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The application of total mixed ration with iso protein and different TDN levels on the productivity of Simmental crossbred cattle

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Abstract. The objective of research was to know the levels of digestibility and fermentability between breeders feed and iso-protein-based feed. A randomized Complete Design with 5 treatments and 4 replications based in the iso-protein with different levels of Total Digest Nutrient (TDN) was employed. Research on amber hay and concentrate combined into "Complete Feed" was conducted. The treatment with T0 = Complete feed (6% CP+ 60% TDN), T1 = Complete (12% CP+ 60% TDN), T2 = Complete feed (12% CP+63% TDN), T3 = Complete feed (12% CP+ 66% TDN) and T4 = Complete feed ((12% CP+ 69% TDN) was given. The parameters observed were dry matter digestibility (DMD), organic matter digestibility (OMD), volatile fatty acid (VFA), NH₃, dry matter intake, CP intake, TDN intake, daily weight gain (DWG), and feed efficiency. The result of complete feed application on Simmental Crossbred Intake of DM T0 and T2 was significantly different, but the CP intake and DWG was not significantly different. TDN intake, conversion, and feed efficiency of feed T0 to all treatments were significantly different (P <0.05). Feeding is recommended using CP 12% and TDN 63% (T2). The results showed that *in vitro* feed analysis was not significantly different (P > 0,05%) in terms of DMD, OMD, NH₃ and VFA values.

1. Introduction

Ruminants require feed for both life and production. The availability of feed ingredients does not always exist at one raising period. The dry season is the season where the availability of forages is reduced. Provision of quality feed can increase livestock productivity [1], availability of quality feed is not always found during the raising process. Agricultural waste can be used as feed alternatives as the availability of forages decreases. Processing needs to be done to improve the quality of agricultural waste such as corn straw. Ammoniation is one way to improve the quality of feed ingredients with low quality. Ammoniation is the addition of urea to straw that can improve digestibility and nitrogen feed ingredients. Ammonium feeding of corn straw increased the intake of dry matter. Single ammoniac straw donation has not been able to meet the physiological needs of livestock for all nutrients, thus to produce the productivity of ruminant livestock that optimally provides ammoniated straw should be combined with concentrate feed. The straw with 4% ammonia and 70% moisture content yields the highest digestibility when it is compared with 2% and 6% ammonia levels with 30%, 50% and 90% water content [2].

Complete-feed is a complete ration prepared to meet the needs of livestock that contain sources of coarse feed and concentrate feed. Complete feed is a feed with a combination of green, concentrate and nutritional supplement of livestock [3]. Complete feeding improves the ability of rumen microbes to utilize crude fiber [4]. The preparation of the complete-feed is highly prospective because of the unstable forage continuity, especially the dry season. Feed quality is another factor to improve the performance of livestock in addition to quantity in order to improve the performance of cattle



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slaughtered. The productivity of ruminant livestock depends on the amount and activity of microbes, protozoa and fungi present in rumen [5] [6]. Livestock ruminants 60% of protein sources are contributed from rumen microbes. Feed with a content of 12% CP may increase rumen fermentation and rumen microbial diversity [7]. NH₃ and VFA are exogenous fermentation products of protein from feed ingredients with the help of rumen microbes [8]. The NH₃ concentration of rumen fluid ranges from 5 - 8 mg /100 ml. The objective of this present research is to know the level of digestibility and fermentability in vitro complete feed and the application to Simental crossbreed cattle. The objective of research was to know the levels of digestibility and fermentability between breeders feed and iso-protein-based feed.

2. Materials and Methods

2.1. Experiment 1, Feeding of total mixed ration to Friesian Holstein (FH) cross grade cattle

Experiment 1 was conducted to evaluate the effect of TMR of iso crude protein 12% with different level of energy (TDN) on the performance of FH cross grade cattle. Twenty male of the animals with initial body weight of 250±33.06 kg were used in this experiment, and were arranged into 5 treatments T0, T1, T2, T3, and T4, and 4 replications. All of the experimental cattle were fed 100 days, two times a day at 07.00 AM and 03.00 PM. Data collected such as: dry matter intake (DMI), crude protein intake (CPI), body weight gain (BWG), and feed conversion ratio (FCR). Completely randomized design (CRD) were used in this experiment, data collected were analyzed using analysis of variance (Anova), and Duncan's multiple range test (DMRT) were used to test differences among treatments [9].

Table 1 shows the experiment of total mixed ration treatment of iso-protein and different level of energy. Treatments using T0 = feed of crude protein (6% CP, and 60% TDN), T1 = Complete Feed (12%CP and 60%TDN), T2 = Complete Feed (12% CP and 63% TDN), T3 = Complete Feed (12% CP and 66% TDN), and T4 = Complete Feed (12% CP and 69% TDN) were made. Feedstuffs and TMR were chemically analyzed according of the procedures of AOAC.

Table 1. Composition of iso-protein-based ration 12%

No	Feed ingredients	T0	T1	T2	T3	T4
		%				
1	Palm cake	8	8	8	9	13
2	Yellow corn	8	8	9	10	14
3	Tou fu dregs	15	20	20	25	24
4	Bran	15	15	11	8	6
5	Candied bean meal	10	14	14	15	12
6	Coffee skin	25	23	20	13	7
7	Coconut oil	0.5	0.5	0.5	0.5	1
8	Coconut meal	5	5	6	8	11
9	CaCO ₃	0.5	0.5	0.5	0.5	0.5
10	Salt	0.5	0.5	0.5	0.7	0.2
11	molases	5	5	10	10	11
12	Urea	0.5	0.5	0.5	0.3	0.3
		100.0	100.0	100.0	100.0	100.0
1	TDN	60	60.64	63.01	65.76	68.88
2	Potein	6	12.26	12.29	12.12	12.21

2.2. Experiment 2, Digestibility and fermentability of TMR

Experiment 2 was aimed to evaluate the digestibility of TMR, and the fermentability in vitro of TMR. Data collected such as: dry matter digestibility, organic matter digestibility, rumen NH₃ concentration, and total VFA's concentration in the rumen in vitro. Digestibility of DM and OM determination were based on the procedure of Tilley and Terry, and for NH₃ and as well [10]. Data collected were analyzed using analysis of variance (Anova), and Duncan's multiple range test (DMRT) were used to test differences among treatments.

3. Results and Discussion

3.1. Complete Feed Application on Livestock

The research on complete feed test with different energy levels on daily weight gain, dry matter ingredient (DM), feed conversion and feed efficiency in Simmental cross breed cattle is presented in Table 2.

Table 2. Results of complete feed application on Simental Crossbreed cattle

Parameters	Treatments				
	T0	T1	T2	T3	T4
DM Intake (kg)	12.85 ^a	8.7 ^{ab}	6.99 ^b	8.58 ^{ab}	8.07 ^{ab}
CP Intake (kg)	1.12	0.92	0.83	1.00	0.85
TDN Intake (kg)	8.44 ^a	5.53 ^b	4.62 ^b	5.36 ^b	5.20 ^b
DWG (kg)	0.54	1.39	1.3	1.51	1.04
Feed Conversion	23.85 ^a	6.77 ^b	5.77 ^b	6.87 ^b	12.16 ^{ab}
Feed Efficiency (%)	11.87 ^b	24.12 ^a	24.92 ^a	24.48 ^a	19.98 ^{ab}

Description: Different superscripts on the same line show a marked difference ($P < 0.05$).

^{abc}Means in the same row without common letter are different at $P < 0.05$

DM intake was significantly different ($P < 0.05$) between the control and T2 the treatment (CP12% and TDN 63%). Dry matter intake of the control is higher, it is related to the quality of feed consumed. The high consumption of high TDN cannot be utilized by the livestock to increase DWG if it is seen from low value of feed efficiency. Low-quality feeding results in high consumption, as livestock tends to continue to eat until nutritional needs are met [10]. Providing ammoniated corn straw without concentrated feed supplementation has not been able to increase livestock productivity, although the consumption is high but if the efficiency is low and the conversion is high, it will not provide relatively low DWG.

The use of ammoniated feed was able to provide rumen bacteria efficiency in utilizing wheat straw [11]. Treatment of complete feed ration resulted in body weight gain between 1.04 to 1.51 kg/head/day. It higher than the weight gain achieved by the control treatment (breeder) which only reached 0.54 kg/head/day. The added weight gain is a manifestation, among others, from the consumption of dry matter, the consumption of organic matter, and its digestibility because it quantitatively and qualitatively reflects the rations consumed by these animals. In addition, the total protein supply derived from the rumen microbial protein and the rumen by-pass protein also contributes significantly to support the weight gain according to its genetic capability. The results of in vitro digestibility and fermentability research indicate that microbial protein synthesis is expected to be maximal. VFA and NH₃ rumen is available in sufficient quantities. Feed with a content of 12% CP may increase rumen fermentation and rumen microbial diversity [7]. The availability of energy needed to support the livestock metabolism process to become sufficient. The average per body weight per head keeps increasing. The result of feed conversion rate (feed conversion ratio), the amount of feed dry weight consumed (kg) needed for each body weight increase (kg). It shows good results because the feed conversion rate in feed complete ration proved to be lower with control rations. The lower feed conversion rate states that the amount of feed used to form 1 (one) kg body weight is also less. It means that the use of the feed is more efficient. The feed conversion rate on all feed complete feeds ranged between 5.77 to 12.16, while in the control rations (breeders), the feed conversion rate is 23.85. It is the complete feed fed treatment, it forms 1 kg of body weight required much less more ration. Meanwhile, among the complete feed treatment, the lowest or best feed conversion rate (5.77) with weight gain of 1.30 kg/head/day was in complete feed rations with 12% iso-protein and 63% TDN content. The relatively similar feed conversion rate (6.87), but the higher added body weight (1.51 kg.head⁻¹.day⁻¹) is the treatment with 12% CP and 66% TDN ration. Low efficiency in livestock is due to low feed protein composition (ranging 60.6 g / kg DM), high NDF content (670.6 g / kg DM [72]), with low energy efficiency due to structural carbohydrate content. It is high with low levels of digestibility and degradability in the rumen. The breeder feed does not undergo ammoniation, this condition leads to low livestock feed efficiency. The complete feed increases the efficiency of cattle feed [13]. The ability of bacteria to degrade feed is influenced by the

number of microbes per cm³, age, feed composition, rumen conditions [14], especially the energy and feed protein levels [7].

3.2. Digestibility and Fermentability

The research results of the complete feed test in vitro with different TDN levels on dry matter digestibility, organic matter, VFA and NH₃ are presented in Table 3. The results showed that all treatments were not significantly different ($P > 0.05$) to DMD, OMD, VFA, and NH₃. DMD in all complete feed treatments resulted in higher dry matter digestibility compared to the control group, although among complete feed rations, relatively equal digestibility values were produced. Similarly, the experimental results on OMD showed the same pattern, while the digestibility coefficient of organic matter in all ration treatments resulted in higher digestibility than the dry matter digestibility. It is in line with the expectation that the higher TDN content also reflects better DMD and OMD. However, the energy content of 63% of TDN (T2) has been shown to produce relatively better dry matter digestibility values and organic matter compared with other rations.

Table 3. Research Results of Digestibility and Fermentability of Iso-protein Complete Feed with Different Energy Levels In Vitro

Parameters	Treatments				
	T0	T1	T2	T3	T4
DMD (%)	49.00	62.33	68.96	64.24	67.08
OMD (%)	54.67	67.73	72.71	68.10	70.03
VFA (mM)	136.67	146.67	180.00	156.67	163.33
NH ₃ (mM)	3.27	3.68	3.82	3.55	3.72

Feed with increased TDN levels may affect OMD [15]. The study of Samanta et al (2003) showed that a complete feed with different protein sources did not have a real effect [16]. Livestock absorb nutritional nutrients feed in two ways, namely: 1) enzyme degradation feed on the rumen by removing various monomer sugar, amino acids, glycerol and fatty acids, and fermentation of compounds with the aid of rumen microbes [17]. Although no significant differences exist in DMD, OMD, VFA and NH₃, degradation and fermentation with different feed compositions can cause different feed efficiencies [7]. Livestock ruminants with higher digestibility coefficient of organic matter can increase VFA rumen which is a source of energy for livestock. The availability of VFA in the rumen is a leading indicator of ration ability in supporting the rumen microbial protein biosynthesis, which is the primary source of total protein supply providers for ruminants. Ruminant feed with CP level of 11.17%, 12.06%, and 13.40% was not significantly different, while feed with CP 14.36% increased production of VFA and NH₃ [17]. The diversity and number of bacteria greatly affect digestibility, production of NH₃ and VFA [6]. The higher digestibility of organic matter, the higher the synthesis of microbial proteins will be, where each kilogram of organic matter can be digested and produce N-microbial.

4. Conclusion

The application of complete feed shows the efficient use of feed for DWG. Complete feeds provide the best conversion and feed efficiency. It seen from low intake levels of DM, CP and TDN. Giving complete feed with 12% iso-protein and 63% TDN is very efficient, and low feed conversion value is recommended for Simental Crossbreed cattle. Animal fee with complete feed treatment in vitro DMD, OMD, NH₃ and VFA levels are the same.

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