Nutrient Disgestibility of Preweaning Pasundan Calves Fed Flushing Diets under Extensive Grazing

By Dede Kardaya

Research Article

Nutrient Digestibility of Preweaning Pasundan Calves Fed Flushing Diets under Extensive Grazing

DEDE KARDAYA*, ELIS DIHANSIH, DEDEN SUDRAJAT, DEWI WAHYUNI

Universitas Djuanda, Indonesia.

Abstract | In an extensive rearing system, immediately after birth, the calf follows the mother to graze on pasture. This condition certainly affects nutrient digestibility because the digestive system is not yet fully developed. The study aims to reveal nutrient digestibility of preweaning calves fed flushing diets under extensive grazing. The study used a completely randomized factorial design with two factors and five replicates. The first factor is gender and the second one is diet treatment. The total number of calves used in this study was 30, consisting of 15 males and 15 female preweaning Pasundan calves. The dietary treatment included: (1) calves are allowed to graze without feeding flushing diet, (2) calves are allowed to graze and fed a flushing diet without urea-impregnated zeolite (flushing-1), (3) calves are allowed to graze and fed a flushing diets with urea-impregnated zeolite inclusion (flushing-2). The measured variables consisted of feed intake and apparent digestibility of nutrients. The collected data were analyzed by a general linear model univariate analysis. The results showed that compared to the control diet, supplementation of flushing diets increased ($P<0.05$) dry matter digestibility up to 29.01% (53.89 ± 4.85% in grazing calves vs. 80.94 ± 1.65% in flushing-1 calves or 82.90 ± 1.47% in flushing-2 calves), crude protein digestibility up to 5.71% (86.17 ± 2.91% in grazing calves vs. 90.61 ± 1.65% in flushing-1 calves or 91.88 ± 0.79% in flushing-2 calves), ether extract digestibility up to 12.12% (80.06 ± 7.39% in grazing calves vs. 92.18 ± 1.57% in flushing-1 calves or 90.09 ± 1.20% in flushing-2 calves), neutral detergent fiber up to 28.81% (54.58 ± 4.01% in grazing calves vs. 81.13 ± 3.41% in flushing-1 calves or 83.39 ± 1.75% in flushing-2 calves), acid detergent fiber by up to 24.27% (54.23 ± 4.69% in grazing calves vs. 72.41 ± 6.78% in flushing-1 calves or 78.50 ± 3.49% in flushing-2 calves), and cellulose by up to 22.79% (61.01 ± 5.15% in grazing calves vs. 82.03 ± 6.04% in flushing-1 calves or 83.80 ± 1.92% in flushing-2 calves). In conclusion, supplementing flushing diet to preweaning Pasundan calves under extensive grazing improved most nutrient digestibility parameters (dry matter, crude protein, ether extract, and fiber).

Keywords | Cellulose, Crude protein, Calves, Flushing, Urea-impregnated zeolite

Received | September 12, 2020; **Accepted** | November 27, 2020; **Published** | December 01, 2020
***Correspondence** | Dede Kardaya, Universitas Djuanda, Indonesia; **Email:** dede.kardaya@unida.ac.id
Citation | Kardaya D, Dihansih E, Sudrajat D, Wahyuni D (2021). Nutrient digestibility of preweaning pasundan calves fed flushing diets under extensive grazing. J. Anim. Health Prod. 9(1): 52-57.
DOI | http://dx.doi.org/10.17582/journal.jahp/2021/9.1.52.57
ISSN | 2308-2801

INTRODUCTION

Currently, the development pattern of beef cattle breeding in Indonesia is still oriented to the pattern of community or family farms where the livestock raising system is carried out extensively or semi-intensively. Extensive maintenance is carried out by leaving the cattle in the pasture all day and night for a certain period without being shed. Semi-intensive maintenance is carried out by herding livestock to a place where there is a lot of grass, then fastening it with a long rope with a radius of 20-30 m from morning to evening. Towards evening, around 05.30 PM, the farmer then drives his cattle back to a certain place, a kind of paddock, which is surrounded by a bamboo fence to ensure that his cattle keep inside the bamboo fence. Cattle control activities in semi-intensive care are carried out throughout the day because the livestock are grazed by one or two herders, depending on the number of the cattle.

Neither the extensive nor semi-intensive rearing systems are supportive of the development of the pre weaned new born calves. The preweaning growth is a critical period because for the first time a calf enters an open environment where everything is out of control. The low quality of field grass in tropical areas worsen the livestock performances grazed extensively. However, in the extensive grazing systems, the utilization of low-quality feed, mainly from crop residues as well as agricultural by-products and other nonconventional feedstuffs is a common practice (Agus and Widi, 2018).

In a cow-calf raising system that is grazed extensively, the preweaning calf only gets solid feed from the forage available in grazing areas, such as field grass, rice straw, or other agricultural wastes. All those feeds are almost undigested by the pre-weaned calves because of their rumen system not well developed yet. Maskaľová and Vajda (2015) described that fibrous feed had lower fiber digestibility because its lignin encrusted the fiber. Labussiere et al. (2009) described fibrous feed decreased dry matter digestibility. de Assis Lage et al. (2019) who fed the preweaning heifers with total solid diets (92% concentrates and 8% hay) resulted in higher digestibility of organic matter, crude protein, and fat. To improve the nutrient digestibility of low-quality feed is to reduce the particle size of the feed as recommended by (Ghassemi Nejad et al., 2012) that the small particle size of feed increased the surface area for microbial enzyme to access the feed particles, thus improved the nutrient digestibility.

However, due to the low quality of forage in the tropics (Agus and Widi, 2018), reducing the particle size alone will not be sufficient to meet the nutrient needs of pre-weaned calves during the transition period. The average crude protein content of field grass obtained from grasslands in the coastal areas of West Java is 9.74%. In fact, rumen microbial life requires feed containing at least 1.28% nitrogen or equivalent to 8% crude protein (Van Soest, 1994) and needs greater than 11% crude protein to support the optimal growth (Pathak, 2008). Thus, the crude protein content of field grass is only sufficient to meet the needs of rumen microbes. Therefore, to improve digestibility and fulfil nutrient requirements in pre-weaned calves that are herded extensively with their cows, a concentrate supplement is needed. Supplementation of the small particle size of concentrate as a flushing diet is expected to improve digestibility and fulfil nutrients requirement in the preweaning calves grazed extensively. The study aims to explore the nutrient digestibility of preweaning calves fed flushing diets under extensive grazing.

MATERIALS AND METHODS

ANIMALS AND EXPERIMENTAL DESIGN

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. The study used 30 preweaning Pasundan calves of 3 months consisting of 15 males and 15 females that were extensively grazed. The initial average body weight was 39.44 ± 13.57 kg for male calves and 37.167 ± 7.78 kg for female calves. The study used a completely randomized factorial design with two factors and five replicates. The first factor is gender and the second one is diet treatment. Five of each male or female calf was randomly selected and allocated to the following three treatments: (1) calves are allowed to graze without feeding flushing diet, (2) calves are allowed to graze and fed a flushing diet without urea-impregnated zeolite (flushing-1), (3) calves are allowed to graze and fed a flushing diets with urea impregnated zeolite inclusion (flushing-2). The measured variables consisted of feed intake and apparent digestibility of nutrients.

Flushing diets and drinking water were provided before and after the calves were grazed. Both flushing diets had similar protein and energy contents (Table 1). The urea-impregnated zeolite was formulated based on (Kardaya et al., 2018). Either flushing-1 or flushing-2 diet was provided in a coarse mash form. The adaptation period for flushing diet was carried out for 7 days and the feeding trial period was carried out for 7 days. Flushing diet was fed twice a day, i.e. in the morning at 0600–0800h as much as 500 grams before the calves were grazed and in the afternoon at 1700-1900h as much as 500 grams after the calves were driven back into the shed without rooftop from the grazing land. Every morning at 0800 h, the calves were driven out of the shed without rooftop and then led to pasture or areas overgrown with natural grass for grazing. Drinking water for the calves during grazing was available in the ponds around grazing areas. In the afternoon, the calves were driven back into the shed without a rooftop.

MEASUREMENTS AND DATA COLLECTION

The measured variables consist of feed intake and apparent nutrient digestibility. Flushing diet intake was calculated by subtracting the refusals from the offered. Apparent nutrient digestibility was determined by internal (lignin) indicator and calculated based on the formula of Zewdie (2019) as follows:

$$\textit{Digestion coefficient of nutrient} = 100 - 100 \times (\%\ \textit{Indicator in feed} \times \%\ \textit{Nutrient in feces}) \times (\%\ \textit{Indicator in feces} \times \%\ \textit{Nutrient in feed})^{-1}$$

The refusals of flushing diets from each calf were weighed after the feeding time, put in a polyethylene bag, and air-dried on the next day. Field grass samples were collected randomly from 30 points (Cayley and Bird, 1996) where 30 calves grazed on pasture. The grass sample was taken as much as 100 grams from each point where the grass was taken so that the total sample of natural grass collected was 3 kg and air-dried. Fecal samples from each calf were collected from the pasture every day between 1100 and 1600 h. Daily fecal samples that had been collected were put into polyethylene bags that had been numbered according to the number of each calf and then air-dried on the next day. The feed offer and refusal flushing diets, field grass, and fecal samples were then ground to pass a 1 mm screen mill for proximate analysis. The proximate analysis was carried out according to (AOAC, 2016) procedures. Neutral detergent fiber (NDF), Acid detergent fiber (ADF), cellulose, and lignin contents were analyzed according to (Van Soest et al. 1991). Hemicellulose was calculated by subtracting ADF from NDF.

Table 1: Nutrient composition of flushing diets.

Compositions	Diets (DM basis, %)		
	Native grass	Flushing 1	Flushing 2
Ingredients, % DM basis			
Rice bran		36	33
Cassava meal		-	12
Palm kernel meal		23	28
Coconut meal		30	23
Soybean meal		8	-
Urea-impregnated zeolite		-	1
Mineral mix†		3	3
Total		100	100
Nutrient composition, % DM basis			
DM††	33.02	89.84	89.41
Crude protein	9.74	17.71	17.69
Ether extract	1.43	5	3.15
Crude fiber	21.76	13.33	12.48
Nitrogen free extract	56.46	53.2	56.16
Ash	10.61	10.76	10.52
NDF††	64.96	66.49	66.16
ADF††	49.69	35.06	37.42
Cellulose	24.13	20.55	21.32
Hemicellulose	15.27	31.43	28.74
Lignin	10.98	10.82	11.48

†Composition (per kg): Vitamin A 3,300 IU, Vitamin D 360 IU, Vitamin E 100 IU, Mg 100 mg, Co 100 mg, P 340 mg, Ca 720 mg, K 650 mg, Na 90 mg, S 120 mg, Fe 7 mg, Mn 5 mg, Zn 4 mg, Cu 1 mg, I 60 mcg, Se 40 mcg, organic chromium 0.3 mg. ††DM, Dry Matter; NDF, Neutral Detergent Fiber; ADF, Acid Detergent Fiber.

Statistical analysis

All variables (dry matter intake of the flushing diets, apparent digestibility of nutrients,) were analyzed by General Linear Model Univariate Analysis (IBM SPSS Statistics 24, 2018). All dietary treatments and calf gender (male and female) were considered as fixed factors. All dietary treatments and gender main effects were subject to the least significant difference (LSD) test option. The result of each variable analysed was considered as statistically significant if $P \leq 0.05$. The statistical model applied for analyses was:

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \varepsilon ijk$$

Where, Yijk is dependent variable; μ is the overall mean; αi is the effect of gender; βj is the effect of dietary treatment; $(\alpha\beta)ij$ is the effect of the interaction between gender and dietary treatment; εijk is the overall error term.

RESULTS AND DISCUSSION

Feed intake

Average flushing concentrates intake (dry matter basis) of the preweaning calves for 60 days ranged within 0.50±0.03 – 0.58±0.07 kg/d (Table 2). Average flushing concentrates intake in the recent study reached 1.44 % and 1.40 % BW of male and female, respectively. There was no significant difference in the concentrate intake between flushing-1 and flushing-2 diets in male and female Pasundan calves reared in a cow-calf system under extensive grazing.

Table 2: Concentrate intake (DM basis) in the grazing-preweaning calves fed the flushing concentrates.

Variables	Treatments	Male	Female	Total
Intake, (Mean ± SD, kg):				
Intake, 60 days (kg)	Flushing-1	37.41±4.49	32.18±2.07	34.80±4.29
	Flushing-2	36.33±0.60	34.39±1.78	35.36±1.62
	Average	36.87±3.07	33.29±2.16	35.08±3.17
Daily intake (kg)	Flushing-1	0.58±0.07	0.50±0.03	0.54±0.06
	Flushing-2	0.57±0.01	0.54±0.02	0.55±0.02
	Average	0.57±0.04	0.52±0.03	0.55±0.04

Various intakes of preweaning calves had been recorded by many researchers. The daily flushing concentrates intake in this study was comparable with Göncü et al. (2010) who fed a total mixed ration, i.e. 499.60±81.69 g/d, Chapman et al. (2017) for preweaning calves fed a calf starter (20% CP), i.e. 537 g/d, or with Wickramasinghe et al. (2019) who reported a calf starter intake 0.66 – 0.60 kg/d. However, either Casper et al. (2017) who fed calf starter containing 40% digestible corn or Li et al. (2019) who compared reconstituted and acidified milk resulted in lower intake (0.36–0.38 kg/d and 0.40–0.43 kg/d, respectively) than the daily flushing concentrate intake recorded in the recent study. The similarity intake between flushing-1 and flushing-2 concentrate related to its similar nutrient contents and its similar forms of both flushing concentrates as proposed by Ghassemi Nejad et al. (2012) that different forms of starter calf affected ($P < 0.05$) dry matter intake (DMI).

Apparent nutrient digestibility

Feeding treatment affected (P < 0.05) apparent dry matter digestibility (DMD). Grazing calves showed lower DMD than flushing-1 calves or flushing-2 calves (Table 3). The flushing-1 calves and flushing-2 calves showed similar DMD. Gender did not affect DMD significantly. There was no significant difference in organic matter digestibility (OMD) among feeding treatment or between gender. Feeding treatment affected (P < 0.05) crude protein digestibility (CPD). Grazing calves showed lower CPD (P < 0.05) than flushing-1 calves or flushing-2 calves. Either flushing-1 calves or flushing-2 calves showed similar CPD. Gender did not affect the CPD significantly. Feeding treatment affected (P < 0.05) fat or ether extract digestibility (EED). Grazing calves had lower EED (P < 0.05) than flushing-1 calves or flushing-2 calves. Gender affected (P < 0.05) the EED, in this case, males showed lower EED (P < 0.05) than the female calves. Feeding treatment affected (P < 0.05) neutral detergent fiber digestibility (NDFD), acid detergent fiber digestibility (ADFD), or cellulose digestibility (CELD). Grazing calves showed lower (P < 0.05) NDFD, ADFD, or CELD than flushing-1 calves or flushing-2 calves. Both flushing-1 calves and flushing-2 calves had similar NDFD, ADFD, or CELD.

Lower DMD in grazing calves was in relation to the low quality of native grass in the grazing area as generally found in tropical pasture regions. This is supported by Labussiere et al. (2009) who described fibrous feed decreased DM digestibility. In addition, preweaning calves have a low capacity to digest fiber, because its rumen development is not yet complete. Lower fiber digestibility (NDFD, ADFD, CELD) in grazing calves as shown in Table 3 confirmed the explanation above. Higher DMD in flushing-1 and flushing-2 calves reflect a higher degradability of nutrients contained in both flushing concentrates. DMD in flushing calves was comparable to the DMD reported by Casper et al. (2017), Chapman et al. (2017), or de Assis Lage et al. (2019), i.e. 86.2%, 78,9%, or 85.8 – 89.2% respectively.

The OMD similarity between grazing calves and flushing calves is still not well explained. This was unexpected because it was previously predicted that the grazing calves would have lower OMD than the flushing calves. Presumably, the grazing calves have adapted well to the condition of the grass in the grazing area so that the grazing calves are able to digest the OM as well as the flushing calves. Even if the OM content in native grass is the same as the OM in flushing concentrates, it does not warrant that the grazing calves would have similar OMD to the flushing calves because the OM compositions in native grass differ with the OM compositions in the flushing concentrates. Ghassemi Nejad et al. (2012) reported that differences in form of calf starter affected nutrients digestibility; calves fed mashed starter indicated lower OMD (78.6%) than the OMD of calves fed pelleted starter (85.0%) or texturized starter (86.6%). The OMD in this study was slightly higher than the OMD (79.80%) obtained by Chapman *et al.* (2017) who fed a calf starter (20% CP) but it was comparable with the OMD (88% – 91.1%) reported by de Assis Lage et al. (2019).

Table 3: Nutrient apparent digestibility (%, Mean ± SD) in grazing-preweaning calves.

Variables†	Diets	Male	Female	Average
DMD	Control (grass)	53.30±3.26	54.49±6.87	53.89±4.85^{a}
	Flushing-1	82.31±0.78	79.56±0.75	80.94±1.65^{b}
	Flushing-2	82.55±1.96	83.25±1.09	82.90±1.47^{b}
	Average	72.72±14.69	72.43±13.99	
OMD	Control (grass)	86.72±1.29	88.22±1.08	87.47±1.34
	Flushing-1	86.42±1.14	84.92±0.81	85.67±1.20
	Flushing-2	86.95±1.00	87.30±0.57	87.13±0.75
	Average	86.70±1.02	86.81±1.64	
CPD	Control (grass)	85.03±3.51	87.31±2.21	86.17±2.91^{a}
	Flushing-1	91.90±1.20	89.31±0.59	90.61±1.65^{b}
	Flushing-2	91.75±0.40	92.01±1.16	91.88±0.79^{b}
	Average	89.56±3.88	89.54±2.41	
EED	Control (grass)	74.02±4.78	86.10±2.12	80.06±7.39^{a}
	Flushing-1	91.47±0.64	92.89±2.07	92.18±1.57^{b}
	Flushing-2	89.71±1.16	90.47±1.36	90.09±1.20^{b}
	Average	85.07±8.68^{a}	89.82±3.39^{b}	
NDFD	Control (grass)	54.71±4.27	54.46±4.69	54.58±4.01^{a}
	Flushing-1	83.32±1.77	78.94±3.40	81.13±3.41^{b}
	Flushing-2	82.75±2.46	84.02±0.65	83.39±1.75^{b}
	Average	73.60±14.40	74.47±13.99	
ADFD	Control (grass)	53.13±4.15	55.32±5.84	54.23±4.69^{a}
	Flushing-1	77.37±4.15	67.45±6.23	72.41±6.78^{b}
	Flushing-2	76.48±2.97	80.53±3.05	78.50±3.49^{b}
	Average	68.99±12.19	67.77±11.82	
CELD	Control (grass)	62.04±5.75	59.98±5.49	61.01±5.15^{a}
	Flushing-1	86.01±1.11	78.05±6.53	82.03±6.04^{b}
	Flushing-2	82.68±2.33	84.92±0.27	83.80±1.92^{b}
	Average	76.91±11.68	74.32±11.94	

Different superscript in the same row or column, significantly different (P < 0.05). †DMD, Dry Matter Digestibility; OMD, Organic Matter Digestibility; CPD, Crude Protein Digestibility; EED, Ether Extract Digestibility; NDFD, Neutral Detergent Fiber Digestibility, ADFD, Acid Detergent Fiber Digestibility; CELD, Cellulose Digestibility.

Similar CPD between flushing-1 calves and flushing-2 calves indicate that CP contents in flushing-1 and flushing-2 concentrates have the same degradability. Lower CPD in grazing calves indicate lower crude protein availability in native grass. Crude protein digestibility in the recent study was higher than CPD (68.1– 72.6%) reported by Ghassemi Nejad et al. (2012) but lower than the crude protein digestibility reported by Casper et al. (2017), Chapman et al. (2017), or de Assis Lage et al. (2019), i.e. 85.2%, 75,0%, or 87.8 – 91.8% respectively.

Higher fat digestibility in female calves suggests that the female calves have the better fat utilization capacity than male calves. This suggestion is supported by Schäff et al. (2016) that female calves had greater capacity in fat deposition than male calves. Meanwhile, higher fat digestibility in flushing-1 calves or flushing-2 calves indicate that the fat contained in the flushing-1 diet or flushing-2 diet more digestible than fat contained in native grass. Fat digestibility in the recent study was lower than the fat digestibility (93.9 – 96.1%) reported by Chapman et al. (2017) who fed milk replacer or fat digestibility (93.1.0 – 96.4%) obtained by de Assis Lage et al. (2019) who fed total solid diets (92% concentrates and 8% hay).

Lower fiber (NDF, ADF, cellulose) digestibility in the grazing calves indicates that the fiber less availability for microbial fermentation. One explanation for this occurrence is in relation with lignin content as proposed by Maskaľová and Vajda (2015) who described that lignin encrusting the fiber, complexing with other nutrients, and resulted in lower fiber digestibility. Supplementing flushing-1 or flushing-2 concentrates improve the fiber digestibility. This improvement may associate with a greater surface area of the small particle size of the flushing concentrates. This explanation is in accordance to Ghassemi Nejad et al. (2012) who explained that the small particle size of feed increased the surface area for microbial enzyme to access the feed particles. Apparently, feed grinding not only increases the surface area of feed particle, but also may destroy lignocellulose complex that increases microbial access to digest the fiber contained in the fibrous feeds, thus increases the fiber digestibility. The NDF digestibility in both flushing calves was comparable with the in vitro NDF digestibility (83.5%) obtained by Marumo et al. (2018) who used a commercial pelleted calf meal, but it was higher than the NDF digestibility (40.5 – 58.7%) obtained by some authors (Hill et al., 2016; Casper et al., 2017; Chapman et al., 2017; de Assis Lage et al., 2019) who fed the calves with milk replacer or calf starter.

CONCLUSIONS AND RECOMMEDATIONS

Supplementing flushing diet to preweaning Pasundan calves under extensive grazing improved most nutrient digestibility parameters (dry matter, crude protein, ether extract, and fiber). It is recommended that preweaning calves under extensive grazing should be provided flushing diets to improve the nutrient digestibility.

ACKNOWLEDGEMENTS

This work was supported by the Directorate General of Research Enhancement and Development, Ministry of Research Technology and Higher Education of Republic of Indonesia (grant number: 2906/L4/PP/2019).

AUTHOR'S CONTRIBUTIONS

Dede Kardaya designed the study, executed the project, and analyzed data. Elis Dihansih assisted in the design of the study and data analyses. Deden Sudrajat designed the study and edited the draft version of the manuscript.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

REFERENCES

- Agus A, Widi TSM (2018). Current situation and future prospects for beef cattle production in Indonesia. A review. Asian Austral. J. Anim. Sci., 31: 976–983. https://doi.org/10.5713/ajas.18.0233
- AOAC (2016). Official methods of analysis. Gaithersburg, MD, USA: Association of official analytical chemists.
- de Assis Lage C, Coelho SG, Diniz-Neto H do C, Rocha-Malacco VM, Pacheco-Rodrigues JP, Sacramento JP, Machado FS, Ribeiro-Pereira LG, Tomich TR, Campos MM (2019). Relationship between feed efficiency indexes and performance, body measurements, digestibility, energy partitioning, and nitrogen partitioning in pre-weaning dairy heifers. PLoS One, 14: 1–18. https://doi.org/10.1371/journal.pone.0223368
- Casper DP, Srivastava S, Strayer B (2017). Feeding a calf starter containing highly digestible corn may improve calf growth. Transl. Anim. Sci., 1(3): 343-350. https://doi.org/10.2527/tas2017.0041
- Cayley J, Bird P (1996). Techniques for measuring pastures. National Library of Australia.
- Chapman CE, Hill TM, Elder DR, Erickson PS (2017). Nitrogen utilization, preweaning nutrient digestibility, and growth effects of Holstein dairy calves fed 2 amounts of a moderately high protein or conventional milk replacer. J. Dairy Sci., 100: 279–292. https://doi.org/10.3168/jds.2016-11886
- Ghassemi Nejad J, Torbatinejad N, Naserian AA, Kumar S, Kim JD, Song YH, Ra CS, Sung KI (2012). Effects of processing of starter diets on performance, nutrient digestibility, rumen biochemical parameters and body measurements of Brown Swiss dairy calves. Asian Austral. J. Anim. Sci., 25: 980–987. https://doi.org/10.5713/ajas.2011.11457
- Göncü S, Boğa M, Kiliç Ü, Görgülü M, Doran F (2010). Effects of feeding regime without roughage on performances and rumen development of calves during preweaning period. Tarim Bilimleri Dergisi, 16: 123–128. https://doi.

org/10.1501/Tarimbil_0000001129
- Hill TM, Quigley JD, Ii HGB, Dennis TS, Schlotterbeck RL (2016). Effect of milk replacer program on calf performance and digestion of nutrients in dairy calves to 4 months of age. J. Dairy Sci., 99: 8103–8110. https://doi.org/10.3168/jds.2016-11239
- IBM Corp (2018). IBM SPSS statistics version 24 for Windows.
- Kardaya D, Wiryawan KG, Parakkasi A, Winugroho HM (2018). Effects of three slow-release urea inclusions in rice straw-based diets on yearling Bali bull performances. South Afr. J. Anim. Sci., 48: 751–757.
- Labussiere E, Dubois S, Van Milgen J, Bertrand G, Noblet J (2009). Effect of solid feed on energy and protein utilization in milk-fed veal calves. J. Anim. Sci., 87: 1106–1119. https://doi.org/10.2527/jas.008-1318
- Li L, Qu J, Xin X, Yin S, Qu Y (2019). Comparison of reconstituted, acidified reconstituted milk or acidified fresh milk on growth performance, diarrhea rate, and hematological parameters in preweaning dairy calves. Animals, 9: 1–9. https://doi.org/10.3390/ani9100778
- Marumo JL, Nherera-Chokuda F V., Ng'Ambi JW, Muya MC (2018). Effect of replacing a commercial pelleted calf meal with lucerne leaf-meal on performance of neonatal and transitional Holstein heifer calves. Anim. Prod. Sci., 58: 834–840. https://doi.org/10.1071/AN16529
- Maskaľová I, Vajda V (2015). Digestibility of NDF and its effect on the level of rumen fermentation of carbohydrates. Acta fytotech. Zootech., 18: 110–113. https://doi.org/10.15414/afz.2015.18.04.110-113
- Pathak AK (2008). Various factors affecting microbial protein synthesis in the rumen. Vet. World, 1: 186–189.
- Schäff CT, Gruse J, Maciej J, Mielenz M, Wirthgen E, Hoeflich A, Schmicke M, Pfuhl R, Jawor P, Stefaniak T, Hammon HM (2016). Effects of feeding milk replacer ad libitum or in restricted amounts for the first five weeks of life on the growth, metabolic adaptation, and immune status of newborn calves. PLoS One, 11: 1–33. https://doi.org/10.1371/journal.pone.0168974
- Van Soest P (1994). Nutritional ecology of the ruminant. Corvallis: O and B Book Company. https://doi.org/10.7591/9781501732355
- Van Soest P., Robertson JB, Lewis B (1991). Methods for Dietary Fiber, Neutral Detergent Fiber, and Nonstarch Polysaccharides in Relation to Animal Nutrition. J. Dairy Sci., 74: 3583–3597. https://doi.org/10.3168/jds.S0022-0302(91)78551-2
- Wickramasinghe HKJP, Kramer AJ, Appuhamy JADRN (2019). Drinking water intake of newborn dairy calves and its effects on feed intake, growth performance, health status, and nutrient digestibility. J. Dairy Sci., 102: 377–387. https://doi.org/10.3168/jds.2018-15579
- Zewdie AK (2019). The different methods of measuring feed digestibility: A review. EC Nutr., 14: 68–74.

Nutrient Disgestibility of Preweaning Pasundan Calves Fed Flushing Diets under Extensive Grazing

ORIGINALITY REPORT

11%

SIMILARITY INDEX

PRIMARY SOURCES

1	f1000research.com Internet	33 words — 1%
2	worldwidescience.org Internet	32 words — 1%
3	orbi.uliege.be Internet	31 words — 1%
4	www.e-sc.org Internet	29 words — 1%
5	Shaobo Yu, Weibing Shi, Bin Yang, Ge Gao, Hongwei Chen, Lei Cao, Zhongtang Yu, Jiakun Wang. "Effects of repeated oral inoculation of artificially fed lambs with lyophilized rumen fluid on growth performance, rumen fermentation, microbial population and organ development", Animal Feed Science and Technology, 2020 Crossref	28 words — 1%
6	researchportal.northumbria.ac.uk Internet	23 words — 1%
7	"Table of Contents", The Journal of Allergy and Clinical Immunology: In Practice, 2021 Crossref	21 words — 1%

8	e-sciencecentral.org Internet	19 words — < 1%
9	ejournal.upi.edu Internet	19 words — < 1%
10	"Novel Combination of Silver Nanoparticles and Carbon Nanotubes for Plasmonic Photo Thermal Therapy in Melanoma Cancer Model", 'International Society for Phytocosmetic Sciences' Internet	18 words — < 1%
11	www.ajol.info Internet	16 words — < 1%
12	www.medsci.org Internet	16 words — < 1%
13	edepot.wur.nl Internet	15 words — < 1%
14	M.C. López, C. Fernández. "Changes in heat production by sheep of Guirra breed after increase in quantity of barley grain on the diet", Small Ruminant Research, 2013 Crossref	14 words — < 1%
15	"Abstracts of Technical Papers", Canadian Journal of Animal Science, 09/2003 Crossref	12 words — < 1%
16	bioinfopublication.org Internet	12 words — < 1%
17	"Compendium dieetproducten en voedingssupplementen", Springer Science and Business Media LLC, 2015	11 words — < 1%

Crossref

18	Tanner J. Carlisle, Samuel A. Wyffels, Steve D. Stafford, Anna R. Taylor, Megan L. Van Emon, Timothy DelCurto. "Evaluation of sustained release mineral boluses as a long-term nutrient delivery method for beef cattle", Animal Feed Science and Technology, 2021 Crossref	11 words — < 1%
19	Ephrem, Nahom, Firew Tegegne, Yeshambel Mekuriaw, and Likawent Yeheyis. "Nutrient intake, digestibility and growth performance of Washera lambs supplemented with graded levels of sweet blue lupin (Lupinus angustifolius L.) seed", Small Ruminant Research, 2015. Crossref	9 words — < 1%
20	uknowledge.uky.edu Internet	9 words — < 1%
21	Challenges and Opportunities for Agricultural Intensification of the Humid Highland Systems of Sub-Saharan Africa, 2014. Crossref	8 words — < 1%
22	Julie Føske Johnsen, Ingrid Hunter Holmøy, Ane Nødtvedt, Cecilie Marie Mejdell. "A survey of pre-weaning calf management in Norwegian dairy herds", Acta Veterinaria Scandinavica, 2021 Crossref	8 words — < 1%
23	Moeini, H., A. H. Mahdavi, A. Riasi, G. R. Ghorbani, E. Oskoueian, M. A. Khan, and M. H. Ghaffari. "Effects of physical form of starter and forage provision to young calves on blood metabolites, liver composition and intestinal morphology", Journal of Animal Physiology and Animal Nutrition, 2016. Crossref	8 words — < 1%

24 eprints.undip.ac.id
Internet
8 words — < 1%

25 ijvm.ut.ac.ir
Internet
8 words — < 1%

26 www.scilit.net
Internet
8 words — < 1%

27 www.tandfonline.com
Internet
8 words — < 1%

28 M. Mirzaei, M. Khorvash, G. R. Ghorbani, M. Kazemi-Bonchenari, A. Riasi, A. Soltani, B. Moshiri, M. H. Ghaffari. "Interactions between the physical form of starter (mashed versus textured) and corn silage provision on performance, rumen fermentation, and structural growth of Holstein calves1", Journal of Animal Science, 2016
Crossref
7 words — < 1%

29 Merkel, R.C.. "Intake, digestibility and nitrogen utilization of three tropical tree legumes", Animal Feed Science and Technology, 19991115
Crossref
7 words — < 1%

30 Hamid Ghorbani, Mehdi Kazemi-Bonchenari, Mehdi HosseinYazdi, Ehsan Mahjoubi. "Effects of various fat delivery methods in starter diet on growth performance, nutrients digestibility and blood metabolites of Holstein dairy calves", Animal Feed Science and Technology, 2020
Crossref
6 words — < 1%

31 www.scielo.br
Internet
6 words — < 1%