Influence of Body Condition Score on Carcass Characteristics of Cull Bali Cows

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Abstract. The objective of this study was to investigate the effect of body condition score (BCS) on dressing percentage and carcass characteristics of cull Bali cows. Three groups of Bali cows (n=4) with body condition of 2, 3 and 4 were used in this experiment. They were assigned as BCS2, BCS3 and BCS4, respectively. The animals were slaughtered at the faculty slaughter house. Weight of non-carcass parts (skin, blood, fluck, offal, hide and head) were recorded. Hot carcass was weighed and fabricated into lean, fat and bone of each sub-primal cuts. Results showed that the percentage of non-carcass part did not differ (P>0.05) among cows with different BCS. Dressing percentage of cull Bali cows was improved (P<0.05) from 48% in BCS2 to 58% in BCS3 and BCS4. Front legs and rib were highest in BCS4, meanwhile hind legs did not differ among cows with different BCS. Total lean meat cut was significantly increased (P<0.05) from 36.84% in BCS2 to 40.63 and 41.12% in BCS3 and BCS4 respectively. Meat from hind quarter and rib were highest in BCS3 but tender loin was highest in BCS4. Carcass fat percentage, however, was also significantly increased (P<0.05) in BCS4, while bone was comparable among cows with different BCS. It can be concluded that although carcass and precious primal cuts are higher in cows with BCS 4 but the excessive degree of carcass fatness made slaughtering cull Bali cows is optimal at body condition score less than 4.

1. Introduction
Improving body condition score (BCS) of cull Bali cows prior to slaughter is one of strategic options to improve beef production in cattle producing area in Indonesia where meat supply comes mainly from cull cows. BCS of cull Bali cows has been reported to increase significantly when a concentrate diet containing 12% crude protein were offered to the animals. Live weight gain as high as 0.53 kg/d was recorded and those cull Bali cows had two points higher BCS after 60 days fattening period [2]. Assuming a similar dressing percentage, cull cows with higher BCS will therefore produce higher meat compared to cows with lower BCS. This means that meat production will be improved when cull cows are fattened to have high BCS before being slaughtered. With higher meat supply, it also means that excessive slaughtering of young productive Bali cows which has been considered as the main factor responsible for the decline of calving rate and the increasing trend of mortality rate [1] can be avoided.

Other advantage of increasing BCS of cows before slaughtered is that meat quality is also improved. Feeding a high-energy diet to cull beef cows has been shown to increase carcass fat content [3,4,5], increase lean meat yields [6,4,5], increase marbling in the longissimus muscle [6,3,4], produce a whiter external fat cover [5], and improve cooked meat palatability [4,7]. Schnell et al. [5] indicated that improvements in the quality and consistency of beef products achieved through feeding a high concentrate diet could enhance the salvage value of cull beef cows. However, limited information is available on the
influence of body condition score on the dressing percentage and carcass quality of cull Bali cows. Therefore, the purpose of this study was to determine the influence of body condition score on carcass production and quality of cull Bali cows.

2. Material and methods

2.1. Animals and experimental design
A total of 12 Bali cows were grouped into three groups of four animals (n=4) which have body condition scores of 2, 3 and 4 respectively. The experiment was following a completely randomized design with 3 treatments i.e. body condition score and 4 replications. The treatment groups were cows with BCS=2 (BCS2), BCS=3 (BCS3) and BCS=4 (BCS4). All animals were purchased from the local cattle market. Twelve hours before slaughter, the animals were assessed for body condition following a 1-5 score system, i.e. 2=thin, 3=moderate, and 4=fat. Feeds were removed during the last 12-h, meanwhile water was available *ad libitum*.

2.2. Parameters, measurement and calculations
Cows were slaughtered in the Meat Science Laboratory, Faculty of Animal Science, The University of Nusa Cendana and in the Kupang City Slaughter House. The animals were fasted for 12 hours before weighed and slaughtered. Blood was collected by placing a big plastic bucket under the head until all blood was drained. Blood was immediately weighed and recorded. Skin was then removed. Thereafter, the weight of the non carcass parts including blood, skin, head, fore feet, hind feet, fluck (lung, heart, liver, spleen, pancreatic gland), and digestive tract were recorded. The forefeet were cut at the metacarpal bones, meanwhile the hindfeet were removed at the tarsal joint. Digestive tract was lifted and directly weight when the digesta was still in it. Digesta was then removed and the digestive tract was cleansed with tap water and reweighed. Liver, lungs, kidney and gall bladder were removed and weighed. Similarly, reproductive organs were also removed and weighed.

Carcass was then cut into different parts, i.e. front legs, hide, ribs and backside. Each part was weighed and the sum of all was assigned as the total carcass weight. Each carcass part was then trimmed to separate meat, fat and bone. Meat, fat and bone from each carcass part were then weighed. All data were expressed as percentage of live weight.

2.3. Statistical analysis
All data was statistically analyzed using Proc. GLM (SAS Institute). The model used was consistent with completely randomized design: \( Y = \mu + \text{BCS} + E \), where \( \mu \) : overall mean, BCS : fixed effect of body condition score, and E: residual error.

3. Result and discussion

3.1. Carcass and non carcass components
Live weight of cull Bali cows at slaughter varied between 185 and 234 kg with the average 217.72 kg. Those cows were over 8 years old. This weight was regarded as a representative of mature Bali cows in the province of East Nusa Tenggara (ENT) [8] and at this age they were commonly considered as cull cows due to the reduction in calving rate. Jelantik [9] reported that calving rate of Bali cows reared under traditional grazing system declined to 40% when they were ten years or more.

The overall average of dressing percentage of cull Bali cows in the present experiment was 55.4%, varying from 48% to 58%. This level of dressing percentage compared well with some reports with Bali bulls. Wiyatna [10] recorded the percentage of carcass for Bali cattle was 54%, meanwhile Pane [11] reported to be between 52% to 57.7%. Similarly, Hapid and Rugiyah [12] found carcass percentage of 53.7% for bali cattle weighing 200-220 kg.

In general, the result of this experiment showed that carcass production was improved with increasing body condition score (Table 1). Dressing percentage increased from 48% in thin Bali cows...
(BCS=2) to 58% in Bali cows with BCS=3. This finding is in accordance to several reports in *Bos taurus* cattle [13]. Maltere dan Jones [14] reported increasing dressing percentage with increasing degree of fatness of cull cows of European breeds. Apple [15] also reported that there was a significant increase in the dressing percentage of Angus, Hereford and Red poll steers when BCS was improved from 2 to 8. Similar improvement was also reported by Schnell *et al.* [5] who recorded increasing carcass percentage with increasing BCS as cows were offered a high energy diet.

Table 1. Carcass and non-carcass parts of cull Bali cows differing in BCS as percentage of BW

| Variable                  | Body Condition Score (BCS) | P     |
|---------------------------|----------------------------|-------|
|                           | 2                          | 3     | 4    |
| Non carcass parts         | 27.99 ± 2.00               | 26.78 ± 0.931 | 26.63 ± 0.73 | 0.448 |
| Skin                      | 7.63 ± 0.84a               | 8.96 ± 0.46b | 7.32 ± 0.40a | 0.033 |
| Blood                     | 3.01 ± 1.57                | 3.99 ± 0.53 | 2.92 ± 0.49 | 0.400 |
| Fluck                     | 3.79 ± 0.04a               | 3.03 ± 0.155b | 2.50 ± 0.06c | <0.001 |
| Offal                     | 8.74 ± 0.67a               | 5.64 ± 0.08b | 8.44 ± 0.26a | <0.001 |
| Head                      | 4.81 ± 0.63                | 5.14 ± 0.23 | 5.45 ± 0.89 | 0.52  |
| Carcass parts             | 49.82 ± 2.65b              | 58.04 ± 0.81a | 58.34 ± 1.02a | 0.001 |
| Front limb                | 10.23 ± 0.36c              | 11.49 ± 0.54b | 12.35 ± 0.97a | 0.002 |
| Hide                      | 15.88 ± 1.71a              | 18.21 ± 0.62b | 17.96 ± 0.93b | 0.097 |
| Ribs                      | 8.62 ± 0.31c               | 11.52 ± 0.68b | 13.48 ± 1.02a | 0.001 |
| Backside                  | 15.07 ± 1.99               | 16.81 ± 1.41 | 14.61 ± 0.78 | 0.237 |

Values bearing different superscript within similar raw differs significantly (P<0.05)

3.2. Meat Production and carcass fatness

The percentage of meat trimmed from different parts of carcass is presented in Table 2. It was shown that moderate (BCS3) and high body condition (BCS4) produced more meat (P<0.05) as the percentage of live weight compared to relatively thin cows (BCS2). Similar trend was also reported by Schnell *et al.* [5] who recorded there was an increased of sub primal cuts with increasing time on high energy diet as their BCS to increase. Improvement of carcass leanness with increasing BCS was also reported by Matulis *et al.* [6] and Cranwell *et al.* [4].

Table 2. Meat Production from different parts of cull Bali cows differing in BCS

| Variable                  | BCS       | P     |
|---------------------------|-----------|-------|
|                           | 2         | 3     | 4    |
| Meat Production production from carcass parts (% LW) | | | |
| Front legs                | 8.53 ± 0.40b | 8.11 ± 0.26b | 9.51 ± 0.45a | 0.01 |
| Hide                      | 9.23 ± 1.59b | 15.19 ± 0.29a | 10.67 ± 0.49b | 0.001 |
| Ribs                      | 4.71 ±0.027b | 6.55 ± 0.011a | 3.65 ± 0.012c | <0.00 |
| Backside                  | 10.38 ± 1.59b | 10.26 ± 0.18b | 15.28 ± 0.35a | <0.00 |
| Total meat production (% LW) | 32.87 ± 1.56b | 40.11 ± 0.45a | 39.13 ± 0.50a | <0.00 |
| Carcass fat (% LW)        | 1.75 ± 0.73a | 1.85 ± 0.81a | 3.66 ± 1.21b | 0.082 |

Values bearing different superscript within similar raw differs significantly (P<0.05)
The different prices for different meat trimmed from different parts of cow carcasses appears to justify the investigation in which part is changed when cull cows become fatter with increasing BCS. It was shown from this study that cull cows having BCS 2 had lowest trimmed meat from all parts of the carcasses. Meanwhile, compared to cull cows with BCS 4, the animal with BCS 3 produced higher meat trimmed from hide and ribs but lower from backside and front legs.

Increasing carcass fatness is the most significant drawback of increasing body condition in cull cows as shown in many studies. Schnell et al. [5] reported increasing carcass fat with increasing time on high energy feed when their BCS increased. Similarly pattern was also reported by Matulis et al. [6] and Cranwell et al. [4] with high energy fed cull cows. In our study, trimmed fats was doubled in BCS4 compared to cows with lower BCS. Fat cull Bali cows (BCS=4) in the present experiment produced trimmed fats as high as 3.66 % LW or about 6.27% of carcass weight. This amount of fats was considered to be high for tropical beef cows [16]. Dewantara et al. [17] reported that the average carcass fats content of Krui cows was 5.28±0.57% with the highest recorded carcass fat content of 7.15%. It is therefore recommended slaughtering cull Bali cows be done at BCS lower than 4 to avoid excessive carcass fatness.

Table 3. Bone weight of different parts of carcasses of cull Bali cow differing in BCS

| Bone weight (% of LW) | BCS 2 | BCS 3 | BCS 4 | P-value |
|-----------------------|-------|-------|-------|---------|
| Front legs            | 2.41 ± 0.73 | 3.48 ± 0.16 | 2.85 ± 0.55 | 0.125   |
| Hide                  | 3.31 ± 1.14 | 2.88 ± 0.61 | 3.35 ± 0.51 | 0.741   |
| Ribs                  | 3.07 ± 0.64 | 3.12 ± 1.00 | 2.82 ± 0.17 | 0.623   |
| Backside              | 6.39 ± 0.07 | 6.57 ± 0.30 | 6.57 ± 0.31 | 0.852   |
| Total                 | 15.19 ± 0.96 | 16.06 ± 1.43 | 15.59 ± 0.16 | 0.591   |

The weight of bone trimmed from different carcass parts was apparently unchanged with differing BCS (Table 3). This finding is consistent with previous studies with other breeds. Matulis et al. [6] and Cranwell et al. [4] reported that there was no significant effect of feeding high energy diet to bone weight of side carcasses which implied that bone was not increased when cows BCS increased.

4. Conclusion

Slaughtering cull Bali cattle at higher BCS than 2 produced more meat which have beneficial implication on the reduction in the number of slaughtering productive cows to suffice the local and national meat demands. Due to the excessive degree of carcass fatness made slaughtering cull Bali cows is optimal at body condition score less than 4.

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