Meat Productivity of Sinhala Cattle

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The word, Sinhala cattle, is a general name given to the cattle indigenous to Sri Lanka, not belonging to any other breed. As they have been crossed with other breeds during a period of many years, they have lost their uniformity as a breed, showing various hair colors, body proportions, and body sizes. The Sinhala cattle account for 80—90% of the total number of cattle[1] and produce about 60% (on calory basis) of the total available meat supply[2] in Sri Lanka. They are regarded an important animal protein source of the nation, because they can produce meat at a relatively low cost with an extensive feeding and management, and cattle resource is relatively more abundant than other meat animals in the country. However, with the progress of farm mechanization, cattle population in Sri Lanka has shown a trend to be stagnant or to decrease[3], in spite of an increasing demand for beef, due to the increasing population. To meet the increasing demand for beef, it would be necessary to increase cattle population and to increase meat product per head. It is not easy, however, to increase cattle population, because grassland development and improvement of pasture utilization are required for that purpose. On the contrary, it is expected that considerable success in increasing meat product per head would be attained by the improvements of rearing and fattening system.

The present study was carried out as a part of a cooperative research project between the Veterinary Research Institute of Sri Lanka and Tropical Agriculture Research Center of Japan with the purpose of contributing to the improvement of beef production in Sri Lanka. Meat productivity of Sinhala steers of 20 months of age was studied in comparison with other breeds, and the variation of meat productivity according to live body weight was examined using materials obtained from a slaughter house in Kandy.

Materials and methods

A fattening trial was carried out in the Veterinary Research Institute (VRI) of Sri Lanka during a period from April 1977 to Feb. 1978, using Sinhala cattle, Red sindhi (both are Zebu type), Ayrshire and Jersey of European cattle, and water baffalo Murrah. All of them were castrated at the start of the trial. For each breed, 6 heads were divided into two lots: 3 for high nutritional level (H lot) and 3 for low nutritional level (L lot). A mixture of equal quantity of each feedstuff shown in Table 1 was supplied at the rate of 1.6% of body weight to the H lots and 0.7% of body weight to the L lots every day. Body weight was measured from the start to the end of the trial at 2-week intervals, and its values were used for calculating the quantity of concentrates to be supplied. As roughages, grass hay and green grasses were supplied during about 1 month after the beginning and then rice straw was used. The roughages were given *ad libitum* and residual amount was measured every day during the fattening period. When the animals reached 20 months of age, they were slaughtered and skinned in a slaughter house of VRI. Their body was separated into feet, shanks, head, tail and carcass. The right halves of the carcasses were dissected into muscle, fat and bone, and weighed.

Changes in meat yield with growth of Sinhala

cattle were studied with 27 bulls selected at random in the Kandy municipal slaughter house. After estimating their age, live body weight, carcass weight and edible meat weight were measured. The result was subjected to statistical analysis together with data of withers height, body length and heart girth measured before slaughter with some of the materials.

Results and discussion

1) *Body weight gain and feed efficiency*

Body weight gains are shown in Table 2. Since the age in days at the start of the trial was somewhat different among the breeds, fattening days differed accordingly: Murrah required 270 days of fattening period while Sinhala cattle, which was youngest at the start, required about 1 month longer fattening period. Body weight gains were generally small, probably due to unfavorable tropical environment, i.e., daily gain of only 0.23–0.38 kg even in the H lots, and as small as 0.09—0.16 kg in the L lots. As to the differences among breeds, Murrah and Red sindhi showed greater gains, followed by Ayrshire and Jersey, while Sinhala was the lowest in the H lots. Such poor growth rate of Sinhala seems to be related to its small body weight at the start of fattening and at the maturity. In the

Table 1. Digestible nutrients of the experimental diets

Feeding stuff	DM	DCP	TDN
Ground coconut meal	89.2%	16.3%	74.9%
Crushed corn	86.5	6.9	79.6
Rice straw	87.0	1.1	37.8
Grass hay	71.5	2.5	46.0
Green grass	23.0	4.5	10.4

Table 2. Comparison of daily gains of different breeds in two nutritional levels

Breed	Murrah	Red sindhi	Sinhala	Ayrshire	Jersey	Average
Fattening period, days	270	237	301	265	287	272
High nutritional level						
No. of animals	2	3	3	3	3	
Initial weight, kg	115.0	119.7	76.0	110.0	116.7	107.5
Final weight, kg	219.0	197.3	144.7	181.0	188.7	186.1
Daily gain, kg	0.38	0.33	0.23	0.27	0.27	0.30
Low nutritional level						
No. of animals	2	3	3	2	2	
Initial weight,kg	120.0	114.7	74.0	116.5	123.5	109.7
Final weight, kg	143.5	152.3	117.0	134.0	156.0	140.6
Daily gain, kg	0.09	0.16	0.14	0.07	0.11	0.11

Table 3. Feed intakes and TDN conversions of different breeds

Breeds	Murrah	Red sindhi	Sinhala	Ayrshire	Jersey	Average
Fattening period, days	270	237	301	265	287	272
Hight nutritional level						
Ground coconut meal, kg	303.1	275.0	242.6	281.7	325.6	285.6
Crushed corn, kg	235.5	220.4	202.3	227.0	266.9	230.4
Roughage, kgDM	963.9	624.4	831.4	880.6	952.6	850.6
TDN conversion, kg	8.6	9.1	11.0	11.7	13.0	10.7
Low nutritional level						
Ground coconut meal, kg	109.8	106.4	95.2	120.0	160.4	118.4
Crushed corn, kg	82.5	83.6	77.9	90.9	123.3	91.6
Roughage, kg DM	837.8	757.4	923.6	1027.1	1265.6	962.3
TDN conversion, kg	23.0	13.3	13.0	36.4	24.8	22.1

Note; Roughages used in this study are mainly rice straw and partially grass hay and green grass.
TDN conversion means amount of TDN required per 1 kg body weight gain.

L lots, the breeds which showed better gains in the H lots were more affected by the low nutrition: Murrah and Ayrshire showed only 24—26% of the gains obtained in the H lots, Jersey and Red sindhi 41–48%, whereas Sinhala gained 67% of that of H lots, indicating a high potential of meat productivity under unfavorable feeding conditions.

Feed consumption and TDN required for 1 kg gain of body weight (TDN conversion) are shown in Table 3. In this experiment, the concentrates were supplied on body weight basis, as stated earlier, so that more concentrates were consumed in the H lots than in the L lots, which showed less gains than the former: 516 kg consumption on an average in the H lots, and 210 kg in the L lots. These are shown in terms of dry matter intake per body weight in Table 4. In calculating the amount of intake by subtracting residual feed from the feed supplied in this experiment, a loss caused by throwing or rooting feed out of the feeder might possibly be included into the intake, so that rate of dry matter intake per body weight might have been turned out more or less higher than actual. However, we took these figures in Table 4 as reasonable, because Masubuchi and Takezawa reported the dry matter intake per body weight of Holstein cow as 4%. As shown in Table 4, the dry matter intakes per body weight averaged 3.43% in the H plots, and 3.44% in the L lots, showing no difference between the two lots. However, there were differences among the breeds: Sinhala showed the highest value, 3.83, followed by Jersey and Ayrshire. The high value of Sinhala is a result of great intake of roughage fed *ad libitum*, and which shows an excellent utility of low quality roughage like rice straw by Sinhala cattle.

The TDN required for 1 kg gain of body weight was 8.6–13.0 kg with an average of 10.7 kg in the H lots, while it was 13.0–36.4 kg with an average of 22.1 kg in the L lots, where poor body weight gain resulted in an increased consumption of TDN for 1 kg gain. Among the breeds, TDN requirement for 1 kg of gain was increased remarkably with Murrah, Ayrshire and Jersey under low nutrition, while the increase was ess with Sinhala and Red sindhi, showing a characteristic response of Sinhala in this respect.

2) *Carcass ratio and muscle: bone ratio*

Killing out percentage and carcass composition at 20 months of age are shown in Table 5. Because of light body weight at slaughter, 186 kg in the H lots and 140 kg in the L plots on averages, the carcass ratio was low, 44.9% in the H lots and 43.9% in the L lots. Sinhala cattle gave higher carcass ratios in both lots than other breeds, in spite of its smaller body weight: 48–49% for Sinhala in contrast to

Table 4. Dry matter intakes in different breeds

Breeds	Murrah	Red sindhi	Sinhala	Ayrshire	Jersey	Average
Fattening period, days	270	237	301	265	287	272
High nutritional level						
Total DM intake, kg	1,502.6	1,119.8	1,276.3	1,389.3	1,545.1	1,366.6
DM intake/day, kg	5.57	4.73	4.24	5.24	5.38	5.03
Average body wt., kg	167.0	158.5	110.4	145.5	152.7	146.8
DM intake/body wt., %	3.33	2.98	3.84	3.60	3.53	3.46
Roughage DM intake/ body wt., %	2.14	1.67	2.50	2.28	2.17	2.15
Low nutritional level						
Total DM intake, kg	1,030.0	947.3	1,096.7	1,238.0	1,549.2	1,172.2
DM intake/day, kg	3.82	4.00	3.64	4.67	5.40	4.31
Average body wt., kg	131.8	133.5	95.5	125.3	140.0	125.2
DM intake/body wt., %	2.89	2.99	3.82	3.73	3.85	3.46
Roughage DM intake/ body wt., %	2.35	2.39	3.21	3.10	3.15	2.84

Note; Roughages used in this study are mainly rice straw and partially grass hay and green grass.

Table 5. Body composition of different breeds after fattening

Breed	Murrah	Red sindhi	Sinhala	Ayrshire	Jersey	Average
High nutritional level						
Final body weight, kg	219.0	197.3	144.7	181.0	188.7	186.1
Carcass weight, kg	94.0	89.4	69.3	81.8	83.6	83.9
Killing out percentage	42.9	45.3	47.9	44.8	43.4	44.9
Muscle in carcass, %	63.2	69.3	67.1	62.7	65.1	65.4
Bone in carcass, %	30.0	20.5	24.9	29.1	28.5	26.6
Fat in carcass, %	3.7	5.5	6.0	5.4	4.0	5.0
Muscle/bone	2.1	3.4	2.7	2.2	2.3	2.5
Low nutritional level						
Final body weight, kg	143.5	152.3	117.0	134.0	156.0	140.6
Carcass weight, kg	61.8	72.6	57.2	52.0	63.8	61.7
Killing out percentage	43.1	47.7	48.9	38.8	40.9	43.9
Muscle in carcass, %	59.9	67.4	64.9	64.4	64.6	64.3
Bone in carcass, %	31.8	23.3	29.0	30.8	30.6	29.1
Fat in carcass, %	4.5	2.9	3.8	1.6	2.9	3.1
Muscle/bone	1.9	2.9	2.2	2.1	2.1	2.2

Table 6. Body measurements of Sinhala bull

No. of animals	27[1]		17[2]	
Item	Mean	Standard deviation	Mean	Standard deviation
Body weight, kg	124.0	28.4	126.2	23.1
Body height, cm	—	—	96.8	6.8
Body length, cm	—	—	94.1	8.5
Heart girth, cm	—	—	121.3	7.4
Carcass weight, kg	61.2	15.7	60.6	11.8
Edible meat weight, kg	43.2	13.3	42.6	11.4

Note 1) Total number of slaughtered bulls
2) Number of bulls to which additional measurement on withers height, body length and heart girth were made, out of the total 27.

Table 7. Relationship between edible meat weight and body measurements in Sinhala bulls

Body measurements (X)	Correlation coefficient	Regression against edible meat weight (Y)
Estimated age	0.44	—
Body weight, kg	0.93	0.433X-10.577
Body height, cm	0.62	1.123X-65.941
Body weight/body height	0.84	46.999X-17.652
Body length, cm	0.56	0.768X-28.619
Heart girth, cm	0.61	0.956X-72.351
Heart girth/body height	−0.01	—
Carcass weight, kg	0.94	0.794X- 5.441

43–44% for other breeds. Matsukawa et al.[5] also found that Sinhala has such a relatively high carcass ratio.

As to carcass composition, muscles accounted for a larger portion due to poor growth and younger biological age in relation to chronological age in all the breeds: an average of 65.4% in the H lots, and 64.3% in the L lots. On the other hand, the proportion of bone averaged 26.6% in the H lots, and 29.1% in the L lots, and that of fat averaged 5.0% and 3.1% respectively, showing a tendency of higher proportion

of fat and, lower proportion of bone in the H lot than in the L lot.

Muscle: bone ratio, obtained from tissue weight, showed an average of 2.5 in the H lot and 2.2 in the L lot, the former being slightly higher than the latter. Of the breeds used, Red sindhi showed the highest ratio, 3.4 in the H lot and 2.9 in the L lot, and Sinhala ranked next with 2.7 in the H lot and 2.2 in the L lot. It is known[6] that there is a close correlation between muscle: bone ratios and edible meat yields and the ratios increase with the increase of carcass weight. The higher muscle: bone ratios, as compared to those of the other breeds, observed in Sinhala and Red sindhi, having not necessary large carcass weight, are considered to be due to a character of Zebu type.

3) *Edible meat ratio of Sinhala cattle*

Results of the study carried out with Sinhala bulls collected in the Kandy municipal slaughter house are shown in Table 6, Table 7, and Fig. 1. Body weight of sample bulls ranged from 70 kg to 170 kg, with estimated ages from yearlings to 5 year old. An average of body weight was 125 kg, and of withers height was 97 cm. showing that unexpectedly small sized bulls are consumed for meat. An average edible meat weight was 43.2 kg with average edible meat ratio of 34.6%. Relationships of edible meat weight to body measurements showed a high correlation with carcass weight and body weight, a low correlation with body dimensions like withers height, body length and heart girth, and no correlation with heart girth/withers height. That the body type of Sinhala cattle has a wide variation, and no fattening is practiced is considered responsible for that result.

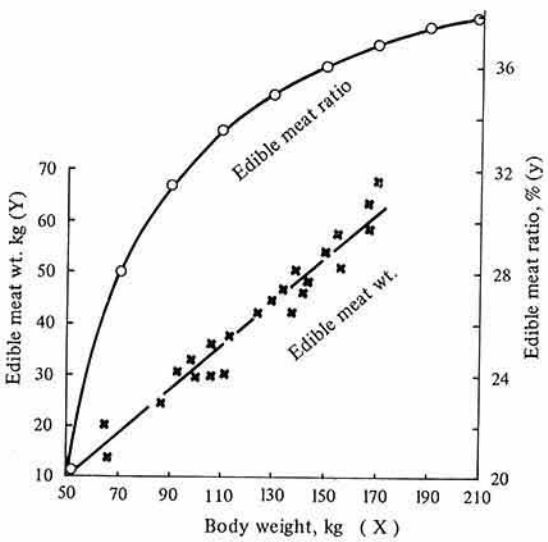

Fig. 1. Relationships of body weight (X) to edible meat weight (Y) and to edible meat ratio (y) in Sinhala bulls. The former relationship is expressed by $Y=0.43X-10.57$, and the latter by $y=Y/X$.

As the edible meat weight showed the highest correlation with body weight, among body measurements, a regression of edible meat weight (Y) against body weight (X) was calculated as follows:

$$Y=0.43\,X-10.57$$

Using this equation, changes of edible meat ratio (y) against body weight (X) were calculated as a curve shown in Fig. 1. The body weight at which the curve reaches its maximum was estimated, by extrapolation, to be 200–210 kg. Based on this result, it is considered that the optimum slaughter weight of Sinhala cattle is about 200 kg, because meat quality is not considered to be important in meat markets of Sri Lanka, and hence it is enough to select the stage with the maximum meat yield per head for slaughter. However, as the body weight of 200 kg is close to the mature body weight for Sinhala cattle, and the natural pastures in the dry zone, a main area of Sinhala cattle production, are likely to be in use already to a full extent, there is a great problem how to extend the feeding period and how to secure necessary feeds for that purpose.

In summary, it was made clear that the Sinhala cattle are able to consume roughages with a high efficiency of utilization, and their body weight gain is less affected by low nutritional condition than those of improved breeds. They show relatively high carcass ratios and high muscle: bone ratios, although their body is small in size and weight. The slaughter body weight for the maximum meat yield was estimated to be 200–210 kg of body weight, suggesting that the optimum slaughter time for Sinhala bulls is at the stage of around

200 kg of body weight.

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