Incremental Level Of *Chromolaena odorata* In Complete Diet For a Cows Fattening

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ABSTRACT

This research was aimed to use of *Chromolaena odorata* as an alternative protein source for livestock is the presence of various anti-nutrient compounds in the plant's tissues. However, recent studies have revealed that physical treatments can effectively eliminate the anti-nutrition associated effects. This experiment aimed at quntifying effects of different levels of *Chromolaena odorata* in a complete diet (given in the form of pellet) on nutrient intake, digestibility, concentration of volatile fatty acids (VFA), and efficiency of rumen microbial crude protein synthesis (EMPs). Four young male Bali cattle(aged ± 2 years old and initial liveweight of 152 kg) were allotted into four dietary treatments were a complete diet containing 10% (COP10) or 20% (COP20) or 30% (COP30) or 40% (COP40) of *Chromolaena odorata* meal given at 2% liveweight. The basal diet (sorghum plumosum hay) and drinking water were given ad libitum. The tested diets were design to be iso-protein (18%) and metabolisable energy (12 MJ) to support a minimum liveweight of 0.8 kg/head/day. Result indicated that increasing level *Chromolaena odorata*from 10% to 40% in the complete diet did not significantly impair all variable measured, though at the higest level (40%) ofinclusion, all variable have shown a diminishing trend. It can be concluded that *Chromolaenaodorata* can potentially be utilized as a cheap protein source for fattened cattle when provided up to 40% in the total diet, but might have a negative effect when the levels raised above the current level since it shows a diminishing trend in important variables such as intake, digestibility and rumen function.

Keyword : Cattle, *Chromolaena odorata*, Microbial crude protein, Rumen digestion

INTRODUCTION

Chromolaena odorata is a threatening weed because it has invaded and dominated almost all the natural grazing areas that exist in NTT and even the dryland areas of the world (Prawiradiputra, 2007). In addition to the weed apparently *Chromolaena odorata* has great potential as a feed. *Chromolaenaodorata* is a potential feed source due to its high crude protein content (21%) andbiomass production, has a good amino acid balance, effective degradability in the rumen> 80% (Mullik, 2002). However, its use as a feed is hampered by its antinutrient content (Akinmoladun, 2007; Ikhimioya et al., 2007). therefore strategy needed to eliminate antinutrient compounds. Physical treatment (mash, pellet, hay block, silage) is very effective to minimize and even eliminate the anti-nutrient content. This study aims to examine the effect of *Chromolaena odorata* level in fattening cattle fed ration seen from intake, digestibility and rumen fementation.

MATERIALS AND METHODS

Four young male Bali cattle an initial liveweight of 152kg (±7.11 kg) were alloted into a 4 x 4 Latin Square experimental design to test four diets . The diets were complete dietcontaining 10% (COP10) or 20% (COP20) or 30% (COP30) or 40% (COP40) of*Chromolaena odorata* meal given at 2% liveweight. The tested diets were designed to beiso-protein (18%) andmetabolisable energy (12 MJ). Feed intake, digestibility, and rumen fermentation were measured for 5 days in each treatment period. Concentration ammonia and volatile fatty acids in the rumen fluid were measured by sampling rumen fluid (using stomach tube aspiration under vaccum) three hours after feeding on the last day of each treatment period. The rumen liquor was strained through two layers nylon stocking and then acidified with concentrated sulphuric acid to lower the pH below 3. Molar proportion of volatile fatty acids (VFA) was quantified using gas liquid chromotography.

To measure rumen microbial protein production (MCP), spot samples of vioded urine by each cattle were taken daily during each data collection period. Daily spot samples were bulked for each animal in a glass container. The collected urine was acidified using 10% H_2SO_4 to keep the pH below 3. At the protocolsolfor spectrophotometry proposed by Chen and Gomez (1995). Calculation of MCP and efficiency of MCP was performed using the formula for zebu cattle proposed by (IAEA 2003). The MCP was calculated using formula Y= 0,85 X 0,147 $W^{0,75}$, were Y is total purine derivatives (PDs) exreted in urine; X is total microbial purines absorbed; metabolic weight of cattle, since spot urine samples was used, molar ratio of PDs, creatinine was used to estimate daily exretion of PDs. Daily creatinine excretion was assumed to be constant and a value of 0,91 mmol/kg $W^{0,75}$ (Chen *et al*. 1996) was adopted in the computation. Data were statistically analys edusing general lenear model priciples (univariate) for latin square experimental design. Diffenerece between treatments were at $P \leq 0,05$ using SAS statistics software.

RESULTS AND DISCUSSION

Intake and Digestibility

All parameters of intake and digestibility were not significantly affected by inclusion of *Chromolaena*meal in the diet, though the empirical data showed a diminishing trend as the level of *Chromolaena*meal increased (Table 1). Total dry matter intake ranged from 2.86 to 3.23% LW (Table 1).Lack of statistical difference in the present study most probably due to a large within treatment variation (larger SEM value) compared to those of mash diets. When compared to the mash form, the smaller pellet variability for ration intake is related to the preferred pellet shape by the livestock rather than the mash form.The larger variability in intake of mash diet mainly related to physical form of the diet since some animal could be distratced by dust from the mash as it can block the breathing airways. Other intake parameters (organic matter and crude protein) were also following the DMI trend.

Ratio of crude protein intake (CPI) and digestible organic matter intake (DOMI) is a good nitrogen-carbon balance indicator for rumen function and efficiency of nutrients utilization at tissue level. Figures in the present experiment were in the range of 222-256 g protein/kg DOMI (Table 1). With 75% digestibility of crude protein (Table 1), it should be estimated that the ratio of digestible protein-DOMI was at least 170 g DCP/kg DOMI which was a very good balance for nutrient fermentation in the rumen and utilization at the tissue.

Tabel 1. Intake and *in vivo* digestibility of a complete diet contains *Chromolaenaodorata*meal at a rate of 10%(COP10) or 20%(COP20) or 30%(COP30) or 40%(COP40) and provided to cattle in pellet form

Variable	COP10	COP20	COP30	COP40	SEM	P value
Total intake						
Dry matter (kg^{-h})	5.29	5.42	4.88	4.86	0.202	0.216
Dry matter (%liveweigth)	3.13	3.23	2.90	2.86	0.339	0.597
Organic matter (kg^{-d})	4.78	4.92	4.40	4.39	0.182	0.191
Crude protein(g^{-d})	600	640	570	530	0.036	0.280
Digestible organic matter (kg^{-d})	3.96	4.04	3.62	3.63	0.141	0.168
Protein:digestible organic matter intake	228	222	240	232	0.124	0.712
Digestibility						
Dry matter (%)	60.86	60.07	60,41	61.42	1.387	0.906
Organic matter (%)	65,96	62.88	66.66	66.41	1.076	0.142

Insignificant decline in the intake found in the present experiment is similar to the results reported by Mullik*et al.* (2014) for cattle given mash diet that had the same nutrient composition and the same level of *Chromolaena* meal. This trendcould not be related to nutrition composition aspect since diets for all treatments were formulated to provide the same level of energy (12 MJ/kg DM) and protein (18%). Therefore, the most probable factor suppressing the intake was secondary metabolic compounds in the diet as in *Chromolaena*meal.Heat drying and grinding of *Chromolaena*might fail to eliminate anti-nutrient compounds inthe meal. A recent study in InstitutPertanian Bogor (Y.M. Mulik, unpublished data) has found that total tannine and anti-tripsin concentration in *Chromolaena* leaf increased dramatically to 3 fold when oven dried or sun-dried. This might be the underlying explanation for the negative effect in intake since it is well documented that anti-nutrient compounds upset rumen fermentation and nutrient digestibility leads to a negative feedback on the intake.

Eventhough digestibility variables were not affected significantly when the level of *Chromolaena* meal was increased up to 40%, yet there was a decline by up to5% for DM digestibility (DMD) and for organic matter digestibility (OMD). Digestibility coefficient found in the present experiment (Table 1) was reasonably good since there is a good balance of nutrients and high level of mash intake.

Rumen Fermentation and Microbial Crude Protein Production.

Measurement of rumen fermentation products such as pH, ammonia (NH_3), volatile fatty acids (VFAs), microbial protein (MCP) production and efficiency of synthesis (E_{MCP}) showed insignificant effects (Table 2). Rumen fluid pH tended to shift slightly toward base zone (7.06-7.18). This happens because of the high protein content (18%) in the diet. Rumen NH_3 was in the range of 229-263 mg/L which indicates an adequate supply of nitrogen for an optimal rumen function. This high rumen NH_3 partly arises from the urea used the diet to adjust the protein level to 18%. Total VFAs and molar propotion of these rumen fermentation products were also not affected by the level of *Chromolaena* meal. Insignificant effects of incremental level of *Chromolaena* in pellet diet on these variables was also reported by Mullik*et al.*(2014) for cattle. Again, lack of response to levels of *Chromolaena*mealwas expected as the same composition of diet presented to the rumen of cattle in all treatements.

Table 2.Rumen fermentation and microbial crude protein (MCP) production in cattle given a complete diet contained 10%(COP10) or 20%(COP20) or 30%(COP30) or 40%(COP40) *Chromolaenaodorata* meal and provided in pellet form

Variable	COP10	COP20	COP30	COP40	SEM	P value
Rumen pH	7.06	7.15	7.18	7.10	0.056	0.545
Rumen NH_3-N (mg/L)	235	263	237	229	11.9	0.209
Total VFA (mM)	128.4	129.1	134.6	130.4	2.60	0.728
Acetat (mM)	88.4	86.3	88.1	85.5	1.17	0.965
Butirat (mM)	12.3	12.3	16.4	10.5	1.98	0.564
Propionat (mM)	27.6	30.5	30.1	34.4	2.78	0.562
Rumen MCP:						
Production (g/d)	206	192	186	136	29.9	0.163
Efficiency (g MCP/kg DOMI)	73	68	72	60	0.80	0.801

Optimal efficiency of rumen microbial crude protein synthesis (E_{MCP}) recommanded in the current feedingsstandards (SCA 2007; NRC 2002) is around 130 g MCP/kg DOMI. This equal to 130 rumen digestibale protein (RDP) per each kg DOMI.The RDP was not measured in the present study hence the RDP:DOMI ratio could not be established. However, the healthiness of the rumen function could be detected using E_{MCP}. The E_{MCP} presented in Table 2 showed a range value of 60-73 g MCP/kg DOMI. These values were far below the recomanded level. Using this data, one can confidently stated that the diet used in the present study did not support an optimum rumen microbial production. A much lower E_{MCP} values (83-103 g MCP/kg DOMI) were also documented by Mullik*etal.*(2014) when complete diets (mash) contained the same nutrient composition and levels of *Chromolaena* meal were offered to cattle in a parallel experiment.However, this does not imply that the diets used in the present study did not provide adequate nutrients into the rumen since it contained 18% CP and 12 MJ ME/kg DM. Rather, lower MCP production and efficiency is related to chemical and physical aspects of the diets. For chemical aspects, high concentration of secondary metabolic compounds, particularly tannins, in *Chromolaena* (Aro*et al.*2009) can bind to protein in the diet and makes it indigestible in the rumen (Van Soest 1996) hence reducing quantity to nutrients available for microbial growth. The physical aspect that contributes the low E_{MCP} in present experint was the particels size. Grinding of the feed stuff increased outflow rate of feed from the rumen as reported by Poppi*et al.* (1980) hence resulted in low rumen microbial growth.

CONCLUSION

It can be concluded that *Chromolaena odorata* can potentially be utilized as a cheap protein source for fattened cattle when provided up to 40% in the total diet, but might have a negative effect when the levels raised above the current level since it shows a diminishing trend in important varibels such as intake, digestibility and rumen function.

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