Effect of feeding different forage and concentrate levels on carcass characteristics and meat quality of Aceh cattle

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Abstract. Aceh cattle is one of the local cattle in Indonesia, traditionally maintained by smallholder farmers in Aceh. Improvement of feed quality become an important key to increase the productivity of Aceh cattle. This study was aimed to measure carcass characteristics and meat quality of Aceh cattle, fed by forage and concentrate at different levels. Twelve of male Aceh cattle were grouped into 4 treatments, based on different proportion of forage and concentrates (T1=70:30, T2=50:50, and T3=30:70). After 90 days, the cattle were slaughtered to obtain carcass and non-carcass weights. The meat was analyzed for physical and chemical characteristics. Data were analyzed using one-way analysis of variance and followed by Duncan's New Multiple Range Test for significant differences. The results showed that T1 had a lower slaughter and carcass weights than other. T2 had the highest carcass percentage compared to other (P<0.05). There were no significant differences on percentage of edible non-carcass and meat quality (pH cooking losses, moisture, fat content, and protein content of meat). However, there were significant differences (P<0.05) on tenderness and water-holding capacity and collagen content. It is concluded that proportion of 50:50 for forage and concentrate might be the best level for Aceh cattle.

1. Introduction

Aceh cattle is one of the local cattle in Indonesia, which has been well adapted in Aceh Province. Aceh cattle have been designated as Indonesian local cattle by the decision of the Ministry of Agriculture of the Republic of Indonesia according the decision number 2907/Kpts/OT.140/6/2011 [1]. Aceh cattle are very potential as meat producers [2]. To optimize the productivity of Aceh cattle, improvement of feed quality become the important key. Feeding concentrates and forages on the daily feed of Aceh cattle with various levels resulted average daily gain around 0.13 to 0.18 kg/head/day compared to feeding forage as single diet [3]. Increasing the nutrient content of the feed, especially protein and energy, will increase nutrient digestibility. Nutrient digestibility can fulfill the requirement of livestock for production, such as muscle, fat deposition and carcass component [4]. [5] reported that...
Bali cattle fed by forage and concentrate with 12% crude protein and 72% total digestible nutrient could increase the carcass weight, meat weight, meat percentage, fat weight, fat percentage, non-carcass weight, and meat quality.

The previous reports showed that Aceh cattle have potential to produce profitable carcasses when obtain sufficient feed. Conversely, the carcasses produced by livestock were not optimal when the feed was not sufficient in quality or quantity. The carcass percentage of Aceh cattle is 49 to 51% [1], so it expected that feeding by forage and concentrate at various levels could increase carcass production and meat quality. This study was aimed to measure carcass characteristics and meat quality of Aceh cattle, fed by forage and concentrate at different levels.

2. Materials and methods

The research was conducted for four months, using 12 heads of males Aceh cattle (1.5 to 2.5 years old) and relatively the same as initial body weight, resulted from the breeding of Livestock Breeding Center for Excellent and Forage Animal Feed (BPTU-HPT) Indrapuri located at Aceh Besar. Aceh cattle were kept intensively on individual housing at BPTU-HPT Indrapuri. Aceh cattle were divided randomly into three group of treatments based on different feeding levels of forage and concentrate, namely T1 (70:30) consisted of 20 kg forage and 1 kg commercial concentrate feed, T2 (50:50) comprised 15 kg forage and 2 kg commercial concentrate feed, and T3 (30:70) consisted of 10 kg forage and 3 kg commercial concentrate feed. Based on proximate analysis, nutrient content of both forages and concentrate feed used in this study was dry matter, ash, crude protein, crude fat, and crude fiber, were 26.13, 8.72, 4.88, 1.62, and 39.81% for forages respectively, and 99.26, 7.19, 18.67, 3.87, and 11.5 for concentrate %, respectively.

Aceh cattle were kept for three months and observed their feed consumption and body weight. At the end of treatments, cattle slaughtered at slaughterhouse located in Lambaro, Aceh Besar. The body weight of the cattle was weighed before slaughtered. Carcass and non-carcass (edible and non-edible) weighted after the slaughtered process and commercial cutting. Meat samples were taken from m. Longissimus dorsi and m. Bicep femoris for meat quality analysis, including the physical quality (pH, cooking loss, tenderness, and water holding capacity) and chemical quality (water/moisture, collagen, fat, and protein). Data were statistically analyzed using a one-way analysis (ANOVA) and continued by Duncan's New Multiple Range Test (DMRT).

3. Results and discussion

The average of daily dry matter intake, initial and slaughter body weight, carcass weight, percentage carcass, and non-carcass, and meat quality of Aceh cattle fed on a different level of forage and concentrate presented in Table 1. The results found no significant differences on the initial body weight of Aceh cattle. The dry matter intake in the T2 higher (P<0.05) than T1 and T3 groups, increasing the level of concentrate feed in the T3 group did not increase a higher dry matter intake than the T2. In contrast with previous research that the increase of concentrate level as finishing feed can improve feed intake and average daily gain [6–7] and produce a higher slaughter weight [4].

The growth and the slaughter body weight in line with the carcass weight. The carcass weight on the T1 has the lowest weight (P<0.05) compared to T2 and T3 groups. The percentage of carcasses at T3 was the lowest (P<0.05), whereas between the T1 and the T2 group did not differ significantly. The result was in line with the percentage of non-edible non-carcass (blood and digestive tract content), the T2 group was significantly lower (P<0.05) than T1 and T3 groups. The previous study [4] found that an increase in slaughter weight may increase carcass weight, but not always in carcass percentage. This study showed that feeding with forage and concentrate on 30:70 ratio (T3) produces a lower carcass weight and percentage carcass compared with 50:50 (T2). Similar to the study [8] that concentrate supplementation on rice straw feed with levels of 1% and 2% of cattle body weight produces a relatively similar commercial cut and the total weight of the edible portion.
Table 1. Feed intake, body weight, carcass, non-carcass, and meat quality of Aceh cattle fed by concentrate with different level (mean±SD)

| Variables                  | T1 (70:30) | T2 (50:50) | T3 (30:70) |
|----------------------------|------------|------------|------------|
| Dry matter intake (kg/d)   | 4.65±0.30  | 5.27±0.26  | 4.97±0.22  |
| Initial body weight (kg)   | 167.90±39.65 | 167.78±38.84 | 167.98±37.85 |
| Slaughter body weight (kg) | 214.33±16.85 | 239.67±24.52 | 241.33±24.97 |
| Carcass weight (kg)        | 119.33±6.51 | 135.67±15.50 | 131.67±13.60 |
| Percentage carcass (%)     | 55.77±1.38  | 56.54±0.68  | 54.56±0.54  |
| Percentage non-carcass     |            |            |            |
| Edible (%)                 | 20.52±0.62  | 20.81±0.18  | 20.94±1.33  |
| Non edible (%)             | 23.70±1.44  | 22.65±0.52  | 24.51±1.42  |
| Meat quality               |            |            |            |
| pH                         | 5.60±0.31   | 5.87±0.27   | 5.85±0.39   |
| Cooking losses (%)         | 30.44±0.99  | 30.55±0.43  | 32.26±2.75  |
| Tenderness (kg/cm²)        | 9.57±1.09   | 14.92±3.56  | 12.46±1.68  |
| Water-holding capacity (%) | 72.05±1.96  | 72.23±0.44  | 68.92±1.35  |
| Moisture (%)               | 71.54±2.81  | 70.15±1.93  | 71.75±2.04  |
| Collagen content (%)       | 1.69±0.22   | 1.69±0.30   | 2.32±0.37   |
| Fat content (%)            | 5.31±0.44   | 5.15±0.40   | 6.20±1.37   |
| Protein content (%)        | 22.20±0.49  | 22.23±0.90  | 22.53±0.63  |

ns Non significant
a,b Different superscripts denote significant differences between rows (P<0.05).

Meat quality analysis showed no significant differences in pH, cooking losses, moisture, fat content, and protein content of meat Aceh cattle fed by forages and concentrate at different levels. Significant differences (P<0.05) found on the tenderness, water-holding capacity and collagen content of the meat. The value of tenderness at the T1 group was the lowest (P<0.05), but T2 and T3 groups did not differ significantly. The T3 has the lowest (P<0.05) of water-holding capacity and in contrast, the collagen content highest (P<0.05), but T1 and T3 groups did not differ significantly. This study showed that feeding with forage and concentrate on 50:50 ratio (T2) produce a higher water-holding capacity and tenderness compared with 70:30 (T1) and 30:70 (T3). The higher of water-holding capacity resulted in higher tenderness that was determined of meat quality [9].

Meat quality of Aceh cattle in the three groups was higher than Hanwoo and Chikso steers fed on a grain-based diet (12% crude protein) in terms of pH (5.41 and 5.40), water-holding capacity (59.9% and 61.1%), and cooking loss (28.9% and 28.9%) [10]. The meat pH value did not significantly differ and in line with the value of tenderness and cooking losses. Consistent with a previous study [11] that a high pH was producing a high tenderness and increased water retention (cooking losses) during cooking than lower pH. The value of moisture is lower than the Angus steer (72.8%) [12], but higher than Hanwoo steer (64.8%), and Chikso steer (67.4%) [10] fed on based diet 12% crude protein. Aceh cattle meat in this study also has lower fat content compared to Hanwoo steer (15.4%), and Chikso steer (12.1%), however, the protein content is higher than Hanwoo steer (18.9%), and Chikso steer (19.6%) [10] and Angus steer (21.1%) [12] fed with finished feed with 12% crude protein content.

4. Conclusion
The results indicate that Aceh cattle fed forage and concentrate with different levels are able to improve dry matter intake, carcass characteristics, and meat quality. Male Aceh cattle fed on 50:50% of forages and concentrate has the highest values of carcass weight, carcass percentages, tenderness and water-holding capacity of meat.
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