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Optimising Rumen Function of Bali Cattle Fed Ration Based on Agriculture By-Products with Supplementation of Multivitamins-Minerals

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ABSTRACT

A research has been carried out to optimize the rumen function and the rumen microbial protein synthesis in Bali Cattle (Steer). Sixteen Bali cattle were used in this experiment with Completely Randomized Block Designed four treatments and four blocks. The first treatment was ration based on agriculture by products without supplementation (R_0), while the other three treatments were supplemented with 0.075% (R_1), 0.150% (R_2) and 0.225% (R_3) multivitamins-minerals. The variables of rumen microbial protein synthesis including urinary exretion of allantoin, purin derivatives absorbsion, rumen microbial protein synthesis and efficiency of rumen microbial protein synthesis, Feed and nutrients degradation on the rumen, pH, concentration of NH_3-N, VFA and amount of protozoa in the rumen fluid were measured in the experiment. The result showed that rumen microbial protein synthesis and amount of microbial purines absorbed in suplementation of 0.150% (R_2) and 0.225% (R_3) multivitamins-minerals were significant difference ($P<0,05$) compared with without supplementation (R_0) (222.83 and 222.24 gram/day Vs 197.83 gram/day) and (49.45 and 49.35 Vs 44.76 mmol/day), but they were not significantly different with without supplementation on rumen microbial protein synthesis (213.57 gram/day) and on amount of microbial purines absorbed (48.67 mmol/day). Degradable organic matter and Sulfur absorbed in the rumen, amount protozoa, and ruminal pH, concentration of NH_3-N, totally VFA and propionate acids of rumen fluid significantly ($P<0,05$) increased as well. Increasing supplementation until 0.15% (R_2) multivitamins-minerals were decreased concentration of acetate acid, butirate acid and methane gas production compare with without supplementation, but increasing until 0.225% supplementation of multivitamins-minerals (R_3) increased concentration of butirate acid and methane gas production. Moreover, regression analyzed showed that suplementation of multi vitamins-minerals of 0.188% coused maximum rumen microbial protein synthesis of 223,39 gram/day. It was concluded that rumen microbial protein synthesis of Bali cattle given ration based on ammoniated rice straw could be increased as maximum 12.92.%. The level optimal multivitamins-minerals supplementation used in this experiment was 0,188%.

Key words: *Agriculture by-products, Bali cattle, Multivitamins-minerals, Microbial Protein Synthesis, Rumen Function.*

INTRODUCTION

Optimise the rumen function on degrading fibrous feed such as non-conventional feedstuffs is one of Bali cattle productivity improvement strategy. The products of rumen function such as degraded nutrients in the rumen, metabolic rumen product (VFA, and NH_3-N) and microbial biomass are essential nutrients to meet the nutrient demands of the anaerobic microbes and body tissues of ruminant animals. Microbial protein synthesis in the rumen supllies 40 to 80% of the amino acids absorbed by ruminants[13] and the amino acid composition of microbial protein is similar to that of protein in the main animal product such as milk, lamb or beef[27].

Microbial protein synthesized in the reticulo-rumen constitutes almost the only source for protein digestion in the small intestine on the animals given feeds with such low quality fibrous diets like as agricultural by product[19]. That ways better strategies minded national program to support feed security especially ruminants feed focused on optimise use agriculture waste and agro-industry by products as feed[12].
The maximum potential of rumen microbes to produce microbial protein and degraded nutrients in the rumen can be explored only by the provision of high quality diet[27], so increasing rumen function in cattle fed ration based on agriculture by product like as rice straw should be focused on strategies for through many problems especially deficiency nutrient and low degistibility at that feed materials. Applied urea ammoniation technologies verified can increased digestible rice straw[6,22], in spite of inadequacy micro-nutrients such as minerals Ca, P, Mg, Cu, Zn, Mn, Co, Fe, S, and vitamins A, D_3 and E can not increased[7]. Multivitamin-minerals supplementation of cattle given ration base on waste is one of the best strategy a farmer can make. That statements founded on vitamins and minerals are important factor to affected the effectivity rumen fermentation and efficiency of microbial protein syntheis[14].
Minerals and vitamins supplement to enhance fermentative digestion and microbial growth efficiency in the rumen of cattle on poor quality feed. The macro-minerals (Ca, P and Mg), micro-minerals (Cu, Co, Zn, Mn, Fe and S) and multi-vitamin (especially Vitamin A and E) most important to rumen fermentation activity, feeds degradation, and microbial protein synthesis[17]. The levels of sulfur and ammonia in rumen fluid which maximize digestibility of fibrous carbohydrates appear to be 1–2 mg S/l and 50–80 mg ammonia N/l respectively, whereas maximum microbial growth efficiency seems to require 4–10 mg S/l and 150–200 mg ammonia N/l respectively[17]. Even though, Bal and Ozturk[3] showed optimise rumen microbial protein synthesis needed 1.6 – 1.9 g Sulfur/kg organic matter digested with N/S ratio 18.5:1. Limited intake of sulfur may restrict rumen activity and microbial protein synthesis when large amounts of non-protein nitrogen are fed to ruminant animals, such as urea or effect given urea ammoniated feeds[14]. In spite of, given fed with very high sulfur can decreased fed consumsion, respiration stress even death[21]. Phosphorus is another mineral required for the synthesis of ATP and protein by rumen microbes. Microbial protein synthesis can be limited by an insufficient supply of P for microbial growth. Parakkasi[21] describe the mineral zinc (Zn) as components and activator of any enzyme such as *deyidrogenase, peptydase* and *fosfatase* with functions at nucleat acid metabolisms, carbohydrate metabolisms and protein synthesis. Rumen microbes needed 130-220 mg Zn/kg for optimise microbes growth and yields. Other minerals such as Ca, Mn, Fe, Co and Cu also important for microbial protein synthesis, synthesis of ATP and vitamins B, microbes activities, nutrient degradable[14,21]. Supply of vitamins A and E important on given ration based on urea ammoniated rice straw because that materials deficience[6]. Vitamins A and E function for microbes growth especially microbial protein synthesis and energy supply for microbes activities[21]. Supply of vitamins B-complex also important couse low of supply mineral precursor finding that vitamin such as minerals S or Co on feed material.
This experiment was conducted to determine the best level of multivitamins-minerals supplementation in the fermentation process on ration based on agriculture by-product that could increase of rumen function to degrade nutrients, produce high quality of rumen metabolic product, and increase supply of nutrients for host animal. The research results are expected to give early illustration of science and technology development especially in optimizing the utilization of local resources based on agriculture by-product feedstuffs to support feed security of ruminant production.

MATERIALS AND METHODS

Location, Animals, Diet and Experimental Design

A research has been carried out at farm of "Nandi Abian" farmers group association, Abianbase of Gianyar Regency used sixteen Bali cattle mean body weight 244.19 $\pm$ 33.78 kg. They were kept in feedlot pens (individual concrete pens) on site for duration of the study. This experiment was run for 12 weeks at the farm and continously laboratory experimental for data analysis at Animal Nutrition Laboratory, Faculty of Animal Husbandry and Analytic Laboratory, Udayana University.

This experiment used a Completely Randomized Block Designed with four treatments and four blocks base on body weight of cattle. The treatment were as follows:

R_0 = Basal Ration without suplemented multivitamins-minerals
R_1 = R_0 were suplemented with 0.075% multivitamins-minerals
R_2 = R_0 were suplemented with 0.150% multivitamins-minerals
R_3 = R_0 were suplemented with 0.225% multivitamins-minerals

Basal ration composed by urea ammoniated rice straw and agroindustry by product. Ration and water provided *ad libitum*. Materials Feedstuffs and Nutrient composition can see at Table 1 and 2.

Table 1. Material Composition of Ration Experimental

Feedstuffs Composition	**Composition Ration** (%)			
	R_0	R_1	R_2	R_3
Urea Ammoniated Rice Straw	25.000	25.000	25.000	25.000
Pollard	34.000	33.966	33.932	33.898
Coconut Meal	25.000	24.975	24.950	24.925
Sugarcane	6.000	5.994	5.988	5.982
Coconut Oil	5.000	4.995	4.990	4.985
Limestone ($CaCO_3$)	2.000	1.998	1.996	1.994
Urea	1.000	0.999	0.998	0.997
Salt	2.000	1.998	1.996	1.994
Pignox	0.000	0.075	0.150	0.225
T o t a l	100.000	100.000	100.000	100.000

Table 2. Nutrient Compositions of Ration Experimental

Nutrient[1]	**Ration**			
	R0	**R1**	**R2**	**R3**
Dry Matter (%)	89.420	89.420	89.420	89.420
Organic Matter (%)	83.728	83.663	83.598	83.533
Crude Protein (%)	14.596	14.584	14.572	14.559
Crude Fibre (%)	12.216	12.211	12.207	12.202
Gross Energy (Mkal)	3.888	3.885	3.882	3.878
Ca (%)[2]	1.348	1.347	1.346	1.345
P (%)[2]	0.450	0.449	0.449	0.449
S (%)[2]	0.300	0.303	0.305	0.308
Zn (%)[2]	0.015	0.016	0.018	0.019
N/S ratio	7.785	7.709	7.634	7.561

Reference: 1) Analysis by Animal Nutrition Laboratory, Faculty of Animal Husbandry, Udayana University, and
2) Analysis by Analitic Laboratory, Udayana University

Data Collection, Sampling Procedure and Analysis

Parameters observed on this research are the variable of rumen microbial protein synthesis (MPS), including urinary exretion of allantoin, purin derivatives absorbsion, rumen microbial protein synthesis and efficiency of rumen microbial protein synthesis (E_{MPS}), feed and nutrients (DM, OM, CF, CP, Ca, P, S and Zn) degradation/absorbsion on the rumen, pH, concentration of NH_3-N, Totally VFA, Partial VFA (Acetate Acids, Propioniate Acids and Butirate Acids) and amount of protozoa in the rumen fluid

Feed were randomly collected and fecal samples were taken from total collection of individual cattle during the last 7 day of the study. They were analyzed for chemical composition such as DM, ash, CP and CF contents with proxymate analyzed[2], and concentrations of minerals Ca (with EDTA method), S (Iodometry method), P and Zn (with Atomic absorption Spectrophotometre/AAS).

At the end total collection period, rumen fluid samples were collected at 4 hours post feeding. Approximately 200 ml of rumen fluid was taken from the middle part of the rumen by using a hand vacum pump.

Rumen fluid was immediated measure for pH using portable pH meter (HANNA instrument HI 9025). Concentration of NH3-N rumen fluid calculated with using fenolhypocloryte method, Totally Volatile Fatty Acid calculated from concentration of Acetate Acids + Propionate Acids + Butirate Acids. Partial VFA (Acetate, Propionate and butirate) analyses using a high performance liquid chromatography HPLC.
The total direct count of protozoa on rumen fluid were counting with using MFS solution at counting chamber/hemocytometer[18].
Urine samples were analyzed for allantoin in urine was determined by HPLC as described by Partama[22]. The amount of microbial purines absorbed (X mmol/day) corresponding to the purine derivates ecreted (Y mmol/day) was calculated based on the relationship derivated by Bowen[4].

$$Y = 0,85\ X + 0,190\ W^{0,75}$$

Where: Y is the excretion of purine derivates (mmol/day); X is the microbial purines absorbed (mmol/day), 0.190 $W^{0.75}$ is contribution of endogenous purine each kg metabolic body weight from Bos indicus

The supply of microbial protein in gram per day was estimated as follows:

$$\text{Microbial Protein (gram/day)} = \frac{70X}{0.116 \times 0.83 \times 1000} \times 6.25$$

With X being the absorption of purine derivates in mmol/day, digestibility of microbial purine is 0.83, the N content of purines is 70 mg N/mmol and the ratio of purine-N : total N in mixed rumen microbes is 11.6:100, the convertion factor N to Protein is 6.25
The E_{MPS} which denote the microbial protein supplied to the animal per unit of DOMR was calculated using the following formula:

$$E_{MPS}\ (\text{g/1000 DOMR}) = \frac{\text{MP (g/day)}}{\text{DOMR (g)}} \times 1000$$

Where : DOMR = DOMI x 0.65 (ARC, 1990 cited by Khampa and Wanapat)[16], DOMR = digestible organic matter apparently fermented in the rumen, DOMI = digestible organic matter intake, E_{MPS} = efficiency microbial protein synthesis

Statistical Analysis

Data Collecting were analyzed by Analysis Variance/ANOVA and continued with Honestly Significant Difference test (HSD-test) if necessary[26]. Contras polinomial analysis were using for optimum supplemented multivitamins-minerals.

RESULTS AND DISCUSSION

Effect on Degradable Nutrients on Rumen

The degradable nutrients and absorbed micro-nutrients (minerals) on rumen are presented in Table 3. Degradable organic matter, Sulfur absorbed and N:S ratio on rumen were affected ($P<0.05$) by multivitamins-mineral supplementation, while degradable DM, CP, CF, energy and absorbed Ca, P and Zn on rumen were similar in all treatments. Degradable organic matter and S absorbed on rumen were significantly higher ($P<0.05$) in Bali cattle fed R_3 (2078.10 g/d and 8.66 g/d) than in R_0 (1846.32 g/d and 6.88 g/d) while N: S ratio on rumen was significantly lower ($P<0.05$) in Bali cattle fed R_3 (6.81) than in R_0, R_1 or R_2 (7.78; 7.83; 8.26).

Similar degradable nutrients on rumen (except organic matter and S absorbed) were affected by quality of ration given. In general, rate of digestion nutrien on rumen is the major factor controlling the energy available for growth of rumen microbes[8]. Furthermore, nutrient composition of all ration were similar (Table 2).

Table 3. Influence of Multivitamins-Minerals Supplementation on Nutrient Degradable and Absorbed on Rumen in Bali Cattle

Item	Treatment[1]				SEM[3]
	R_0	R_1	R_2	R_3	
- Degradable DM (g/d)	2170.02[a2]	2325.66[a]	2417.05[a]	2422.55[a]	67.18
- Degradable OM (g/d)	1846.32[a]	1989.86[ab]	2070.04[ab]	2078.10[b]	52.96
- Degradable CP (g/d)	334.60[a]	370.70[a]	379.28[a]	367.62[a]	11.73
- Degradable CF (g/d)	219.75[a]	212.89[a]	242.05[a]	219.15[a]	13.28
- Degradable Energy (Mkal/d)	8.34[a]	8.85[a]	9.08[a]	9.32[a]	0.27
- Ca Absorbed on Rumen (g/d)	24.64[a]	25.46[a]	26.38[a]	26.63[a]	2.04
- P Absorbed on Rumen (g/d)	6.34[a]	5.15[a]	5.74[a]	4.61[a]	0.77
- S Absorbed on Rumen (g/d)	6.88[a]	7.57[ab]	7.35[ab]	8.66[b]	0.31
- Zn Absorbed on Rumen (g/d)	0.08[a]	0.13[a]	0.20[a]	0.07[a]	0.04
- N:S ratio on rumen	7.78[b]	7.83[b]	8.26[b]	6.81[a]	0.13

Note: 1) R_0 = Ration without multivitamins-minerals supplementation, R_1 = Ration with 0.075% multivitamins-minerals supplementation, R_2 = Ration with 0.150% multivitamins-minerals supplementation, and R3 = Ration with 0.225% multivitamins-minerals supplementation, 2) The same letter in same row is not significantly difference (P>0.05), 3) SEM = Standard Error of the Treatment Means

Significantly degradable organic matter and S absorbed on rumen by supplementation of 0.225% multivitamins-mineral show increasing efectivity of rumen microbes esspecially rumen bacteria where showed by high microbial protein yield were similar with R_2 but higher ($P<0.05$) than R_0 (Table 5) and with lower (quantitative) amount protozoa than R_2 ($5.80x10^5$ Vs $6.20x10^5$ cells/ml) (Table 4). The low populated protozoa will increasing populated of bacteria and than increasing rumen degradable nutrients[24].

Effect on Amount Protozoa and Rumen Fermentation

Table 4 present amount protozoa and rumen fermentation characteristic. As for amount protozoa, supplementation of 0.150% multivitamins-minerals (R_2) increasing amount populations and 60% higher ($P<0.05$) than R_0 but not significantly than R_1 dan R_3. Ruminal pH values were found in a range of 6.94 – 7.34 which were significantly different among treatment. The supplementation of R_3 resulted in highest pH, while the supplementation at R_0, R_1 and R_2 were similar among treatment. The supplementation at R_1 and R_2 also similarly with at R_3. Ruminat pH rumen fluid in this study there are in the normally range pH like as reported by Owen and Goetsch[20] (except at R_3) are 5.5-7.2 and supplementation of multivitamins-mineran can as buffer for to prevent reduce pH as effect from increase bacteria population. Furthermore, normally ruminal animals depend on cellulolytic bacteriato digest cellulose, but these bacteria cannot resist the low ruminal pH and an increase in pH gradient leads to anion toxicity[25]. In addition, most ruminal bacteria prefer pH near neutrality for growth although some species (e.g., *Streptococcus bovis* and *Prevotella ruminicola*) can growth in pH 5 to 6 ranges.

The concentration of ruminal ammonia-N (NH_3-N) were significantly higher ($P<0.05$) in the R_3 than in R_0, but not significantly compared with R_1 and R_2. The supplementation of 0.075% (R_1) and 0.150% (R_2) multivitamins-minerals also result high concentration NH_3-N but not significantly ($P>0.05$) compare with R_0 (Table 4). The higher NH_3-N concentration associated with high supplementation of multivitamins-minerals may have been due to increasing effectivity used N component from feeds by rumen microbes. Zinc on multivitamins-minerals have been increasing microbes enzyme activities so that degrable protein process to peptide, olygopeptide, amino acids and ending to ammonia can produce with well[1]. Furthermore, higher NH_3-N concentration associated with high organic matter degradable on rumen may have been due to the continuous supply of new substrates from soluble fractions especially N-component[5].

Table 4. Influence of Multivitamins-Minerals Supplementation on amount protozoa and Rumen Fermentation Characteristic in Bali Cattle

Item	Treatment[1]				SEM[3]
	R_0	R_1	R_2	R_3	
Amount Protozoa (x 10^5 cells/ml)	3.88[a2]	5.20[ab]	6.20[b]	5.80[ab]	0.51
Ruminal pH	6.94[a]	6.95[a]	7.23[ab]	7.34[b]	0.09
NH3-N (mM)	5.33[a]	7.13[ab]	7.89[ab]	8.98[b]	0.66
Total VFA (mM)	114.80[a]	117.09[ab]	120.08[b]	117.24[ab]	0.89
Partial VFA					
Acetate Acid (mM)	73.10[b]	72.90[ab]	72.24[a]	73.05[ab]	0.19
Propionate Acid (mM)	22.00[a]	26.70[abc]	29.40[c]	22.60[ab]	1.33
Butirate Acid (mM)	19.69[a]	17.49[a]	18.44[a]	21.58[a]	1.14
Concentration of Methane (mM)	40.90[ab]	38.52[ab]	37.99[a]	41.67[b]	0.83

Note:1) R0 = Ration without multivitamins-minerals supplementation, R1 = Ration with 0.075% multivitamins-minerals supplementation, R2 = Ration with 0.150% multivitamins-minerals supplementation, and R3 = Ration with 0.225% multivitamins-minerals supplementation, 2) The same letter in same row is not significantly difference (P>0.05), 3) SEM = Standard Error of the Treatment Means.

Total and partial VFA concentration were significantly (P<0.05) by supplementation of multivitamins-minerals. Concentration of totally VFA and propionate acids in Bali cattle fed R_2 were significantly higher (P<0.05) than those fed without supplementation of multivitamins-minerals (R_0). The higher VFA concentration associated with high organic matter degradable on rumen (Table 3), protozoa populated (Table 4) and estimation bacteria populated (shown by high microbial protein synthesis, at Table 5). The increasing rumen microbes populated (bacteria and protozoa) as effect the supplementation of multivitamins-minerals have been increasing carbohydrate fermentation to produce VFA. Furthermore, the higher propionate acids concentration on R_2 as effect of high organic matter content with low crude fiber content on ration given (Table 2). The higher total VFA and propionate acids concentration in this study suggested by Hermawan[10] were reported supplementation 0.05% ammonium sulfate and 0.03% *pignox* have been increasing totally VFA and propionate acids proportion on rumen.

The methane gas concentration on rumen fluid were significantly (P<0.05) by supplementation of multivitamins-minerals on ration based on urea ammoniated rice straw. Concentration of methane gas production in Bali cattle fed R_3 were significantly highest than the others treatment, while given fed R_2 result lowest methane gas production (Table 4). This case may be happened as given fed R_3 in Bali cattle to result minerals concentration on rumen highest so that negative responds for growth and rumen microbes activities. Furthermore, given fed R_3 may be also to result run of secondary fermentation process so more reduction H^2 molecule which used by *Methanobacterium ruminantium* and *Methanobacterium mobilis* to produce methane[11,]. Moreover, the lower methane gas concentration on rumen fluid at R_1 and R_2 are surprising, while show the optimizing bio process on rumen and reduced acidosis risk in Bali cattle. Furthermore, low methane production is surprising because reduced global warming risk and can positive for animal, farmer and environment[9].

Effect on Microbial Protein Supply

As shown in Table 5, the allantoin excretion in urine and efficiency microbial protein synthesis (E_{MPS}) in the rumen were not significantly (P>0.05) in all treatment with range 51.23 – 55.76 mmol/d and 107.17 – 107.74 g/1000g DOMR, while the allantoin absorbed and microbial protein synthesis have been increased by suplementation of 0.150% - 0.225% multivitamins-minerals on ration.

The higher allantoin absorbed and microbial protein supply in Bali cattle fed R_2 and R_3 may be due to synchronization of available fermentable energy and degradable nitrogen in rumen and also supply and availability trace mineral and vitamins as effect of supplementation multivitamin-minerals. Karsli and Russell[14] reported in addition to N and carbohydrate supply, microbial yield is affected by concentration of trace minerals and vitamin. In addition, dietary sulfur concentration has been found to effect microbial growth.

The amount of sulfur required by rumen microbes for synthesis of methionine and cysteine range from 0.11 to 0.20% of the total diet, depending on the status of the cattle. Limited intake of sulfur may restrict microbial protein synthesis when large amounts of NPN are fed to ruminal animals, such as urea or urea were fixation in product urea ammoniated rice straw.

Table 5. Influence of Multivitamins-Minerals Supplementation on Microbial Protein Supply in Bali Cattle

Items	Treatments[1]				SEM[3]
	R_0	R_1	R_2	R_3	
Allantoin excretion (mmol/d)	51.23[a2]	55.13[a]	55.52[a]	55.76[a]	1.34
Allantoin Absorbed (mmol/d)	44.76[a]	48.67[ab]	49.45[b]	49.35[b]	1.19
Microbial Protein Synthesis (g/d)	197.83[a]	213.57[ab]	222.83[b]	222.24[b]	5.43
E_{MPS} (g/1000 g DOMR)	107.17[a]	107.36[a]	107.74[a]	107.42[a]	4.96

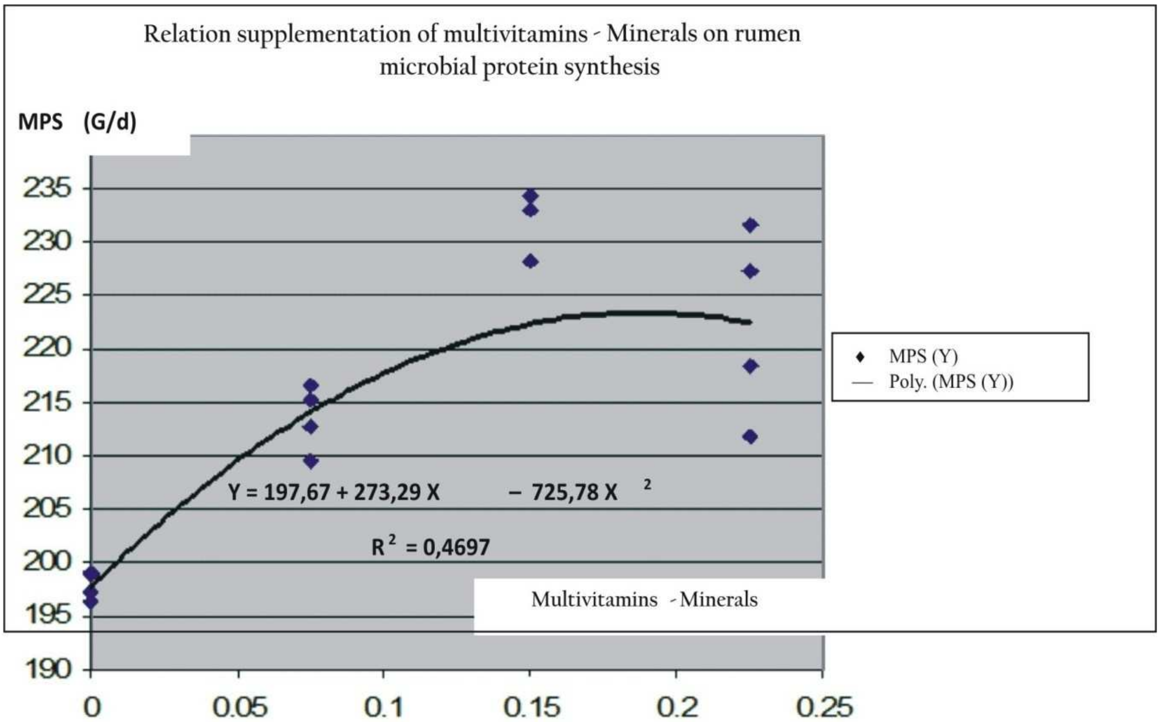
Note:1) R0 = Ration without multivitamins-minerals supplementation, R1 = Ration with 0.075% multivitamins-minerals supplementation, R2 = Ration with 0.150% multivitamins-minerals supplementation, and R3 = Ration with 0.225% multivitamins-minerals supplementation, 2) The same letter in same row is not significantly difference (P>0.05), 3) SEM = Standard Error of the Treatment Means.

Similar of the Allantoin excretion and efficiency protein microbial synthesis (E_{MPS}) of Bali cattle fed ratio based on urea ammoniated rice straw were 51.23 – 55.76 mmol/day and 107.17 – 107.74 g/1000g DOMR shown Bali cattle can be adaptation of environment as well. Moreover, that are may be as effect of increasing populated of protozoa in Bali cattle fed ration with supplementation of multivitamins-mineral especially R_2 (Table 4). High populated protozoa on rumen can take advantages and disadvantages. Protozoa on rumen can increase protein degradable, supply ammonia nitrogen (NH_3-N) on rumen and reduce acidosis risk, in spite of high populated of protozoa also can decrease the number of bacteria and fungi in the rumen liquor as effect protozoa is a predator of bacteria. Bacteria are sources of nitrogen/protein of protozoa. So protein microbial synthesis can be decrease of high populated protozoa and efficiency microbial protein synthesis on digestible organic matter apparently fermented in the rumen can be reduced.

Generally, efficiency microbial protein synthesis (E_{MPS}) in the rumen of Bali cattle given ration based on urea ammoniated rice straw with supplementation of multivitamins-minerals ere enough (107.36-107.42 g PMS/1000g DOMR). This is surprising because Bali cattle were supplemented of multivitamins-minerals on ration based on urea ammoniated rice straw have a much better Allantoin excretion from dairy cattle fed cottonseed meal at 0.5 kg/head/day and urea-treated rice straw was offered *ad lib.* with supplementation of corn meal and cassava chip as energy sources and with vary levels were result 28.1 – 45.8 mmol/d[16], in spite of lower than Allantoin excretion of crossbreed (Brahman Vs Local) given urea treated rice straw with supplemented 1-3% per metabolic body weight ($BW^{0.75}$) concentrate which result 130.7 – 244.6 mmol/d[28].

The E_{MPS} of Bali cattle given ration based on urea ammoniated rice straw with supplementation of multivitamins-minerals was 107.17 – 107.74 g MP/1000g DOMR equal with 69.51 – 69.97 g MP/1000g DOM or 17.27 – 17.78 g N/kg DOMR were there in range values E_{MPS} fattening cattle reported Karsli and Russell[14,15] were 70–237g MPS/1000g DOMR. This is surprising because ration based on urea ammoniated rice straw have a much better E_{MPS} from crossbreed cattle (Brahman Vs Local) were given fed various of energy source and level supplementation which calculate 4.3 – 10.7 g N/kg DOMR[16]

Picture 1.



Relation supplementation of multivitamins-minerals on the ration based on urea ammoniated rice straw with rumen microbial protein synthesis

Generally, relation supplementation of multivitamins-minerals with rumen microbial protein synthesis in Bali cattle given ration based on urea ammoniated rice straw following regression formula: Y = 197.67 + 273.29 X – 725.78 X^2, where R^2 = 0.4697 (Picture 1), where Y = rumen microbial synthesis (g/d), and X = supplementation of multivitamins-minerals on ration. Based on that regression analyses known that suplementation of multi vitamins-minerals of 0.188% coused maximum rumen microbial protein synthesis of 223.39 gram/day or maximum increased 12.92%.

CONCLUSION

Supplementation of multivitamins-minerals on ration based on ammoniated rice straw can increasing maximum microbial protein supply as 223.39 g PMS/day (increase 12.92.%) with optimum supplementation are 0.188%.

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