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

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


Kata kunci: nutrient, pakan sapi, produksi gas
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°C and 95%; Tuban Regency, 24°C and 95%; and Malang Regency, 22°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 (Praftiri 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
assessments 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⁻¹day⁻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 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 (Rody 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).

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

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

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

**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,
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 mg DM). 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.

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.

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

<table>
<thead>
<tr>
<th>Areas</th>
<th>Diet</th>
<th>Total gas production (ml per 500 mg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malang Regency</td>
<td>Fattening</td>
<td>80.089 ± 5.94</td>
</tr>
<tr>
<td></td>
<td>Breeding</td>
<td>44.564 ± 6.53</td>
</tr>
<tr>
<td>Tuban Regency</td>
<td>Fattening</td>
<td>67.033 ± 6.87</td>
</tr>
<tr>
<td></td>
<td>Breeding</td>
<td>44.627 ± 5.21</td>
</tr>
<tr>
<td>Pamekasan</td>
<td>Fattening</td>
<td>54.647 ± 5.83</td>
</tr>
<tr>
<td>Regency</td>
<td>Breeding</td>
<td>52.065 ± 5.47</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Areas</th>
<th>Diet</th>
<th>Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malang Regency</td>
<td>Fiber sources</td>
<td>Elephant grass, native grass, odot grass, rice straw, corn stover, corn straw, corn straw silage.</td>
</tr>
<tr>
<td></td>
<td>Energy &amp; protein sources</td>
<td>Beef cattle concentrate, wheat pollard, rice bran, copra meal and coffee pulp, molasses.</td>
</tr>
<tr>
<td>Tuban Regency</td>
<td>Fiber sources</td>
<td>Elephant grass, native grass, rice straw, sorn straw.</td>
</tr>
<tr>
<td></td>
<td>Energy &amp; protein sources</td>
<td>Beef cattle concentrate, wheat pollard, rice bran, corn bran.</td>
</tr>
<tr>
<td>Pamekasan</td>
<td>Fiber sources</td>
<td>Elephant grass, native grass, rice straw, leave plants.</td>
</tr>
<tr>
<td>Regency</td>
<td>Energy &amp; protein sources</td>
<td>Beef cattle concentrate, corn milled, corn bran and rice bran.</td>
</tr>
</tbody>
</table>
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 composed 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


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