.90	29.60	27.10	0.93
12	30.63	29.67	33.30	31.20	32.73	30.23	0.95
24	46.87	45.57	49.03	47.20	48.20	45.03	1.04
48	61.20	59.83	63.23	61.57	62.60	59.67	0.98
72	67.77	67.27	69.97	69.47	70.50	67.93	1.02
Gas production parameter							
b (ml)	67.28	66.53	66.40	67.57	67.00	65.04	0.88
c (h^{-1})	0.05	0.04	0.05	0.05	0.05	0.04	0.00

^{a,b,c} Means with different superscripts in a row differ significantly (P< 0.05)

Table 2 *In vitro* true digestibility and volatile fatty acids from *in vitro* fermentation

Parameter	Percentage of RTP replacement in meal concentrate						SEM
	Control	20	40	60	80	100	
IVTD (%)	74.31^{a}	73.25^{a}	73.30^{a}	72.30^{a}	62.29^{b}	65.09^{b}	2.11
TVFAs (mM/L)	29.39^{b}	29.35^{b}	39.31^{a}	39.90^{a}	25.27^{b}	33.48^{ab}	0.98
Acetate (C_2) (%)	67.08^{c}	69.44^{b}	70.13^{ab}	71.24^{a}	70.40^{ab}	70.02^{ab}	0.44
Propionate (C_3) (%)	22.38^{a}	21.60^{b}	21.10^{c}	20.90^{c}	21.74^{b}	21.87^{b}	0.15
Butyrate (C_4) (%)	10.54^{a}	8.96^{b}	8.76^{b}	7.86^{c}	7.85^{c}	8.12^{bc}	0.31

^{a,b,c} Means with different superscripts in a row differ significantly (P< 0.05)

C_2, C_3 and C_4 were significantly different (P<0.05) among treatments. The group replacement with 60 % of the pods was highest C_2 but not significantly different among the groups replacement with the pods at 40, 80 and 100%, respectively. However, it was higher than the group replacement with 20% of RTP. In that case may be attributed to the high content of neutral detergent soluble fiber fraction in those groups. Meanwhile, C_2 was lowest in control group. Since, this group had low fiber content resulting C_2 to decrease since fiber degradation is related to increase C_2 production (Murphy et al., 1982). The C_3 in control group was significantly higher (P<0.05) than other treatments which replacing concentrate with this pod. In that case may be due to this group presented high concentrate and low fiber content. While, treatment that replacement with 40 and 60% of the pods were significantly lower (P<0.05) C_3 than replacement at 20, 80 and 100% of the pods. Thus, the high levels of C_3 can indicate low fiber content in feed. The values of C_4 in control group was significantly higher (P<0.05) than other groups.

คำสำคัญ: ฝักจามจุรี, วัตถุดิบอาหาร, การย่อยได้

Introduction

The rain tree (*Samanea saman*) is cultivated as ornamental shade tree yielding dark brown and large leathery pods which can be a valuable supplementation to ruminants (Stewart and Dunsdon, 2000). It contains high protein content and digestibility without any toxicity. In addition the pod itself enrich with tannin that some animals are be able to adapt high tannin diets by producing proline rich saliva proteins to bind with tannin (Hagerman and Butler, 1991). There could be substituted 20 % in feed without affecting to growth but when substituted about 30% of RTP was declined weight gain of goat and heifer (Thole et al., 1992). However, the understandings about the benefits of the pods in livestock are less. Hence, the study aimed to determine this pod to concentrate meal replacement on *in vitro* fermentation by using gas production technique.

Materials and methods

The experimental design was a Completely Randomized Design (CRD) with three replications. The treatments were ratio of replacing concentrate with RTP were control, replacing ratio 20, 40, 60, 80 and 100% of the pods. *Digitaria decumbens* hay as roughage source. Substrates were dried at 65 °C and ground to pass through 1 mm. They were analyzed crude protein (CP) (AOAC, 1990), neutral detergent fiber (NDF) and acid detergent fiber (ADF) (Goering and Van Soest, 1970). The inoculums were artificial saliva and rumen fluid, ratio 2:1 (Menke et al., 1988). The substrate weight was 200 mg into serum bottle. 30 ml of inoculums were added to each bottle then incubated at 39 °C. Gas production was recorded at 2, 4, 6, 8, 10, 12, 18, 24, 36, 48, 60, 66 and 72 hr. Gas production was fitted to model of Orskov and Mcdonald (1979) as $Y = a + b (1-e^{-ct})$. Where Y is volume of gas produced at time (t), the symbol a is the gas production from the immediately soluble fraction (ml), the symbol c is the gas production rate constant for the insoluble fraction (ml h^{-1}), the symbol a+b is the potential gas production (ml) and the symbol t is incubation time. At 12 hr post incubation were analyzed C_2, C_3 and C_4 (Samuel et al,. 1997). IVTD was determined at 48 hr post incubation (Van Soest and Robertson, 1985). The data were analyzed the analysis of variance. Means were separated by Duncan New s' Multiple Range Test. The model is $Y_i=\mu+t_i+\varepsilon_{ij}$.

Results and discussion

The substrates contained CP ranging from 11.08-12.36%. NDF was 51.30, 47.57, 48.50, 49.43, 50.37 and 46.63%. ADF was 64.04, 57.63, 51.02, 44.51, 38.01 and 64.04%. Values for the estimated parameters are shown in Table 1. The gas volume at 4, 6, and 8 hr after incubation were significantly different ($P<0.05$) among treatments. At 8 hr the replacement levels of 40 and 80 % of the pods were highest gas production. Besides, the control group was lowest gas production. Gas production from the insoluble fraction (b) and rate constants of gas production for the insoluble fraction (c) were not significantly different. The low values of the estimated parameters can also be attributed the high fiber content prevalent in the hay which used in this study. Moreover, gas production can be estimated feed degradation that it is a good parameter to predict digestibility, fermentation end products and microbial protein synthesis of microbes in *in vitro* (Bergman, 1990). The effects of replacing concentrate with this pod on IVTD, C_2, C_3 and C_4 are shown in Table 2. The IVTD were significantly different ($P<0.05$) among treatments. It was highest in control group and followed by the pods replacement at 20, 40 and 60%. Meanwhile, the IVTD were the lowest in 80 and 100%

Conclusion

Based on this study found that IVTD was high but could not be replaced exceeded 60% of the pods. C_2 was lowest in control group and 20% replacement of the pods. The C_3 and C_4 were highest in control group. The RTP supplemented were increased the C_2 proportion without affecting to digestibility of feed. Therefore, the pods should be taken use in dairy production due to could be increased milk fat. Since, it is precursor for milk fat synthesis. Also, the nutritionist should be investigated about utilization of RTP may be due to it could possibly be incorporated in ruminants diet to replace meal concentrate which could be reduced feed cost in the future.

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