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Research Article

Effect of age on the grading of carcass of indigenous cattle in Bangladesh

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Abstract

The objective of this study was to examine the effect of age on the grading of carcass of indigenous cattle. This experiment was conducted with five (5) treatments (T_1, T_2, T_3, T_4 and T_5) where T_1 = 0 Permanent incisor, T_2 = 2 Permanent incisors, T_3 = 4 Permanent incisors, T_4 = 6 Permanent incisors, T_5 = 8 Permanent incisors having ten (10) replications. From this study, the mean rib eye muscle area (REA) and the mean rib fat thickness was 43.26, 49.93, 61.38, 70.43, 69.24 cm^2 and 0.61, 0.68, 0.66, 1.07 and 0.97 cm with T_1, T_2, T_3, T_4 and T_5, respectively. The mean retail cut percentage of our indigenous beef cattle was 52.36, 52.27, 53.32, 52.69 and 52.58 with T_1, T_2, T_3, T_4 and T_5 dental age groups, respectively. It also reveals that the overall maturity (on the basis of skeletal maturity and lean maturity) of indigenous beef cattle was A^{80}, B^{90}, C^{90}, D^{80} and E^{80} withT_1, T_2, T_3, T_4 and T_5 dental age groups, respectively. Indigenous cattle population was fallen in the marbling sub groups of $Slight^{91}$, $Small^{90}$, $Small^{59}$, $Modest^{57}$ and $Moderate^{40}$ with T_1, T_2, T_3, T_4 and T_5 dental age groups, respectively. With the combination of overall maturity and marbling score, indigenous cattle for beef production possess in the quality grade of Select, Choice, Commercial, Utility and Utility with respect to T_1, T_2, T_3, T_4 and T_5 dental age groups. Indigenous cattle did not satisfy the criteria for the highest quality grade e.g., Prime to Standard and the lowest quality grade e.g. Cutter to Canner. In conclusion, dental age maturity had a highly significant ($p<0.001$) effect on average skeletal maturity, marbling score of the carcass and also had a significant ($p<0.01$) effect on rib fat thickness as well as on rib eye muscle area (REA) irrespective of all age group of indigenous beef carcass in Bangladesh. This research will play a vital role in the path toward the development of Bangladeshi beef standards and will be helpful to grade indigenous beef cattle at butcher or commercial beef industries level.

Introduction

Livestock is a vital part of agricultural economy in Bangladesh, serving a variety of purposes including the provision of food, nourishment, revenue, savings, social, and cultural needs. (Rahman et al., 1999; Hossain et al., 2016; Kamal et al., 2019, 2020, 2022a & 2022b; Hasan et al., 2021 & 2022; Islam et al., 2022). The rural poor, notably landless, destitute, and divorced women, are turning to the beef fattening industry as a source of employment and income (Islam et al., 2022). Small farmers in Bangladesh currently generate a significant return from raising cattle for beef production (Ahmed et al., 2010; Kamal et al., 2019). In Bangladesh, the predominant source of beef are the old, unproductive bullocks, cows and slaughtered farm animals as well as some imported animals' livestock from the nearby nation of India (Hosain et al., 2015).

One of the major characteristics of the small-scale beef production which supplies the informal or formal market is the unavailability of records to determine the age of animals for sell. Beef cattle of unknown ages are on offer on the informal market and pricing of animal has been very difficult (Van Rooyen et al., 2007). Elsewhere, age determination of beef cattle by means of dentition has generally been done using the norms accepted for sheep and goat (Wilson and Durkin, 1984). Deciduous teeth (milk teeth) erupt first and are replaced by permanent teeth. The time of eruption or breaking through the gums by the teeth is probably the most accurate aid criterion of determining the age of animals when no other accurate records are available. There is need to know the age of animals on offer because age has been known to affect carcass yield, edible body parts and meat offal's in beef cattle (Aduku et. al., 1991; Skapetas et. al., 2006). The grade of a beef carcass is critical to the beef producer, since the economic value received is directly dependent upon the grade (USDA, 1997). USDA beef grading standards state that carcass maturity is determined by evaluating the size, shape, and ossification of the bones and cartilages, especially the split chine bones, and the color and texture of the lean. Over the years, the USDA beef grading system has been criticized for its imprecision due to the subjective methodology used for determining grades. Highly subjective USDA beef grading system lacked accuracy and consistency, and these shortcomings would persist until objective grading instruments could be developed (Emerson et al., 2013). South Africa and Australia use the number of permanent incisors present at slaughter to estimate maturity in their beef carcass classification systems (Government Gazette, 1990; AUS-MEAT, 1995). The South African system uses dentition scores of A, B, and C, where A - no permanent incisors, B - one to six permanent incisors, and C - seven or eight permanent incisors. The Australian system consists of dentition age grades (zero, two, four, seven, or eight permanent incisors) (Lawrence et al., 2001). Most countries follow some basis for grading of beef carcass e.g., EUROP, USDA, AUS-MEAT etc.The knowledge of differences between carcasses has sufficiently great economic impact that the meat industry has changed throughout the world (Cross and Savell, 1994). Evaluation of beef carcass yield and quality traits is relevant for consumers, cattle producers and meat packers. It is clear that carcasses offering the most sought-after quality standards and best yield are the most valuable (Kempster et al., 1982). Meat scientists have developed a methodology for measuring carcass attributes that affect meat yield and palatability traits. Segregation by quality and quantity attributes has helped beef producers worldwide to better meet the demands of the consumer. In South-east Asia as well as in Bangladesh no research on beef grading has been conducted yet. Moreover, no database is available to recognize the yield and quality attributes of beef carcasses nationwide in Bangladesh. Certainly, this research will play a vital role in the path toward the development of Bangladeshi beef standards. Only limited research is reported on slaughter age determination in beef cattle and lamb in Bangladesh (Ali et al., 2013). The objective of this study was to know the effect of dental age on the grading of carcass on average skeletal maturity, marbling score, rib fat thickness, rib eye muscle area (REA) and hot carcass weight of indigenous cattle.

Materials and Methods

Experimental design

The experiment was conducted with five (5) treatments (T_1, T_2, T_3, T_4 and T_5) having ten (10) replications of different age group of animals. The total number of animals of different age group was fifty (50).

Ribbing

Ribbing is the process of one or both sides of the carcass between the 12th and 13th rib to expose the ribeye (longissimus) muscle, marbling and fat thickness. After sawing, a knife was used to follow the curvature of the 12th rib to complete the exposure of the ribeye muscle, so marbling, ribeye area, lean firmness, color and texture, and fat thickness was determined (Boggs and Merkel, 1990). Beef carcass quality grading was based on (1) degree of maturity and (2) degree of marbling.

Carcass maturity

Maturity refers to the physiological age of the animal rather than the chronological age. Because the chronological age is virtually never known, physiological maturity is used; and the indicators are bone characteristics, ossification of cartilage, color and texture of ribeye muscle. (Boggs et al., 1990). Cartilage was those associated with the vertebrae of the backbone. Cartilage was considered in arriving at the maturity group. The buttons were the most prominent, softest and least ossified in the younger carcasses. Table 1 shows that, as maturity proceeded from A to E, progressively more and more ossification became evident. Ribs were quite round and red in A maturity carcass, whereas E maturity carcasses had wide and flat ribs. Redness of the ribs gradually decreased with advancing age in C maturity, and they generally became white in color. Color and texture of the longissimus muscle was used to determine carcass maturity when these characteristics differed sufficiently from normal (Boggs and Merkel, 1990). In terms of chronological age, the buttons begin to ossify at 30 months of age. When the percentage ossification of the cartilage reaches 10, 35, 70, and 90 percent, the maturity is B, C, D, and E, respectively from Table 2.

Table 1. Carcasses are stratified into five maturity groups, based on the estimated age of the live animal

Carcass maturity	**Approximate live age** (Months)
A	9 - 30
B	30 - 42
C	42 - 72
D	72 - 96
E	> 96

Table 2. Ossification of the vertebral column

Vertebrae	**Maturity Group**				
	A	**B**	**C**	**D**	**E**
Sacral	Distinct separation	Completely fused	Completely fused	Completely fused	Completely fused
Lumbar	No ossification	Nearly completely ossified	Completely ossified	Completely ossified	Completely ossified
Thoracic	No ossification	Some ossification	Partially ossified	Considerable ossification (outlines of buttons are still visible)	Extensive ossification (outlines of buttons are barely visible)
Thoracic buttons	0-10%	10-35%	35-70%	70-90%	>90%

Source: Boggs and Markel, 1990.

Determination of marbling

Marbling (intramuscular fat) is the intermingling or dispersion of fat within the lean. Graders evaluate the amount and distribution of marbling in the ribeye muscle at the cut surface after the carcass has been ribbed between the 12th and 13th ribs. Degree of marbling was the primary determination of quality grade. Amount of marbling in the eye muscle area was divided into ten degrees. These 10 degrees from the lowest to the highest were: devoid, practically devoid, traces, slight, small, modest, moderate, slightly abundant, moderately abundant and abundant. Each degree of marbling was divided into 100 subunits (Boggs and Merkel, 1990).

Lean maturity determination

Table 3. Color and Texture

Maturity	Lean Color	Lean Texture
A^0	Light cherry-red	Very fine
B^0	Light cherry-red to slightly dark red	Fine
C^0	Moderately light red to moderately dark red	Moderately fine
D^0	Moderately dark red to dark red	Slightly coarse
E^0	Dark red to very dark red	Coarse

Source: Boggs and Merkel, 1990.

Determination of overall maturity

Step-Wise Procedure for Quality Grading Beef Carcasses:

Carcass skeletal maturity was determined by evaluating the degree of skeletal ossification in the top three thoracic vertebra (buttons), and the sacral and lumbar vertebra. Color and shape of the ribs were also evaluated. Then the lean maturity was determined by evaluating the color and texture of the lean in the ribeye exposed between the 12th and 13th ribs.

Skeletal Maturity + Lean Maturity = Overall Maturity

$A^{60} + A^{40} = A^{50}$ (Simple Average)

$B^{60} + A^{80} = B^{30}$ (>40; 10% to bone)

$C^{60} + B^{10} = C^{00}$ (B/C line)

$D^{60} + B^{20} = C^{60}$ (<=100% from bone)

Determination of final quality grade

After determination of degree of maturity and marbling, these two factors were combined to arrive at the final Quality Grade. The fundamentals involved in applying quality grades were learning the degrees of marbling in order from the lowest to the highest and minimum marbling degrees for each maturity group and understanding the relationship between marbling and maturity in each quality grade. The following chart was used to determine the quality grade (Boggs and Merkel, 1990).

Results and Discussion

Parameters related to grading

Descriptive statistics of the sample population presented in Table 4 indicates that dental age had a significant (p<0.01) effect on rib fat thickness and also had a significant (p<0.001) effect on REA irrespective of all age group. Means for instrumentally assessed Yield grade (YG) traits and retail cut percentage are also shown in Table 4. Dental maturity group has no significant effect on yield grade. Yield grade identifies cattle from differences in yields of boneless, closely trimmed retail cuts from the round, loin, rib and chuck. Yield grade is often used synonymously with cutability. The yield of boneless, closely trimmed retail cuts (cutability) is usually expressed as a percentage of carcass weight. However, the percentage figure is converted to yield grade designation between 1.0 to 5.9. A yield grade of 1.0 is equivalent to >52.3% whereas, a 5.9 yield grade is equivalent to <45.4% boneless, closely trimmed retail cuts from the round, loin, rib and chuck. The factors used to determine the yield grades are, the amount of external fat; the hot carcass weight; the amount of kidney, pelvic, and heart fat; and the area of the ribeye muscle (Boggs and Merkel, 1990). Moon et al. (2006) reported that in Korean Hanwoo beef females, yield grade decreases with the advances chronological age. He stated in his experiment that the yield grade of younger, middle and old aged beef cows was 2.10, 2.10 and 1.97, respectively. Moon et al. (2006) also found that chronological age has no significant effect on yield grade. This finding is well matched with present result that yield grade decreases with the advances of dental maturity. Boggs and Merkel (1990) also reported in the studies that as fat thickness, KPH and hot carcass increase, yield grade increases; whereas, as rib eye area increases, yield grade decreases. Our result is well consistent with the findings of Boggs and Merkel (1990). In another study, Garcia et al. (2008) stated that as USDA YG increased (from YG 1to YG 5), marbling, adjusted fat thickness, HCW, and KPH percentage also increased, whereas, LM area decreased. These relationships between carcass traits and our indigenous cattle YG are similar to those reported by Lorenzen et al. (1993), Boleman et al. (1998), and McKenna et al. (2002).

Table 4. Parameters related to grading and retail cut of beef (n=50)

Parameters (Mean±SE)	T_1	T_2	T_3	T_4	T_5	P value	Sig. level
Rib fat thickness(cm)	$0.61^{c}\pm0.10$	$0.68^{bc}\pm0.09$	$0.66^{bc}\pm0.13$	$1.07^{a}\pm0.12$	$0.97^{ab}\pm0.07$	0.01	**
Rib fat thickness(inch)	$0.24^{c}\pm0.04$	$0.27^{bc}\pm0.04$	$0.26^{bc}\pm0.05$	$0.42^{a}\pm0.05$	$0.38^{ab}\pm0.03$	0.01	**
REA (cm^2)	$43.26^{b}\pm3.55$	$49.93^{b}\pm3.30$	$61.38^{a}\pm3.19$	$70.43^{a}\pm3.18$	$70.43^{a}\pm3.18$	<0.001	***
REA ($inch^2$)	$6.71^{b}\pm0.55$	$7.74^{b}\pm0.51$	$9.51^{a}\pm0.49$	$10.92^{a}\pm0.49$	$10.73^{a}\pm0.31$	<0.001	***
KPH% on hot carcass basis	$2.45^{b}\pm0.08$	$3.02^{a}\pm0.12$	$2.35^{b}\pm0.20$	$3.36^{a}\pm0.28$	$3.11^{a}\pm0.23$	0.002	**
Hot carcass wt., kg	$68.51^{b}\pm6.92$	$90.13^{b}\pm5.54$	$120.48^{a}\pm11.59$	$134.83^{a}\pm10.98$	$139.45^{a}\pm8.72$	<.0001	***
Yield Grade	2.02 ±0.11	2.05±0.07	1.58±0.18	1.85±0.16	1.81 ±0.13	0.11	NS
Yield Grade	YG2	YG2	YG1	YG1	YG1		
% Retail cut	52.36±0.26	52.27 ±0.17	53.32 ±0.41	52.69±0.37	52.78±0.29	0.15	NS

T1 = 0 Permanent incisor, T2 = 2 Permanent incisors, T3 = 4 Permanent incisors, T4 = 6 Permanent incisors, T5 = 8 Permanent incisors; Means with different superscripts in a row differ significantly NS= Non significant, *p<0.05; **p<0.010 and ***p<.001.

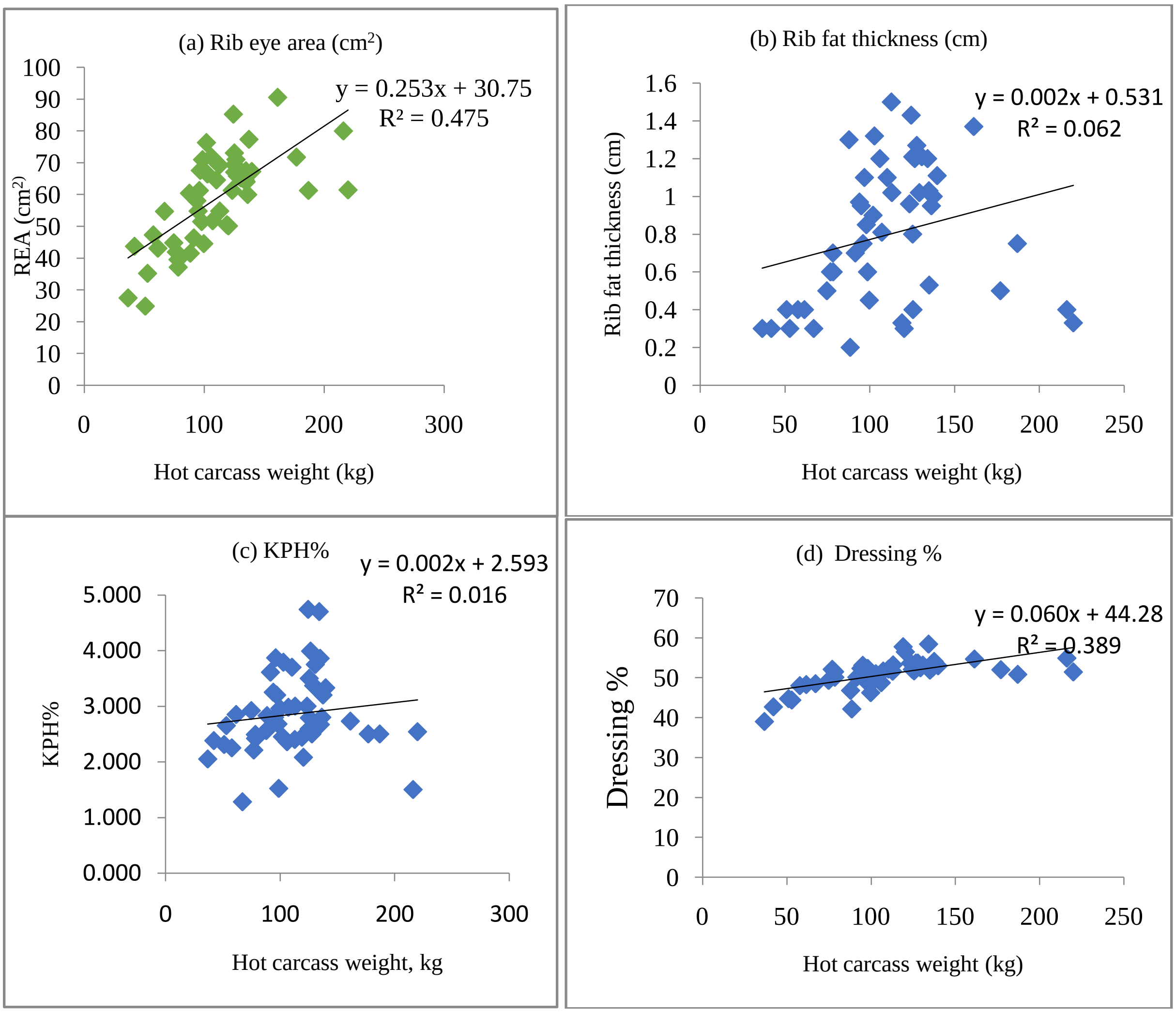

Figure 1. Relationship between the hot carcass weight and (a) ribeye area, (b) rib fat thickness, (c) KPH% and (d) Dressing %.

Relationship between hot carcass weight with ribeye area, rib fat thickness, KPH% and dressing % was showed in figure 1. It might be explained from the figure 1 that rib eye area (R^2=0.475) and dressing% (R^2=0.389) were positively correlated with hot carcass weight. In case of KPH% and rib fat thickness hot carcass weight was not highly correlated (0.216 and 0.016, respectively.

Quality grade and overall maturity

Relationship between quality grade and overall maturity on the basis of ossification and lean maturity score of carcass ossification presented in Table 5. It reveals from the Table 5 that dental age maturity group had a highly significant (p<0.001) effect on average skeletal maturity of the carcass. The average skeletal maturity (chronological age, in month) of indigenous beef cattle was 18.75, 26.10, 38.10, 62.40 and 84.00 withT_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively. It is also shown in the Table 5 that the average skeletal maturity (physiological age on the basis of ossification score of vertebral columns) of indigenous beef cattle was A^{80}, B^{90}, C^{90}, D^{80} and E^{80} withT_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively. It is also shown in the Table 5that the average lean maturity (physiological age on the basis of color and shape of the rib bone) of indigenous beef cattle was A^{80}, B^{80}, C^{90}, D^{80} and E^{80} with T_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively. It also reveals from the Table 5 that the overall maturity (on the basis of skeletal maturity and lean maturity) of indigenous beef cattle was A^{80}, B^{90}, C^{90}, D^{80} and E^{80} withT_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively.

Table 5. Relationship among quality grade and overall maturity on the basis of ossification and lean maturity score of carcasses (n=50)

Parameters	Dental Age (Permanent incisors)				
	T_1	T_2	T_3	T_4	T_5
Ave. skeletal maturity (months)	18.75^d±2.52	26.10^d±2.69	38.10^c±2.10	62.40^b±3.60	84.00^a±0.00
Skeletal maturity	A^{80}	B^{90}	C^{90}	D^{80}	E^{80}
Lean maturity	A^{80}	B^{80}	C^{80}	D^{70}	E^{70}
Overall maturity	A^{80}	B^{90}	C^{90}	D^{80}	E^{80}
USDA maturity level (Reference value)	A	B	C	D	E

T_1 = 0 Permanent incisor, T_2 = 2 Permanent incisors, T_3 = 4 Permanent incisors, T_4 = 6 Permanent incisors, T_5 = 8 Permanent incisors; Means with different superscripts in a row differ significantly; NS= Non significant, *p<0.05; **p<0.010 and ***p<.001.

Relationship between dental age and marbling

Comparison among USDA maturity group, dental age and marbling of indigenous cattle carcass was presented in Table 6. Dental age maturity group had a highly significant ($p<0.001$) effect on marbling score of the carcass. It reveals that indigenous cattle population possessed in the marbling sub groups of Slight^{91}, Small^{90}, Small^{59}, Modest^{57} and Moderate^{40}with T_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively when the marbling score was categorized in the form of marbling group. Noticeably, it can be concluded that the beef cattle population cannot satisfy the criteria for pertaining the marbling sub group of Abundant, Moderately Abundant and Abundant. On the other hand, our native stock pertains much better criteria rather than those of the criteria related to the marbling sub group of Devoid, Practically Devoid and Traces.

Table 6. Comparison among USDA maturity group, dental age and marbling of indigenous cattle carcass (n=50)

Parameters	T_1	T_2	T_3	T_4	T_5
Age based on dentition (month, Reference value)	14-18	18-24	30-36	42-60 60-84	84-120 120-144
Ave. skeletal maturity (months)	18.75^{d}±2.52	26.10^{d}±2.69	38.10^{c}±2.10	62.40^{b}±3.60	84.00^{a}±0.00
Age based on USDA maturity level (month, Reference value)	9 to <30	30 to <42	42 to <72	72 to < 96	96 and over 96
USDA maturity level (Reference value)	A	B	C	D	E
Marbling score (1-1000) (Mean±SE)	391.00^{c}±33.65	490.00^{bc}±42.48	459.00^{bc}±35.92	557.00^{ab}±45.07	640.00^{a}±22.99
Marbling group	Slight^{91}	Small^{90}	Small^{59}	Modest^{57}	Moderate^{40}

T_1 = 0 Permanent incisor, T_2 = 2 Permanent incisors, T_3 = 4 Permanent incisors, T_4 = 6 Permanent incisors, T_5 = 8 Permanent incisors; marbling score represents Devoid 0-100, Practically devoid101-200, Traces 201-300, Slight 301-400, Small 401-500, Modest 501-600, Moderate 601-700, Slightly abundant 701-800, Moderately abundant 801-900 and abundant 901-1000; NS= Non significant, *p<0.05; **p<0.010 and ***p<.001.

Correlation matrix among selected beef grading properties

Correlations among color physical variables and other beef grading traits are presented in Table 7 shows that hot carcass weight, rib fat thickness, REA, b*, c*, fat%, yield grade and marbling score were positively associated with each other. Since the measurement of color can be an easy and fast method, it is important to know the relationship between these measurements and other beef quality traits in order to predict the beef quality. In Table 7 it has been shown that the color band L* and a* are negatively correlated (r=-0.11). It is fully consistent with the findings of Moss et al., 1994 where they revealed that L* and a* are non-significantly (p>0.05) and negatively correlated in meat species. The findings of Insausti et al. (2008) also supported our findings. Hot carcass weight was associated with REA (r=.72, p<0.001); a* (r=0.54, p<0.05); h* (r=-0.68, p<0.01); fat% (r=0.60, p<0.05); yield grade (r=0.70, p<0.001) and retail cut% * (r=-0.72, p<0.001). The association was also observed between a* and b* (r=0.80, p<0.001); a* and c* (r=0.95, p<0.001); a* and h* (r=-0.67, p<0.001); a* and fat% (r=-0.74, p<0.001); b* and c* (r=0.95, p<0.001); yield grade and retail cut% (r=-0.99, p<0.001); yield grade and marbling score (r=0.68, p<0.001) and Retail cut% marbling score (r=-0.68, p<0.05). In other cases, the above stated variables in Table 7 were non-significantly (p>0.05) and positively or negatively correlated.

Table 7. Pearson correlation coefficients among selected beef grading properties (n=15).

Parameters	Mean±SD	1	2	3	4	5	6	7	8	9	10	11
1. Hot carcass wt., kg	112.46± 41.18											
2. Rib fat thickness, cm	0.71±0.39	0.08^{NS}										
3. REA, cm^2	61.86±18.41	0.72***	0.52^{NS}									
4. L*	28.00±2.44	-0.41^{NS}	0.07^{NS}	-0.17^{NS}								
5. a*	7.38±1.59	0.54*	0.02^{NS}	0.40^{NS}	-0.11^{NS}							
6. b*	9.40±1.32	0.20^{NS}	0.08^{NS}	0.10^{NS}	0.02^{NS}	0.80***						
7. c*	12.00±1.92	0.38^{NS}	0.05^{NS}	0.26^{NS}	-0.05^{NS}	0.95***	0.95***					
8. h*	52.04±3.57	-0.68**	0.05^{NS}	-0.59*	0.14^{NS}	-0.67***	-0.13^{NS}	-0.43^{NS}				
9. Fat%	3.40±0.32	0.60*	0.05^{NS}	0.37^{NS}	-0.41^{NS}	0.74***	0.45^{NS}	0.63*	-0.61*			
10. Yield Grade	4.12±0.56	0.70***	0.76***	0.87***	-0.19^{NS}	0.37^{NS}	0.16^{NS}	0.27^{NS}	-0.44^{NS}	0.43^{NS}		
11. Retail cut%	47.46±1.32	-0.72***	-0.74***	-0.87***	0.20^{NS}	-0.38^{NS}	-0.16^{NS}	-0.2^{NS}	0.46^{NS}	-0.44^{NS}	-0.99***	
12. Marbling score (1-1000)	481.54±107.61	0.38^{NS}	0.61*	0.57*	0.40^{NS}	0.38^{NS}	0.35^{NS}	0.38^{NS}	-0.26^{NS}	0.20^{NS}	0.68***	-0.68**

Lightness (L*), Redness (a*), Blueness (b*), Chroma (c*) and Hue (h*); NS= Non-significant; *p<0.0; **p<0.010 and ***p<.001.

Relationship between USDA quality grade and quality grade of indigenous cattle

Comparison between USDA quality grade and quality grade of Bangladesh indigenous cattle presented in Table 8 indicates that the overall maturity (on the basis of skeletal maturity and lean maturity) of indigenous beef cattle was A^{80}, B^{90}, C^{90}, D^{80} and E^{80} with T_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively. It is also revealed that when the marbling score of indigenous beef cattle was transformed to marbling group the experimental cattle population was fallen in the marbling sub groups of Slight^{91}, Small^{90}, Small^{59}, Modest^{57} and Moderate^{40} with T_1, T_2, T_3, T_4 and T_5 dental age maturity groups, respectively. With the combination of overall maturity and marbling score, indigenous beef cattle possess in the quality grade of Select, Choice, Commercial, Utility and Utility with respect T_1, T_2, T_3, T_4 and T_5 dental age maturity groups. On the contrary indigenous cattle did not possess the highest quality grade e.g., Prime to Standard and the lowest quality grade e.g., Cutter to Canner.

Table 8. Comparison among USDA quality grade and quality grade of indigenous cattle of Bangladesh (n=50)

Parameters	Dental Age (Permanent incisors)							
	-	-	-	T_1	T_2	T_3	T_4	T_5
Degree of marbling	Abundant to Slightly Abundant	Moderate to Small	Abundant to Small	Slight[91]	Small[90]	Small[59]	Modest[57]	Moderate[40]
Maturity level	-	-	-	A[80]	B[90]	C[90]	D[80]	E[80]
USDA Quality Grade	Prime	Choice	Standard	-	-	-	-	-
Quality Grade (Bangladesh)	No	No	No	Select	Choice	Commercial	Utility	Utility

T_1 = 0 Permanent incisor, T_2 = 2 Permanent incisors, T_3 = 4 Permanent incisors, T_4 = 6 Permanent incisors, T_5 = 8 Permanent incisors; marbling score represents Devoid 0-100, Practically devoid101-200, Traces 201-300, Slight 301-400, Small 401-500, Modest 501-600, Moderate 601-700, Slightly abundant 701-800, Moderately abundant 801-900 and abundant 901-1000.

Relationship among marbling, maturity and carcass quality grade of indigenous cattle of Bangladesh

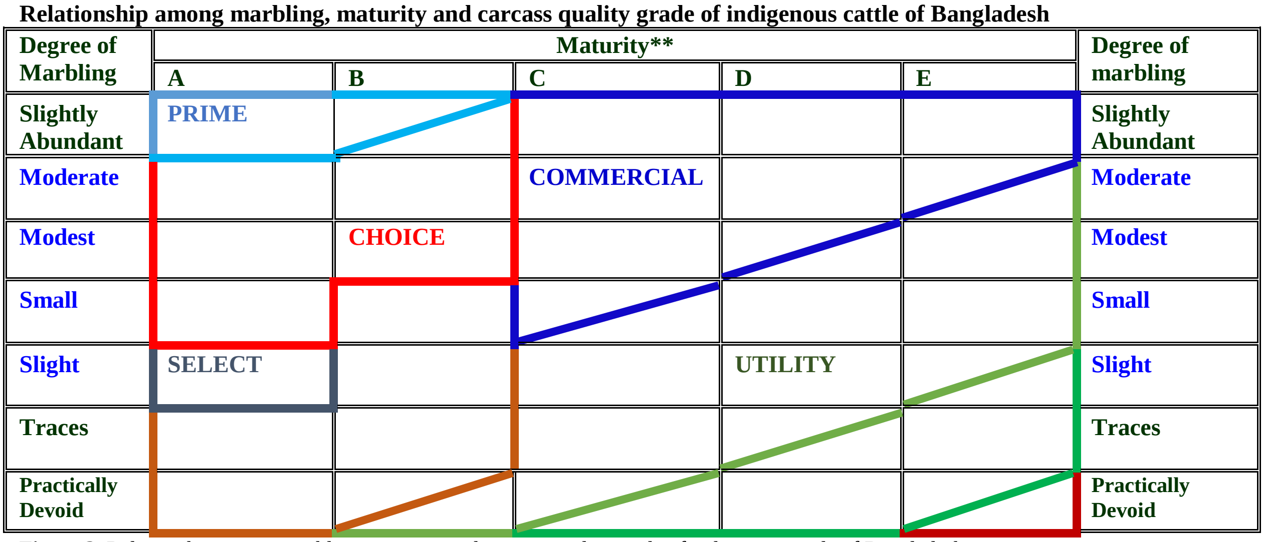

Figure 2. Relationship among marbling, maturity and carcass quality grade of indigenous cattle of Bangladesh.
*Assume that firmness of lean comparably developed with the degree of marbling and that the carcass is not a 'dark cutter'** Maturity increases from left to right (A through E).

It is the view that beef grading schemes that are focused on a consumer outcome need to be developed and implemented to underpin value-based payment (VBP). A logical next step would be the formation of a large scale international collaborative effort which would be directed at transforming the meat industry into marketing a contemporary consumer product that may grow demand, while also improving production efficiency through transparent VBP systems.

The most important potential use of dental age classification is in beef carcass grading and it is commonly used for this purpose. In Bangladesh, this database will be helpful to grade indigenous beef cattle at butcher or commercial beef industries level.

Conclusions

It can be concluded that, dental age maturity had a highly significant effect on beef carcass grading and it is commonly used for this purpose. The use of dental age would ensure a more accurate identification of youthful carcasses and so ensure a more standard of meat quality.

Conflicts of Interest

The authors declare no potential conflict of interest.

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