Open access
Vol. 21 No. 1: 35-40, April 2023
e-ISSN: 2622-3279, p-ISSN: 2657-0068
DOI: http://dx.doi.org/10.29244/jintp.21.1.35-40

JINTP
Jurnal Ilmu Nutrisi dan Teknologi Pakan
http://journal.ipb.ac.id/index.php/jurnalintp

Comparative Study of Feeding and Nutrition for Beef Cattle in Smallholder Farmers: Case Study in Regency of Malang, Pamekasan, and Tuban

A N Huda*, Kusmartono, P H Ndaru, T Susilawati, Mashudi

Corresponding email:
nurulasri@ub.ac.id,

Faculty of Animal Science, University of Brawijaya, Malang 65145, Indonesia

Submitted : December 15, 2022
Accepted : April 6, 2023

ABSTRACT

This study evaluated feeds for fattening and breeding beef cattle in smallholder farmers located in Malang, Pamekasan, and Tuban regencies. The research was conducted using two methods i.e., survey and laboratory analysis. The data survey was carried out in each area, and 30 respondents (n=30) were observed per area in classification of low to medium livestock ownership. Laboratory analysis was performed to analyse the chemical composition of the feed and to measure the total gas production. The data analysis approach used quantitative descriptive to describe the nutritional value quality of beef cattle feed with available quantitative data. The results showed variations in the nutrient content of the beef cattle feed in three different study locations in *smallholder* farmers located in Regency of Malang, Pamekasan, and Tuban while the total gas production showed a high production in the fattening cattle feeds between three study locations. Thus, it was concluded that the feed for fattening cattle had better nutrient content in terms of crude protein content and total gas production than the breeding cattle feed.

Key words: cattle feed, nutrition, gas production

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi pakan sapi potong penggemukan dan pembibitan pada peternak rakyat di Kabupaten Malang, Pamekasan dan Tuban. Penelitian dilakukan dengan dua metode, yaitu survei dan analisis laboratorium. Survei data dilakukan di masing-masing wilayah tersebut dan diambil sampel sebanyak 30 responden (n=30) per wilayah dengan klasifikasi kepemilikan ternak rendah sampai sedang. Analisis laboratorium dilakukan untuk menganalisis komposisi kimia pakan dan mengukur total produksi gas. Pendekatan analisis data yang digunakan adalah deskriptif kuantitatif, untuk menggambarkan kualitas nilai nutrien pakan sapi potong dengan data kuantitatif yang tersedia. Hasil penelitian menunjukkan variasi kandungan nutrien pakan sapi potong pada tiga lokasi penelitian, selain itu total produksi gas menunjukkan nilai yang tinggi pada pakan sapi penggemukan di tiga lokasi penelitian. Dengan demikian disimpulkan bahwa pakan sapi penggemukan memiliki kandungann nutrien yang lebih baik ditinjau dari kandungan protein kasar dan nilai total produksi gas dibandingkan dengan pakan sapi pembibitan.

Kata kunci: nutrient, pakan sapi, produksi gas

JINTP

INTRODUCTION

East Java is considered the most central province on Java Island, producing beef cattle with a total population in 2020 of 4,815,330 heads and contributing 26.67% of Indonesia's total beef cattle population (General Directorate of Livestock and Animal Health, 2021). As smallholder-owned beef cattle farming has become an essential income for their families, profitable agriculture has to be the primary goal. The feeding system is critical to support the success of beef cattle farming, as 60% - 70% of farming expenditure is spent on feed (Huda *et al.* 2020. For this reason, it is necessary that the farmers have to know what and how the feeds are offered to achieve high feed efficiency, hence improving the farming profit.

One of the problems small beef cattle farmers face in East Java is a high fluctuation in feed quantity and quality, especially during dry seasons when forages are primarily available for those that have low quality, such as energy, protein, and minerals (Rochana *et al.* 2016).

This research was conducted in three regencies, namely Pamekasan, Tuban, and Malang Regencies. These three areas have almost the same characteristics as seen from their average temperatures and humidities, namely in Pamekasan Regency, 25^{o}C and 95%; Tuban Regency, 24^{o}C and 95%; and Malang Regency, 22^{o}C and 98% (Development Planning Agency at Sub-National Level East Java 2021). The altitudes where the three regencies are located, ranging from 4 to 556 meters above sea level (Central Bureau of Statistics, 2015), may have led to differences in the evaluation of feed utilization. Therefore, this study measured the carrying capacity of those three regions by identifying available feeds and doing chemical analysis and in vitro digestibility tests (Hambakodu 2021).

METHODS

Location and Methods

This research was conducted in Regencies of Malang, Pamekasan and Tuban, through two methods: observation and laboratory analysis (Rastosari, 2017). Thirty respondents (n=30), beef cattle farmers representing each district, were involved in filling out a structured questionnaire. Respondents were classified according to cattle ownership, namely low and medium categories (Aprilia *et al.* 2018). The provisions for grouping livestock are low, with 3 to 5 heads ownership, while high ownership is more than five heads (Huda *et al.* 2020).

Laboratory analysis was carried out at the Nutrition and Animal Feed Laboratory of the Faculty of Animal Husbandry, Universitas Brawijaya, involving nutrient content to the procedure of AOAC (2005) and gas production tests according to the procedure of Blümmel *et al.* (1997).

Data Analysis

In this study, the data obtained were analysed based on the purpose of the research. The approach of data analysis was descriptive quantitative, which described the nutrient quality of beef cattle with existing quantitative data (Rastosari 2017). Researchers collected feed samples from 90 respondents from three research locations by classifying them based on the type of feed and the type of feed used (fattening and breeding).

RESULTS AND DISCUSSION

Overview of Study Location

Pamekasan, Tuban, and Malang Regency are in East Java between 111°, 0'-114°,4' East Longitude and 7°,12'-8°,48' South Latitude, and the average temperature ranges from 21–34 °C. East Java province can be divided into two major parts, namely mainland East Java and the Madura Islands. Most people in East Java have a livelihood in agriculture (46.18%), the rest work in the trade sector (18.80%), the service sector (12.78%), and the industrial sector (12.51%).

Overview of Respondents

The different characteristics of each farmer's household could influence farm's decision making, especially about the feed proportion and management. Respondents in this study had different characters based on regional origin. The Pamekasan community tends to have solid and persistent characteristics, but few groups of beef cattle farmers are still found (Huda *et al.* 2021) as most of the respondents do the beef farming as a side job. Breeding communities in Malang Regency tend to work together in groups and move forward to support each other among group members (Prafitri *et al.* 2022). The community of beef cattle breeders in Tuban has almost the same characteristics as Malang, where beef cattle business is the main livelihood of the respondents from Malang and Tuban (Huda *et al.* 2018). Overall, farmers in the medium category are still traditional in their business scale, while farmers in the high category have made innovations and better feeding management.

Evaluation of the Nutrient Content of Feed Ingredients

Evaluation of the nutrient content of feed ingredients is one step in determining the quality of feed ingredients. Proximate analysis (AOAC, 2019) was carried out to determine the content of each feed ingredient, including dry matter (DM), organic matter (OM), crude protein (CP), and crude fiber (CF). According to Bakari, *et al.* (2017) proximate analysis has benefited as an

Table 1 The results of the proximate analysis of beef cattle diet in smallholder farmers at Regencies of Malang, Pamekasan, and Tuban

Areas	Diet	DM (%)	OM* (%)	CP* (%)	CF* (%)
Malang	Fattening	53.46 ± 0.568	77.85 ± 0.498	11.72 ± 0.476	28.82 ± 0.583
	Breeding	50.75 ± 0.625	86.33 ± 0.515	8.43 ± 0.647	26.07 ± 0.563
Tuban	Fattening	47.03 ± 0.497	85.85 ± 0.486	12.58 ± 0.487	29.05 ± 0.486
	Breeding	52.41 ± 0.521	77.58 ± 0.467	8.02 ± 0.518	31.34 ± 0.532
Pamekasan	Fattening	52.19 ± 0.461	88.82 ± 0.475	10.66 ± 0.617	28.15 ± 0.493
	Breeding	51.97 ± 0.494	93.87 ± 0.518	7.60 ± 0.495	30.89 ± 0.669

*: Based on Dry Matter 100%, DM: Dry Matter, OM: Organic Matter, CP: Crude Protein, CF: Crude Fiber

assessment of the quality of feed or food ingredients, especially on the standard of food substances that should be contained therein. Table 1 showed the results of proximate analysis of forages found in the three areas which includes DM, OM, CP, and CF contents.

Based on the data in Table 1, feed for fattening cattle had higher CP than breeding cattle, while the CF content varies. Most of the respondents used concentrates or other supplementary feeds for fattening beef cattle, while only agricultural waste or fiber feed sources were used for breeding beef cattle. Agricultural waste, such as rice and corn straw, has a low nutritional content and digestibility value, so it needs treatment before being given to cattle (Mayulu *et al*. 2021). Farmers provide grass and tree leaves as a source of fiber feed only in certain months due to the season. The availability of grass fluctuates because not all farmers have sufficient land to plant grass. According to Mudavadi *et al.* (2020), feed availability fluctuations are influenced by two seasonal factors and the limited land for farmers.

Feed quality presented by the National Standardization Agency (2022) shows that concentrate feed for fattening cattle contains organic matter (OM) 84.5-86.5%, CP 10%-14%, and CF 18%-22% of 100% DM. If the quality of CP concentrates 10%-14% combined with Elephant grass (*Pennisetum purpureum*), with a CP content of 10.25% (Aprilia *et al*.2018), then the estimated CP content of the diet is 10.125%-12.125% if the ratio of forage and concentrate is 50:50. At Table 1, the most suitable CP diet content according to these standards is the fattening diet in three regions. However, if the feed source of fiber used is rice straw with a crude protein content of 4% (Mayulu *et al*. 2021), with a rice straw ratio of 50:50, then the CP content of the diet is 7%-9%.

Nutrient adequacy can be measured by comparing nutrient consumption with needs. DM intake of mature cattle ideally is 1.7% - 2% of body weight and, of course, with completed nutrient content for maintenance and productivity (Lalman & Richards, 2017; Mayulu *et al.* 2021). The requirement of crude protein intake is about 16% of DM intake (Lalman & Richards, 2017). Referring to Lalman & Richards (2017) & Mayulu *et al.* (2021), cattle with a body weight range between 300-350 kg, DM intake is around 6-7 kg head^{-1}day^{-1}, and CP intake is 0.96-1.12 kg head^{-1} day^{-1}. With feed quality, as shown in Table 1, if cattle consume the same amount of DM intake, then the one with the highest CP intake is fattening cattle in the Tuban region because the feed has the highest SP content among other regions. In contrast, cattle breeding in the Pamekasan region has the lowest intake CP.

Body weight is one measure in determining the nutritional needs of fattening cattle or breeding cattle. The complete feed formulations provided by farmers in the three areas had good feed quality for fattening beef cattle, but the quality of animal feed for breeding beef cattle does not meet the standards so that it will affect feed efficiency. The diet for breeding cattle contains at least 12%-16% depending on the physiological status of being pregnant or lactating (Bindari *et al.* 2013). Pregnant and lactation cattle require special attention to their nutritional adequacy. The quality and adequacy of nutrients for cattle breeding determine livestock fertility (Rodney *et al.* 2018). CP Observations of feedlot ADG showed the highest data from Tuban, Malang and Pamekasan at 0.6-0.7; 0-5-0.6; and 0.3-0.4, respectively, while the success of pregnancy from Tuban, Malang and Pamekasan is 80%; 65% and 45% respectively. These results showed that feeding in Tuban has better feed efficiency compared to the other two locations. according to Mayulu & Suharti (2016) stated that the level of feed efficiency can be seen from livestock production. The efficiency of feed use is influenced by several factors including the ability of livestock to digest feed ingredients, nutrient adequacy for basic life, growth and body functions and the type of feed used (Kenny *et al.* 2018).

Total of *In Vitro* Gas Production

In-vitro gas production is a technique that can be used for feed evaluation and selection of the best feed ingredients for livestock. According to Tikam *et al.* (2015) the technique of gas production in vitro is a simple and is widely used in rumen fermentation research, although in-vivo techniques are needed in the end. Generally, in vitro technique has been used in the initial stage of research to predict the digestibility of feed in the rumen and the nutritional value of the feed. In-vitro gas production methods are generally cheaper, easier, faster,

Table 2 The results of total in vitro gas production in smallholder farmers at Regencies of Malang, Pamekasan, and Tuban

Areas	Diet	Total gas production (ml per 500 mg DM)
Malang Regency	Fattening	80.089 ± 5.94
	Breeding	44.564 ± 6.53
Tuban Regency	Fattening	67.033 ± 6.87
	Breeding	44.627 ± 5.21
Pamekasan Regency	Fattening	54.647 ± 5.83
	Breeding	52.065 ± 5.47

and can be applied to stimulate the fermentation of feed ingredients in the rumen (Kleden *et al*. 2021).

Based on Table 2, Malang Regency has a feed formulation for fattening cattle with the highest total gas production compared to Tuban and Pamekasan Regencies (80.089 + 5.94 ml per 500 mgDM). The high gas production value indicates that the feed formulation in this area has a high energy value. Fajri *et al.* (2018) reported that feed with high energy sources would increase the total gas production value and vice versa. Feeds with a high energy value can facilitate the formation of beef fat so that the feed has high efficiency for fattening cattle. Hartutik (2012) suggested that gas production describes the amount of VFA formed in the rumen so that the higher the gas production, the higher the VFA production in the rumen. The high VFA production makes producing fat easier for the cattle's body. Beef fat is formed from VFA in the rumen, especially propionic fatty acid (Wang *et al.* 2020; Suryani *et al.* 2020). Table 2 shows that Pamekasan Regency has a feed formulation for breeding beef cattle with the highest gas production compared to Malang and Tuban Regencies. In breeding cattle, feed is needed that is able to supply high fat and protein for livestock because these two ingredients are needed for hormone production and cell division. The high value of gas production also indicates the high production of VFA and microbial protein cells formed in the rumen (Hartutik 2012). Feed with high production of VFA and microbial protein cells can increase the efficiency of cattle reproduction because more materials for hormone production and cell division are available with the same amount of ingredients.

Table 3 The feeding ingredient in in smallholder farmers at Regency of Malang, Pamekasan, and Tuban

Areas	Diet	Ingredient
Malang Regency	Fiber sources	Elephant grass, native grass, odot grass, rice straw, corn stover, corn straw, corn straw silage.
	Energy & protein sources	Beef cattle concentrate, wheat pollard, rice bran, copra meal and coffee pulp, molasses.
Tuban Regency	Fiber sources	Elephant grass, native grass, rice straw, sorn straw.
	Energy & protein sources	Beef cattle concentrate, wheat pollard, rice bran, corn bran.
Pamekasan Regency	Fiber sources	Elephant grass, native grass, rice straw, leave plants
	Energy & protein sources	Beef cattle concentrate, corn milled, corn bran and rice bran.

The highest gas production in Table 2 shows that the feed with the highest gas production was found in Malang Regency used for fattening cattle. The feed formulation in Malang Regency for fattening cattle comprised of odot grass (*Pennisetum purpureum* cv Mott) and elephant grass with wheat pollard, rice bran, copra meal and coffee pulp and the total gas production recorded was 80.089 ml per 500 mg DM and CF content was 28.821%. The combination of odot and elephant grass is known to produce higher total gas production efficiency than the combination of elephant grass and field grass which was applied in Pamekasan Regency and the use of elephant grass alone in Tuban Regency because odot grass has a higher nutrient content than elephant grass so that when combined it resulted in higher gas production.

The feed formulation for breeding cattle which has the highest gas production was found in Pamekasan Regency compared to Malang Regency and Tuban Regency because in Pamekasan Regency, farmers add coarse corn to their feed formulation. Coarse corn has a high energy value due to the content of easily fermentable carbohydrates. Fermentable carbohydrates in feed will increase gas production drastically even if given in small amounts. Tuban Regency has low gas production in feed formulations for fattening cattle and breeding cattle due to the high crude fiber content of the two feeds, namely 29.046% and 31.344%, respectively. High crude fiber content in a feed will inhibit rumen bacteria to degrade feed so that it will reduce total gas production. Du *et al*. (2016) showed that feeds with high crude fiber content had a lower rate of degradation and potential for degradation so that it would reduce total gas production. Low degradation potential directly affects the total gas production because the degradation potential describes how much feed can be degraded by rumen bacteria, resulting in higher gas production.

The feed ingredients in the form of grass actually have good quality compared to agricultural waste. This is evidenced by the relatively higher gas production of grass-based feed compared to straw-based feed. Ideally, the grass is harvested before entering the generative phase or before flowering so that the quality is good. Min (2016) reported that the quality of forage decreased along with the increase in age of harvesting time. A decrease in forage quality will affect the quality of animal feed ingredients. The decline in plant quality is indicated by the accumulation of fiber and a decrease in the nutritional value of the feed because the previously stored nutrient content will be used to prepare the generative phase of the plant. Therefore, the gas production of feed for fattening cattle is relatively higher than that for breeding cattle because the feed is ccomposed of straw, which has had low quality.

CONCLUSION

The feed for fattening cattle has a higher CP content than for breeding cattle in the three regions. The data is linear with the total value of fattening cattle gas production, which is higher in cattle breeding. The quality of beef cattle feed should be provided with balanced nutrition, including fiber, energy, protein, vitamins, and minerals.

REFERENCES

AOAC. 2005. *Official Methods of Analysis of the Association of Official Analytical Chemists*. Marlyand (US): Published by the Association of Official Analytical Chemist.

Aprilia RM, Hartutik, & Marjuki. 2018. Evaluasi kandungan nutrien konsentrat sapi perah rakyat di kabupaten malang nutrient content evaluation of concentrate for dairy cattle in Malang Regency. *Jurnal Nutrisi Ternak Tropis.* 1(1): 54-59.

Bakari S, Daoud A, Felhi S, Smaoui S, Gharsallah N, & Kadri A. 2017. Proximate analysis, mineral composition, phytochemical contents, antioxidant and antimicrobial activities and GC-MS investigation of various solvent extracts of cactus cladode. *Food Science and Technology*. 37(2): 286-293.

Bindari YR, Shrestha S, Shrestha N, & Gaire TN. 2013. Effect of nutrition on reproduction-A review. *Advances in Applied Science Research*. 4(1):421-429.

Blümmel M, Makkar, H., & Becker K. (1997). In vitro gas production: a technique revisited. *Journal of Animal Physiology and Animal Nutrition.* 77(1-5): 24-34.

Central Bureau of Statistics. 2015. Tinggi wilayah Diatas Permukaan Laut (DPL) menurut Kabupaten/Kota di Provinsi Jawa Timur 2015. https://jatim.bps.go.id/statictable/2016/07/26/347/tinggi-wilayah-di-atas-permukaan-laut-dpl-menurut-kabupaten-kota-di-provinsi-jawa-timur-2015.html

Central Bureau of Statistics. 2020. Jumlah populasi sapi pedaging di Jawa Timur. https://www.bps.go.id /indicator/ 24/469/1/ populasi-sapi- potong-menurutprovinsi.html.

Development Planning Agency at Sub-National Level East Java. 2021. Suhu dan kelembapan rata-rata Jawa Timur. http://bappeda.jatimprov.go.id/

Du S, Xu M, & Yao J. 2016. Relationship between fibre degradation kinetics and chemical composition of forages and by-products in ruminants. *Journal of Applied Animal Science*. 44(1): 189-193.

Fajri AI, Hartutik & Irsyammawati A. 2018. Pengaruh penambahan pollard dan bekatul dalam pembuatan silase rumput odot (*Pennisetum purpureum*, Cv. Mott) terhadap kecernaaan dan produksi gas secara in vitro. *Jurnal Ternak Tropis*. 1(1): 9-17.

General Directorate of Livestock and Animal Health, 2021. 2020. Statistik peternakan dan kesehatanhewan. https://pusvetma.ditjenpkh.pertanian.go.id/upload/statistik/1615509509.statistik%202020.pdf

Hambakodu M. 2021. Evaluasi nilai nutrisi dan kecernaan in vitro beberapa rumput alam dari lahan perkebunan dan padang penggembalaan. *Jurnal Peternakan Indonesia*. 23(2): 130-135.

Hartutik. 2012. *Metode Analisis Mutu Pakan.* Malang (ID): UB Press.

Huda AN, Mashudi, Kuswati, Susilawati T, Wahyuningsih S, Isnaini I, Yekti APA & Satria AT. 2018. Evaluasi kecukupan nutrisi induk sapi potong di Desa Leran Wetan dan Leran Kulon, Kecamatan Palang, Kabupaten Tuban. *Jurnal Ternak Tropika* 19 (2): 111-119.

Huda AN, Ndaru PH, Ridhowi A, Nuningtyas YF, Putritamara JA, & Soetanto H. 2020. Economic value of dwarf elephant grass and dried distiller grain with soluble as feed of smallholder dairy farm in Tulungrejo Village, Ngantang District, Malang Regency. *IOP Conferences Series: Eart and Environmental Science.* 478 012056.

Huda AN, Yekti APA, Ndaru PH, Putritamara JA, Adli DN, & Shamad Z. 2021. Potential of small-scale business development and socio cultural of beef cattle farm at Pamekasan Regency: case study at Madura Island. *Jurnal Ternak.* 12(1): 1-5.

Kenny DA, Fitzsimons C, Waters, SM & McGee, M. 2018. Invited review: Improving feed efficiency of beef cattle-the current state of the and future challenges. *Animals* 12 (9): 1815-1826.

Kleden MM, Hartati E, Ratu MRD, Lestari GAY & Manu AE. 2021. In vitro gas production and cinetical fermentation of a few local feed in Kupang East Nusa Tenggara. *IOP Conf. Ser.: Earth Environ. Sci.* 888 012077.

Lalman D & Richards C. 2017. *Nutrien Requirements of Beef Cattle*. Departmen of Animal Science, Oklahoma Cooperative Extension Service.

Mayulu H & Suhardi. 2016. The feed intake and daily weight gain of locally sheep fed with amofer palm oil plantation and mill's by-product based complete feed. *International Journal of Science and Engineering*. 10(2): 67-73.

Mayulu H, Topan EA, Haris MI & Daru TP. 2021. Evaluation of dry matter intake and average daily gain of beef cattle in Samarinda city. *Journal of Soutwest Jiaotong University.* 56 (1): 164-175.

Min D. 2016. Effects of cutting interval between harvests on dry matter yield and nutritive value in alfalfa. *American Journal of Plant Sciences*. 7(8): 1226-1231.

Mudavadi OP, Emmanuel MA, Charles G, Namasake MF & Bernard LA. 2020. Effects of season variation on water, feed, milk yield and reproductive performance of dairy cows in Smallholder Farms in Eastern Africa. *Journal of Agriculture and Ecology Research International.* 21(8): 1-15.

National Standardization Agency. 2022. SNI 3148-2:2022 Pakan Konsentrat-Bagian 2: Sapi Potong. https://www.bsn.go.id

Prafitri R, Susilawati T, Yekti APA, Huda AN, Kuswati, Hermanto & Onni Meirezalni. 2022. Pembentukan kawasan pembiakan sapi potong. Malang (ID): UB Press.

Rastosari A. 2017. Karakteristik kualitatif dan kuantitatif induk sapi Peranakan Onggole (PO) dan persilangannya di Pacitan, Jawa Timur. *Jurnal Wahana Peternakan*. 1(2): 1-41.

Rochana A, Indriani NP, Ayuningsih B, Hernaman I, Dhalika T, Rahmat D, & Suryanah S. 2016. Feed forage and nutrition value at altitudes

during the dry season in West Java. *Animal Production*. 18(2): 85-93.

Rodney RM, Celi P, Scott W, Breinhild K, Santos JEP & Lean IJ. 2018. Effects of nutrition on the fertility of lactating dairy cattle. *Journal of Dairy Science.* 101 (6): 5115-5133.

Suryani NN, Suarna IW, Mahardika IG & Sarini NP. Rumen fermentation and microbial protein synthesis of Bali cattle heifers (Bos sondaicus) fed ration containing different energy protein level. *Jurnal Sain Peternakan Indonesia*. 15 (2): 187-194.

Tikam K, Phatsara C, Sorachakula C, Vearasilp T, Samiprem S, Cherdthong A, Gerlach K, & Südekum KH. 2015. In vitro gas production, in vivo nutrient digestibilities, and metabolizable energy concentrations for sheep of fresh and conserved pangola grass. *Small Ruminant Research*. 128: 34-40.

Wang L, Zhang G, Li Y & Zhang Y. 2020. Effects of high forage/concentrate diet on volatile fatty acid production and the microorganisms involved in VFA production in cow rumen. *Animals 10* (2):1-12