

26 Specifications and Grading Systems for Beef: Japan, USA, Korea and Australia

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Learning objectives

The objective of this lecture is to outline the main features of the grading systems of our major trading partners, Japan, United States and Korea.

At the end of this section you will be able to:

1. describe the Japanese, Korean and USA grading schemes
2. compare the various attributes which are considered important in assigning grades in the different countries

26.1 Introduction

Japan, the United States and Korea all have grading systems based on yield and quality grade, as assigned by end point assessment of the carcass. This differs from Meat Standards Australia (MSA), Australia's new domestic grading scheme, which is covered in a separate chapter. The Australian carcass specification system (AUS-MEAT) is briefly discussed. It is a trading language rather than a grading system.

Figure 26.1 Japanese Graders examining the eye muscle of sides, which have been broken at the 6/7th rib, to assess marbling, colour and texture. Photograph supplied by D. Perry.



26.2 Japanese carcass grading system

In April 1988 the beef carcass grading system in Japan was revised and new standards established. The Japan Beef Grading System is based on a YIELD and QUALITY grade. There are three yield grades: A, B and C which are classified by yield percentage estimates and five quality grades (1, 2, 3, 4, 5) based on 4 quality traits. Carcasses are assessed between the 6th and 7th ribs. The overall final grade is decided by combining the yield and quality grades, resulting in 15 possible classes (Table 26.1).

Notes – Lecture 26 – Specifications and Grading Systems for Beef: Japan, USA, Korea and Australia

Table 26.1 Division of classes in the Japanese Grading System.

Source: Japan Meat Grading Assoc. (1988).

Meat quality score					
Yield score	5	4	3	2	1
A	A5	A4	A3	A2	A1
B	B5	B4	B3	B2	B1
C	C5	C4	C3	C2	C1

Yield The yield score is determined utilising a regression equation using four carcass measurements. These are: rib eye area, rib thickness, cold left side weight and subcutaneous fat thickness. The equation used for yield estimation is:

$$\text{Estimated \%} = 67.37 + (0.130 \times \text{Rib eye area cm}) + (0.667 \times \text{Rib thickness cm}) - (0.025 \times \text{Cold left side weight kg}) - (0.896 \times \text{Subcutaneous fat thickness cm})$$

You obviously will not walk around with this in your head, so the main point to remember is the *classification* of yield grade (Table 26.2).

Table 26.2. Yield categories in the Japanese beef grading system.

Source: Japan Meat Grading Assoc. 1988.

Grade	Yield estimated %	Specification
A	72% and above	Above average
B	<69% to 72%	Average
C	< 69%	Below average

Yield average value is determined so as to normally distribute around the B rank. The sites where the carcass measurements are taken are illustrated in Figure 26.2

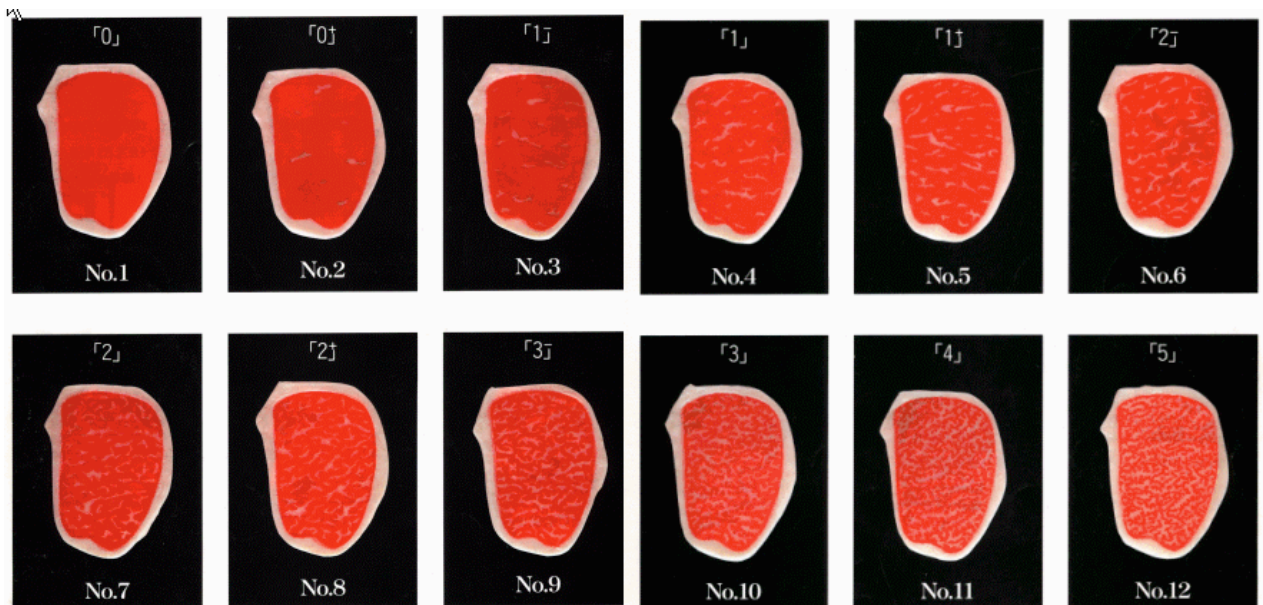
Quality Meat quality score is determined in terms of 1) marbling, 2) meat colour and brightness, 3) firmness and texture of meat, and 4) colour, lustre and quality of fat.

Figure . 26.2. Site of carcass measurements on the 6th to 7th rib section.
Source: Japan Meat Grading Assoc. (1988).



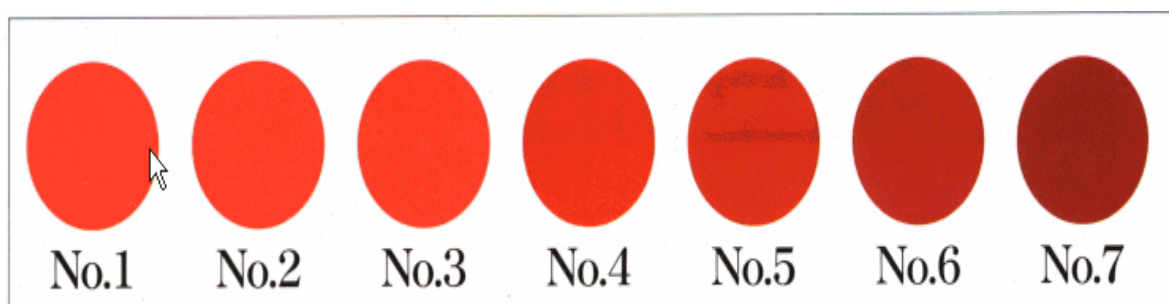
Marbling: There are 12 standards of marbling in the Japanese system (Figure 26.3), with 12 having the most marbling.

Figure . 26.3. The Japanese marbling standard chips.
Source: Japan Meat Grading Assoc. (1988).



Colour and brightness of meat: The beef colour standards (BCS) consist of seven continuous standards, numbered 1 to 7. Brightness is evaluated visually. The final decision of grade is determined by a combination of colour and brightness. The grades are specified on page 6 of the Japanese booklet (Japan Meat Grading Association 1988). The grades are numbered 1 to 5: 1 is inferior (dark) and 5 is very good. It is interesting to note that the Very Good (Grade 5) comes from BCS scores 3 to 5, Good (Grade 4) comes from BCS scores 2 to 6, Average (Grade 3) from 1 to 6, and Below Average (Grade 2) from 1 to 7.

Figure . 26.4. The Japanese meat colour chips. Source: Japan Meat Grading Assoc. (1988).

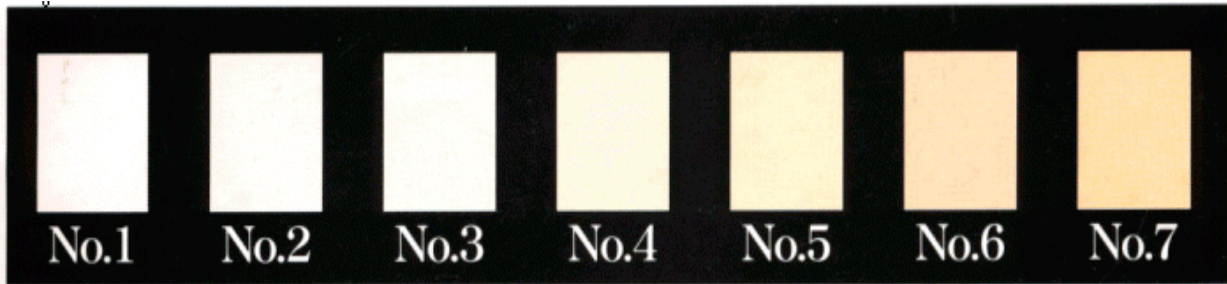


Firmness and texture of meat Two factors are evaluated by visual appraisal and are classified into five grades, from 1 to 5. 1 is inferior with a coarse texture and 5 is very good with a very fine texture.

Colour, lustre and quality of fat Fat colour is evaluated by use of beef fat standard (BFS) scores ranging from 1 to 7. Lustre and quality are evaluated by visual appraisal. The three combine to provide the final grade. Grade 5 is excellent fat colour with BFS scores of 1 to 4 and Grade 2 (below average) from 1 to 7.

Notes – Lecture 26 – Specifications and Grading Systems for Beef: Japan, USA, Korea and Australia

Figure 26.5. The Japanese fat colour chips. Source: Japan Meat Grading Assoc. (1988).



Determination of overall meat quality score. Overall meat quality score is graded DOWN to the lowest grade amongst the four items listed above. The assessment may be as follows:

Table 26.3. Overall meat quality score. Source: Perry, (2005).
(The overall meat quality score is therefore 3)

Beef marbling	4
Colour and brightness	4
Firmness and texture	3
Fat colour, lustre and quality	4

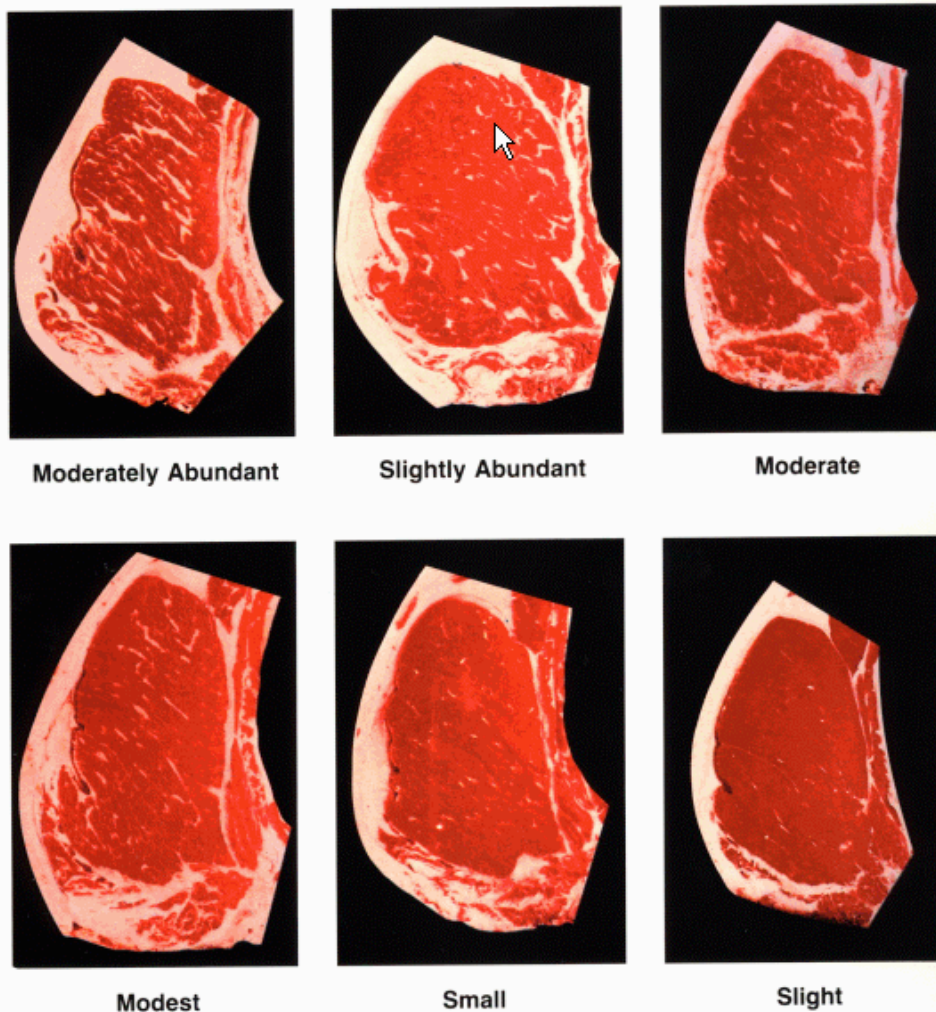
The final carcass grade is stamped on the carcass as a combination of the yield and quality grades. The grading of meat carcass animals is managed by the Japan Meat Grading Association and is performed at the meat wholesale markets and meat centres in Japan.

26.3 United States carcass grading scheme

In the United States, the demand is for high quality lean beef with a minimum of waste in the form of either fat or bone. Beef quality characteristics are of importance because of their relation to palatability of the cooked meat and to the appearance of cuts at the retail counter. The United States does not differ from Australia in their quest for the highest meat quality standard with the greatest yield of the high value retail cuts with the least amount of trim.

Beef quality attributes of most importance are maturity, marbling, texture of lean, firmness of lean and fat, and the colour of the lean and fat. Consumers do not like soft, dark and coarse meat. In the US, it is accepted that the attributes of maturity, marbling, texture and firmness have been related to tenderness, flavour and juiciness in varying degrees. The location used for assessment is the rib eye or *M. longissimus dorsi* muscle in the ribbed carcass. The preference is for firm, fine-textured meat of a bright cherry red colour. It is well marbled and the marbling is fine in texture and uniformly distributed. There is no evidence of excess surface moisture. A body with coarse marbling and heavy bands of connective tissue and coarse stringy meat is down-graded.

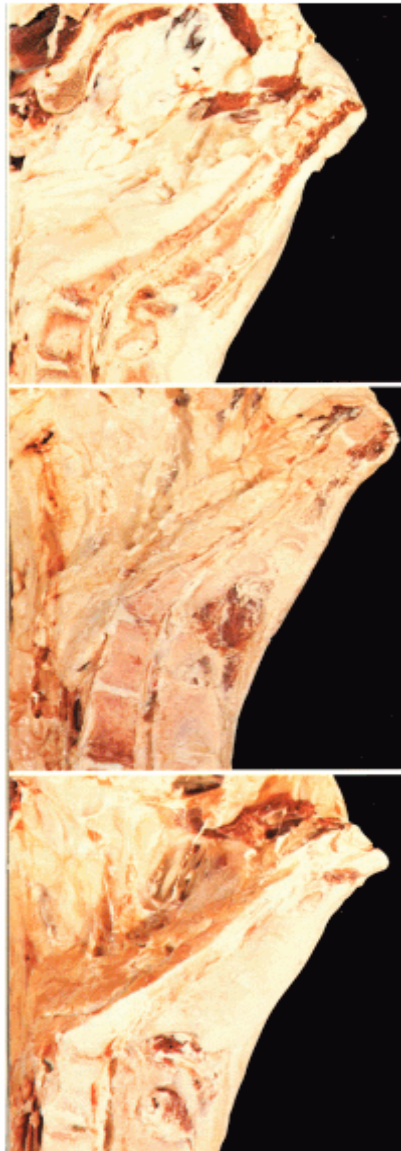
Figure 26.6. The USA marbling chips.
Source: US National Livestock and Meat Board (1988).



The US system pays great attention to the maturity of the animal, as it is considered to be closely associated with the eating quality of beef. Maturity is assessed largely by examination of the vertebrae of the animal. In young animals, the processes of the split dorsal vertebrae are soft, red, porous and are tipped with large amounts of soft, pearly white cartilage, especially in the thoracic vertebrae.

As the animal ages and matures, these parts of the skeleton become harder, whiter and the cartilaginous buttons become ossified. Changes in ossification become obvious first in the posterior portion of the vertebral column (sacral vertebrae), up near the tail. As the animal matures, progressive ossification changes are observed in the lumbar vertebrae, the posterior thoracic vertebrae and finally the anterior thoracic vertebrae. In very mature carcasses, all of the cartilage on the anterior thoracic vertebrae is completely ossified. This is typical of old cows and bulls. The meat colour becomes darker as the animal matures. Veal lean is typically a pale pink and mature cows are usually a deep dark red colour.

Figure 26.7. The USA ossification standards.
Source: US National Livestock and Meat Board (1988).



Fat colour and texture are also important, with a preference for firm, white (free of greasy or oily appearance) fat. Yellow fat has a lower consumer appeal and typically comes from pasture-fed animals. The yellow fat is due to the concentration of fat-soluble carotinoid pigments in the fat. In the US the fat of pasture fed animals is generally softer and more oily than that of grain-fed animals.

After highlighting the quality characteristics preferred and assessed in the US, **cutability** and **yield** are the other major features considered in the grading system. The actual classifications of the US grading system are covered later in this lecture. Cutability refers to the proportion of the carcass that is saleable as trimmed (boned or partially boned) retail cuts. The yield of saleable beef is greatly influenced by the amount of excess trimmable fat and by muscling. Ideal carcass finish or amount of fat covering the carcass in the US is around a third of an inch, measured at the 12th rib. A thin uniform covering is preferable. It is recognised that heavier deposits of fat can be expected in the flank, brisket, plate, cod or udder, as well as the rump, sirloin and chuck. For this reason, it is important to make your overall assessment taking all of the areas of the body into account.

Figure 26.8 The relationship between marbling, maturity and carcass quality grade. Source: US National Livestock and Meat Board (1988).

Degrees of Marbling	Maturity ²				
	A ³	B	C	D	E
Slightly Abundant	PRIME				
Moderate			COMMERCIAL		
Modest	CHOICE				
Small					
Slight	SELECT		UTILITY		
Traces					
Practically Devoid	STANDARD			CUTTER	

¹Assumes that firmness of lean is comparably developed with the degrees of marbling and that the carcass is not a "dark cutter."

²Maturity increases from left to right (A through E).

³The A maturity portion of the Figure is the only portion applicable to bullock carcasses.

Classification and grading In 1916, the USDA formulated tentative standards for grades of beef. These were meant to provide the basis for a National Meat Reporting Service. Further refinement occurred in later years with the Official US Standards for Grades of Carcass Beef set on 3 June, 1926. The use of Federal grades by industry is on a voluntary basis and in no way compulsory. Individual packers can and do use in-house grading and branding systems in the US. The grading service is operated on a self supporting basis, the necessary funds being derived from fees collected from users of the service.

Factors determining class and grade. **Class** refers to carcasses or cuts derived from the same species or kind of animal and having a similar commercial use. The grouping of carcasses according to their degree or relative development of these desirable physical characteristics constitutes grading. A **grade** includes a group of a class with a sufficiently narrow range in grade-determining factors to give a degree of interchangeability of individual units.

Basis for quality grade. The basic considerations are twofold. They are (1) to reflect or measure differences in the proportion of the more desirable to less desirable parts of the carcass and the ratio of meat to bone; and (2) to evaluate the characteristics of the meat which are associated with ultimate palatability.

Conformation Conformation as considered in grading meat refers to the proportionate development of the various parts of the carcass or wholesale cut and to the ratio of meat to bone. Conformation is a direct measure of one major consideration— in grading meat the relative proportion of more desirable to less desirable parts and the percentage of useable meat.

Quality. Quality refers to the relative desirability or expected palatability of the meat in a carcass or cut. It is measured primarily in terms of marbling and firmness of lean in relation to maturity. Assessment is performed at the 12th/13th rib site of the rib eye. Indicators of intra-muscular fat in unribbed carcasses are feathering between the ribs, fat streaking in the inside flank muscles and firmness of the fat and lean. The amount of external fat is one of the least reliable indicators of

Notes – Lecture 26 – Specifications and Grading Systems for Beef: Japan, USA, Korea and Australia

intra-muscular fat. Excellent quality in meat usually implies a full, well developed, firm muscle of fine texture and bright colour, containing a liberal amount of and a minimum of connective tissue.

The quality grades are Prime, Choice, Select, Standard, Commercial, Utility, Cutter and Canner, decreasing in order of quality. In practice, you first establish the maturity of the body then assess the degree of marbling and make your grade. Degrees of range from Slightly Abundant, Moderate, Modest, Small, Slight, Traces, Practically Devoid. Maturity range is from A to E, A being young and E being old.

Yield grade. The USDA adopted yield grades for beef carcasses in 1965. These are designed to identify carcasses for differences in cutability or yield of boneless, closely trimmed retail cuts from the round, loin, rib and chuck. Four features are considered. Source: Perry, 2005.

1. the amount of external fat;
2. the amount of kidney, pelvic and heart fat;
3. the area of the rib eye muscle; and
4. the carcass weight.

The yield grade operates on a scale of 1 to 5. Grade 1 represents the highest yield and Grade 5 the lowest. Similar to the Japanese system, the USDA system uses a yield grade equation based on the factors listed above to calculate final yield. Two stamps are put on a body, one for yield and one for quality. An example would be yield grade 2 and Prime stamped as the quality grade.

26.4 Korean grading system

The Korean government introduced a beef carcass grading system in 1992. The overall grade is a combination of a quality grade and a yield grade.

Quality. Quality grades are based on the colour, firmness and texture of the lean, maturity of the carcass, fat colour, and marbling in the rib eye muscle (*M. longissimus dorsi*) at the level of the 13th rib (National Livestock Cooperatives Federation 1998). There are 4 quality grades, from Grade 1+ (highest quality, most desirable) to 3 (least desirable). To achieve a Grade 1+ the meat must have a marble score of 6 or 7, to achieve a Grade 1 it must have a marble score of 4 or 5, for Grade 2 it must have a marble score of 2 or 3. Marble standards range from 1: devoid, to 7: very abundant. Meat and fat colour standards are similar to those used in Japan. The maturity of the carcass is determined by evaluating colour, shape and ossification of the bones and cartilages.

Yield. There are 3 yield grades, based on retail cut percentage. Yield grade A: retail cut percentage greater than 69%. Yield grade B: retail cut percentage from 66-69%. Yield grade C: retail cut percentage less than 66%. Retail cut percentage is determined using an equation based on back fat thickness (subcutaneous fat), rib eye area, and carcass weight.

26.5 Australia

Australia has a carcass description scheme (AUS-Meat) which has been in place since the late 70's. This is a system of standardised language used to describe carcasses for trading. It is not a grading scheme. It is complimented by the implementation of MSA. Whereas AUS-Meat has focused on providing an accurate description of commercial carcass traits, MSA has focused on predicting the palatability of cuts for specific cooking procedures. These systems compliment one another, rather than being interchangeable. The AUS-Meat language specifies age, carcass weight (based on standard trim), fatness (fat depth), and whether grain or grass fed. AUS-Meat also measures traits such as marbling, meat colour and fat colour, but it does not assign any prediction of eating quality to these descriptions. They are for use in meeting market specifications.

Readings

There are no readings for this topic.

Summary

Summary Slides are available on web learning management systems

- Japan and Korea assess quality and grade separately, and then assign a combined grade based on these
- The USA assesses quality and yield separately, and stamps each carcass with these separate grades
- All three countries calculate yield percentage using an equation based on carcass weight, subcutaneous fat depth and eye muscle area. They then divide the carcasses into 3 to 5 scale grades based on percentage yield.
- All three countries base their quality grades mainly on assessment of marbling in the rib eye muscle (*M. longissimus dorsi*).
- Japan has 12 marbling (112) standards and seven meat- and fat colour standards (17). The USA has six marbling standards (Slight to Moderately Abundant) and subjective assessment (no set standards) of meat- and fat colour. Korea has 7 marbling standards (17) which are more similar to the US than to Japan. Korea uses the same meat and fat colour standards as Japan.
- The US marbling standards are actual photographs of meat, whilst the Japanese and Australian standards are computer generated images.
- Quality grades are assigned on endpoint measurements or assessments made on the carcass. Compare this with the MSA system, covered in a separate lecture.

References

- Anon 1998. Handbook of Australian Meat 6th Edition AusMeat, Brisbane
- Japan Meat Grading Association. New Beef Carcass Grading Standards. Japan: Japan Meat Grading Association, 1988.
- Kim CJ and Lee ES. 2003. Effects of quality grade on the chemical, physical and sensory characteristics of Hanwoo (Korean native cattle) beef. Meat Science– vol 63 pp 397-405.
- National Live Stock and Meat Board. Meat evaluation handbook. USA: National Live Stock and Meat Board, 1988.
- National Livestock Cooperatives Federation (NLCF) 1998. Korean carcass grading standard. Seoul: National Livestock Cooperatives Federation

Notes – Lecture 26 – Specifications and Grading Systems for Beef: Japan, USA, Korea and Australia