

APPENDIX C: THE JAPANESE BEEF LANGUAGE

Author: R. Polkinghorne

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 Birkenwood Pty Ltd, Merringanee, 431 Timor Road, Murrurundi,
 NSW 2338. Email: Rod.Polkinghorne@gmail.com

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KEY POINTS

- There is a clear distinction at all trade levels between full blood Japanese Black (Wagyu¹) cattle, dairy beef and the F1 cross between the two.
- Beef cattle represent 65% of the Japanese cattle herd and 46% of Japanese beef production.
- Imported beef accounts for 60% of total beef supply with Australia the largest supplier.
- Most traditional Japanese farms are either breeding or fattening with the connecting point a live animal auction. Some vertical integration is occurring in response to the small scale and increasing age of traditional breeding farm owners.
- Pedigree data is critical for full blood Japanese Black calves but less so for dairy and of intermediate importance for F1.
- Cattle must have individual ID and whole of life RFID traceability. Japanese Black cattle are also identified by nose print, the cattle equivalent to fingerprints.
- The farmer pays a charge for slaughter and grading, retaining ownership until carcass sale post grading. The processor acts as an agent to market the co-products and arrange the slaughter and grading service.
- Grading data is the primary value determinant and while not compulsory 90% of carcasses are graded.
- Grading is conducted by the Japanese Meat Grading Association (JMGA), an independent public company.
- Independent yield (A, B or C) and quality (1 to 5) grades are combined to produce carcass grades such as A5 or B3 etc.
- Grader training is extremely detailed and heavily based on extensive field experience with toward 20 years required to achieve the highest certification level.
- Both yield and quality grades are calculated from multiple contributing inputs.
- Despite high levels of appraisal consistency and multiple inputs, correlation between the grades assigned and actual Japanese consumer sensory response is moderate at best.
- The assignment of a single grade to the carcass may partially explain the reduced precision.
- Around 40% of carcasses are sold by auction and the remainder by negotiation.
- While exhibiting strong traditions new innovations including advanced image analysis and NIR fatty acid composition are being utilised in developing grading standards.
- Brand names and regional sources contribute heavily to value at wholesale and retail in conjunction with breed and JMGA grade.
- Individual animal ID is maintained to the retail pack for all but ground beef products.
- Retail display is of an exceptional standard further underlying the premium and special nature of beef in Japanese

¹ Wagyu is used loosely in this report to denote full blood domestic Japanese black cattle. Within Japan these are described by kanji. Japanese MAF guidelines discourage the use of Wagyu for describing imported beef as it is not of Japanese origin and therefore not regarded as full blood Wagyu although some importers are describing high quality imported beef with "Wagyu" genetics as a crossbreed.

BACKGROUND TO THE JAPANESE BEEF INDUSTRY

Japan's total cattle population of 4,065 million head in December 2013 comprised 2.64 million (65%) beef cattle and 1.42 million (35%) dairy (Anon, 2014). Beef produced is categorised as Japanese Black, which account for 98% of "Wagyu" cattle. The remaining 2% include Japanese Brown, Shorthorn, Polls and their crosses. Beef cattle represent 45% of total head slaughtered and 46% of carcass tonnage, the remainder being categorised as dairy and 1% of other. The 534,846 tonne of imported beef in 2013 represented 60% of total supply with Australia the largest supplier at 286,545 tonne. Imported Australian beef is utilised in various market sectors ranging from manufacturing to food service and direct retail outlets.

The majority of higher quality Australian imported product aligns with the domestic Japanese dairy category.

It is somewhat a tale of two markets, Japanese Black and the rest, at all points of the supply chain from original genetics to final retail product. Japanese culture places great importance on tradition and on perfection with these traits also evident in the production, description, marketing and consumption of beef. Pricing differences are extreme and heavily weighted toward Japanese Black with F1 (Japanese Black x dairy) steers midway between the Japanese Black and dairy benchmarks as displayed in Table 1.

Table 1: Japanese beef carcass wholesale pricing² (2013) – Yen/kg cold carcass weight and % of A4 Japanese Black steer

	Steers						Cows	
	Wagyu A4	Wagyu A3	F1 B3	F1 B2	Dairy B3	Dairy B2	Dairy C2	Dairy C1
JMGA Grade								
JPY	¥1,873	¥1,717	¥1,227	¥1,112	¥859	¥768	¥485	¥411
AUD	\$20.31	\$18.61	\$13.30	\$12.06	\$9.31	\$8.33	\$5.26	\$4.46
	100.0%	91.7%	65.5%	59.4%	45.9%	41.0%	25.9%	21.9%

² Australian \$ to Japanese Yen conversion rate 92.24 (www.xe.com, accessed on 14 Feb 2015).

A similar relationship is exhibited at retail with average 2013 Tokyo beef sirloin pricing (Anon, 2014) reported at Y1,189 per 100gm for Wagyu relative to Y621 for dairy (52%) and Y335 for Australian (28%). High quality beef in Japan remains a status item displayed and marketed as a luxury good but beef is also sold at more assessable prices as hamburger, hamburg (formed) steaks and meatballs together with imported and Japanese dairy beef consumed in traditional Japanese cooking styles such as yakiniku, shabu-shabu and geydon. Channel distribution data 2012 (Anon, 2014) for all Japanese beef consumption, including imported beef, indicates that foodservice utilised 62% of beef with home consumption 32% and processing 6%.

Japanese consumption has been stable at 5.9 to 6kg per head (Anon, 2014) since 2011 with growth potential influenced by economic conditions. The predominant retail display is within cooking style with lesser association to the source cut but an overwhelming emphasis on Japanese Black, the traditional Japanese breed, and marbling level. Given the prestige and premium pricing associated with high end domestic Japanese Black it is unsurprising that farming practices, live cattle marketing and beef grading display a similar focus.

BEEF LANGUAGE, LIVE CATTLE AND CARCASS TRADING

Japanese beef farmers may be breeders or fatteners and tend to specialise in either area with a live cattle auction the interconnecting transaction point. In line with the meat value chain those breeding Japanese Black are more heavily involved in livestock pedigree and performance recording with attendant heavy use of AI from proven high reputation sires. Regional bloodlines also feature through proud and competing tradition (Kuchida *pers comm*).

A recent trend is for some of the larger fatteners to vertically integrate back in to breeding to assure supply. This has been influenced by concerns relating to the small scale and increasing age of traditional breeding farm suppliers (P Troja *pers comm*).

All cattle must have RFID by law with birth date, dam ID, date of birth and lifetime movement recording also mandatory. In addition Japanese Black cattle are identified by a nose print, the cattle equivalent to fingerprints, used for registration in conjunction with complete pedigree data. Given the relative value it is critical that they maintain Japanese Black certification.

There is an extensive Japanese Black progeny testing scheme where 20 progeny from test bulls are raised to 28 months and slaughtered to provide the all-important carcass data. There is strong involvement by local government at prefecture level in Japanese Black genetics

in addition to private companies. The Government controlled Livestock Improvement Association of Japan is a further influential body. The genetics providers publish EBVs for carcass yield and quality plus growth data. The decade's long concentration on carcass attributes has resulted in the breed excelling in marbling but often at the expense of other trait such as milk production, fertility and structure. Most Japanese Black calves are either fully hand fed or supplemented with milk replacer.

Most calves are sold to fattening farmers through a physical calf auction market. Electronic bidding systems are generally used in both live and carcass markets. The electronic bidding is "blind" in that buyers press a button on their handheld electronic device to bid and there is no visual indication of the bidder other than the increased price registered on the sale screen. Data provided in the sale catalogues includes birth date, sex and liveweight. Pedigree data is critical for full blood Japanese Black calves and important for F1 whereas visual body type and condition is the primary assessment for dairy stock.

In contrast to Australian practice finished cattle ownership is retained by the farmer until after carcass grading. The farmer pays the processor a slaughter fee and receives payment for the hide and offal. While managed by the processor on behalf of the farmer, the by-products are purchased by different groups reflecting traditional arrangements where this franchise was granted to a particular class. The standard carcass is traded with the head, hocks and tail removed but with the kidneys and kidney fat retained. It should be noted that Japanese Black fat is valued and often provided in small blocks by department stores for cooking. It is also commonly mixed with imported Australian cow beef by the retailer, further processing plant or restaurant to provide extra flavour or exported to Asian markets. Consequently fat carries a far higher value connotation relative to that in Australian processing where "over fat" carcasses are strongly discouraged.

Figure 1: Kyushu cattle farm





Figure 2: Store cattle auction

Grading charges, paid by the farmer, are levied by the Japanese Meat Grading Association (JMGA) with these data owned by the farmer and not automatically passed on or accumulated. Depending on location the carcass may

be sold either by auction (40%) or negotiation (60%) with the grading data the principal price determinant. Pricing is in yen/kg of carcass weight. Major carcass auctions are held in Tokyo and Osaka.

JAPANESE CARCASS GRADING

Carcass grading is conducted by the Japanese Meat Grading Association (JMGA). The JMGA was established in 1975 to administer grading standards through an independent public company structure although carcasses had been graded into Choice, Select and Prime from 1961. Carcass grading standards are established by the association under the approval of the Minister for Agriculture, Forestry and Fisheries (MAFF) (Anon, 2000). Standards were amended in 1976, 1979 and 1988.

The 1988 amendment established separate yield and quality grades. Graders operate at 10 central wholesale markets, 22 local wholesale meat markets and 96 meat centres throughout Japan (Anon, 2014a). While not compulsory 90% of carcasses are graded with those not graded mostly very old cows or internal company owned cattle. If graded, both yield and quality grades are required. Currently the grading fee is ¥540 per head.

GRADER TRAINING AND CALIBRATION

There are 200 beef graders in Japan, all employed by the JMGA. Beef grading is a highly skilled occupation with many years' experience and training required to attain first grade status. Trainee graders, generally from an agricultural or meat science university background, are selected after sitting a written general exam (unrelated to grading knowledge). They may progress to assistant grader rank after 3 years (and attaining a minimum age of 25) and then work with a grader recording data for a minimum further 5 years at which point they sit both practical and written exams to attain a third class grader ranking. A further minimum 5 year period is required to move up to second grade status and a final 5 years to

attain first grade. Consequently the youngest first grade JMGA grader will be 40 years old and have a minimum 18 years of practical experience (K.Kuchida *pers comm*). This provides an interesting comparison with USDA and Australian grader training and certification standards.

Consistent standard application is taken extremely seriously and involves a mix of direct "human eye" calibration and image analysis appraisal. Professor Kuchida of Obihira University currently leads the annual calibration meeting which involves farmer, government, industry and JMGA representatives. Professor Kuchida specialises in image analysis systems with his beef

carcase camera system and software used to produce the JMGA photographic standards for marbling (BMS – Beef marbling score) and meat colour (BCS – Beef colour score). Following the annual national meeting the JMGA delegates return to their regions where they in turn establish calibration among the local graders, normally two to three times per year.

The Japanese grading standards are applied to a cold carcass with standard trim and quartered between the sixth and seventh thoracic vertebrae with the cut surface of the sixth rib viewed for assessment. The final grade comprises a yield and quality component with the yield designated by A, B or C and the quality component a numeral from 1 to 5. Thus a carcass may have a grade of A4 or B3 etc denoting the balance of yield and quality.

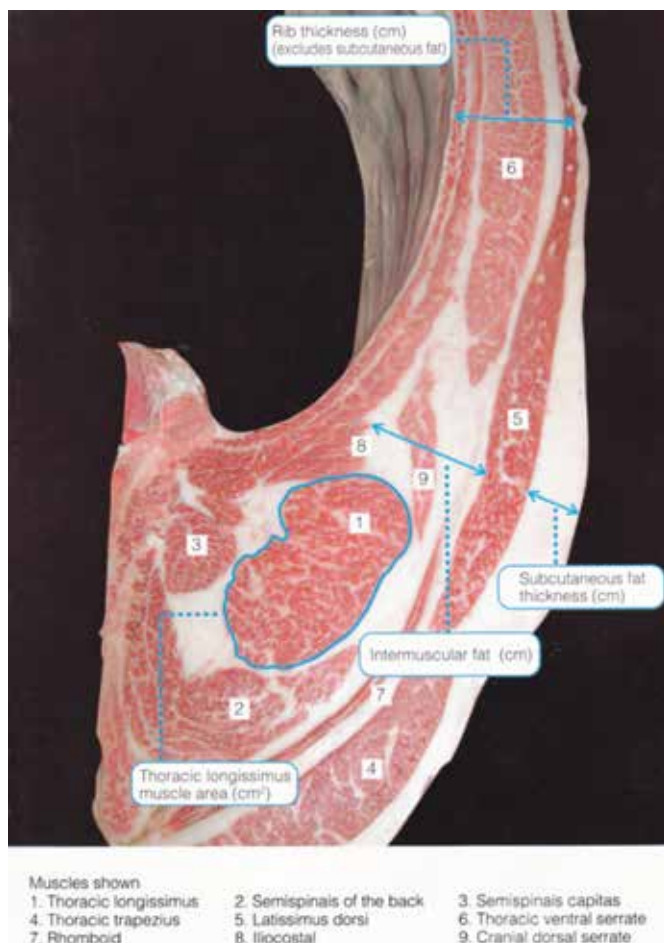
JMGA YIELD GRADE (Anon 2014a)

The yield grades denote estimated total cut yields of above average (A), average (B) or below average (C). The related formulae are reviewed at the annual standards meeting with A currently estimated as a yield of 72% or above, B 69 to 72% and C below 69%. The yield grade is determined from four factors further illustrated in the figure below.

The yield calculation is as follows:

$$\begin{aligned} \text{Estimated yield} = & 67.37 + [0.130 \times \text{thoracic longissimus} \\ & \text{area (cm}^2\text{)}] \\ & + [0.667 \times \text{rib thickness (cm)}] \\ & - [0.025 \times \text{cold split carcass} \\ & \text{weight (kg)}] \\ & - [0.896 \times \text{subcutaneous fat} \\ & \text{thickness (cm)}] \end{aligned}$$

Figure 3: Measurements taken at the 6th/7th rib cross section for JMGA Yield Grade calculation



A further 2.049 is added to this for Japanese Black carcasses.

The carcass can be moved down one grade if fat relationships are outside limits of 12cm² for seam fat, if the fat seam between the *M.thoracic trapezius* and *M.thoracic longissimus* muscles exceeds 4.0 cm or if the intermuscular fat in the rib exceeds 8cm. To achieve the calculated grade rib eye areas must be at or above 45cm² for Japanese Black, 44cm² for F1 and 35cm² for dairy.

Due to the extreme cost of beef in Japan and also to the number of variations in retail cutting lines the accuracy of the yield grade equation is not regularly tested but believed to have a correlation of 0.8 or better (K.Kuchida *pers comm*).

JMGA QUALITY GRADE (Anon 2014a)

Four factors are considered when determining the quality grade. These are marbling level, meat colour and brightness, meat firmness and texture and fat colour, lustre and quality. A score between 1 and 5 is assigned for each factor with the lowest determining the carcass grade; for example if marbling was 4, meat colour and brightness 4 and meat firmness and texture also 4 the carcass quality grade would be 2 if the fat colour, lustre and quality was 2.

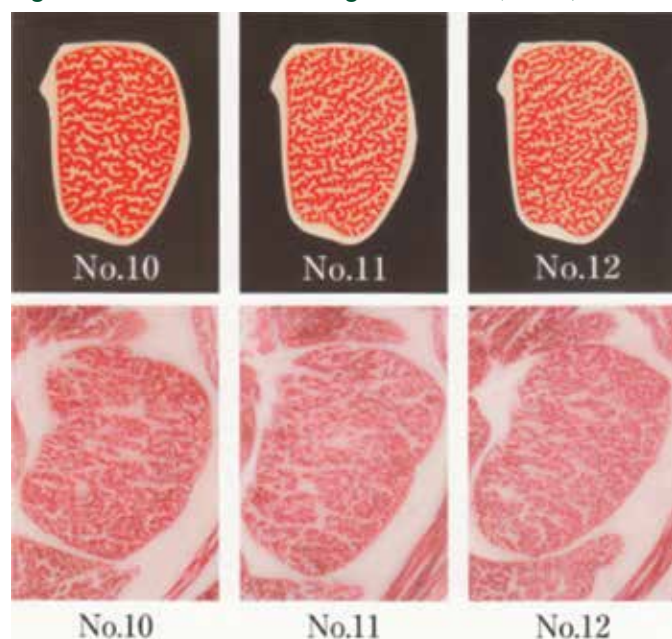
Marbling is assessed within 12 levels with silicon and photographic standards from 3 to 12. Beef Marbling Score (B.M.S) 1 is defined as practically devoid of marbling with B.M.S 2 described as a failure to meet BMS

3. No silicon or photographic standards are produced for B.M.S 1 or B.M.S 2. The silicon model standards are prepared by the National Institute of Animal Industry under MAFF. The original silicon standards were developed in 1988. Equivalent photographic standards were developed in 2009 and updated in 2014. Advances in image analysis technology and accumulation of many thousands of images facilitated use of a combination of marbling percent and new fineness index measures to produce a close to linear photographic series that is now the primary assessment tool. A portion of the series is shown in illustration 2. Table 2 below defines the linkage between the B.M.S score and the 1 to 5 marbling grade allocation.

Table 2: Relationship of JMGA B.M.S ranking and assigned marbling Grade³

B.M.S. Rank	1	2	3	4	5	6	7	8	9	10	11	12
Grade	1	2	3		4			5				

Figure 4: JMGA Beef Marbling Standards (B.M.S)³



Meat colour is judged against the objective Beef Colour Score (B.C.S) standard silicon chips. Brightness is determined by visual appraisal. There are 7 BCS reference standards, again related to a 1 to 5 grade allocation as depicted in Table 3 below.

Table 3: Relationship of JMGA B.C.S scores to assigned meat colour and brightness Grade (Anon 2014a).

GRADE		B.C.S. Score						Brightness	
		1	2	3	4	5	6		7
5	Very good	VERY GOOD						Very good	
4	Good	GOOD						Good	
3	Average	AVERAGE						Average	
2	Below average	BELOW AVERAGE						Below average	
1	Inferior	INFERIOR		Any Rank other than 2 to 5					

The meat firmness and texture grade is assigned from visual appraisal in accordance with the descriptions in Table 4.

Table 4: Assignment of JMGA meat firmness and texture grade (Anon 2014a).

GRADE	Firmness	Texture
5	Very good	Very fine
4	Good	Fine
3	Average	Average
2	Below average	Below average
1	Inferior	Course

Fat colour, lustre and quality is the fourth appraisal considered in the grading process. There are 7 Beef Fat Standard (B.F.S) beef fat colour standards used to assign the B.F.S score in conjunction with a visually-appraised lustre and quality adjustment. The relationship between the final fat colour, lustre and quality grade and the factors analysed is shown in Table 5.

Table 5: Assignment of JMGA fat colour, lustre and quality grade (Anon 2014a).

GRADE		B.C.S. Score						Brightness
		1	2	3	4	5	6	
5	Very good	VERY GOOD						Very good
4	Good	GOOD						Good
3	Average	AVERAGE						Average
2	Below average	BELOW AVERAGE						Below average
1	Inferior	Any Rank other than 2 to 5						

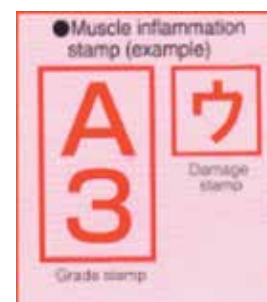
In addition any carcass damage is assessed and the carcass stamped with a damage stamp if applicable. The carcass damage classifications used are displayed in Table 6. The “other – KA” description is used for damage not listed in the other categories and includes poor carcass splitting, broken bones, incomplete bleeding, foul smell, unusual colour and significant contamination.

Table 6: JMGA carcass damage classifications (Anon 2014a)

Type of damage	Symbol
Muscle bleeding (stain)	A
Muscle edema	I
Muscle inflammation	U
Missing part	O
Other	KA

The detailed scores for the four quality factors and the resultant 1 to 5 grades are recorded in standard JMGA format and the final carcass grade computed from the lowest quality factor and the yield grade. The final carcass grade is then stamped on the carcass as shown in Figure 5 which includes a damage stamp for muscle inflammation.

Figure 5: Example of JMGA carcass grade and damage stamps (Anon 2014a).



FURTHER JMGA GRADE DEVELOPMENT

The JMGA grading system is highly regarded by the industry and an important part of the commercial trade description and valuation. There is no doubt that the intense and long term dedication to the art of beef grading in Japan develops extremely high skill levels and the highest of professional standards. The training is by far the most rigorous in the world and meat grading is a well-respected profession. The cattle population also represents an extreme with the strong influence of Japanese Black genetics, the related grade standards and strong retail price signals leading to an aura around highly marbled beef at the premium end. This cattle population sits at an extreme end relative to countries other than Korea with progressively less overlap from USA>Australia>Europe.

As such it is highly likely that the consistency of appraisal, particularly at the high marbling extreme, is better than might be expected from Australian or other graders not regularly exposed to similar carcasses. This contention is supported by camera and image analysis data collected in conjunction with AUS-MEAT, but not MSA, grading parameters in Australia from Wagyu cattle and reported by Maeda et.al. (2013). Their study suggested that image analysis approaches could provide superior accuracy and definition with associated improved genetic correlations (marbling heritability 0.54 vs 0.23 from AUS-MEAT marbling scores). The Australian Wagyu Association has purchased a camera and image analysis software and is utilising this in Australian appraisal work.

Within Japan there is also considerable further study devoted to improved grading accuracy and potential linkage to consumer sensory response. Image analysis system development has proceeded extensively over the past 10 years and now forms the basis for establishment of official standards. Equipment variations have been developed to operate at cut level in boning rooms and faster automated image analysis software suitable for on line grading use are being developed.

In other work on-line analysis of fatty acid composition using NIR technology has been progressed with a pilot scheme in Nagano Prefecture providing a certified deliciousness rating for Japanese Black carcasses with defined levels of B.M.S and oleic acid. The standards applied to attain a delicious certification are:

- A BMS number of 7 or greater and oleic acid of 55% or higher or
- A BMS of 5 or higher and oleic acid of 58% or better or
- A BMS of 8 or higher and oleic acid of 52% and above.

The certified delicious beef is supplied only to registered outlets within the prefecture.

Other brands have since added an oleic acid standard, adding further refinement to grading and associated branding.

RELATIONSHIP OF JMGA CARCASS QUALITY GRADES AND INPUTS TO CONSUMER SATISFACTION

While the JMGA grading system ensures very consistent application of grading standards the relationship of the standards applied and final consumer enjoyment is less clear and appears to be subject to less rigorous formal evaluation. An opportunity to evaluate this issue arose from an MSA study that used MSA protocols for grill, yakiniku and shabu shabu cooking methods across 1620 Japanese consumers in Tokyo and Osaka (Watson, 2008). The research included striploin, outside flat and chuck from Japanese Black, F1 and Dairy beef, slaughtered in Kyushu, and the same cuts from a range of Australian cattle.

The relationship of all the individual JMGA grade inputs and the final yield and quality grades assigned was examined statistically with the correlations to the sensory grades assigned by consumers as shown in table 7. While, as might be expected, many of the yield inputs are at the low end the quality factors also have a relatively poor relationship to the consumer response, including the JMGA Quality grades. These low correlations reflect the difficulty of accurately predicting consumer response from a carcass grade with at least part of the problem being the application of a common grade to all cuts.

The dotplots for consumer assessed grade versus JMGA Yield grade (Figure 1) and JMGA Quality grade (Figure 2) further demonstrate the considerable overlap between either grade and ultimate consumer response with the yield grade not dissimilar to the quality grade in discriminate ability.

Within the Japanese beef trade there is some concern regarding a disconnect between producers striving to achieve the highest A5 grading standard and the reducing premium obtainable at consumer level relative to A3 (P Troja *pers comm*). The extent to which reduced demand

for A5 represents economic pressures, health concerns or experienced quality is not known but the current situation is challenging trade margins.

While the cause of any preference change is not known Japanese consumers are reported to consistently identify beef quality and to assign samples to alternate quality grades (Polkinghorne et.al., 2011). Further the Japanese consumers assigned very similar ratings to Australian consumers for paired samples cooked as yakiniku and shabu shabu but generally lower scores when grilled (Polkinghorne et.al., 2012).

Table 7: Correlations of JMGA Grades and grade components to Japanese consumer grade star (Watson, 2008).

Attribute	r
BMS	0.442
Fat lustre	0.441
Fat Grade	0.441
Marbling Grade	0.439
JMGA Grade	0.428
Yield	0.425
JMGA Quality Grade	0.412
Firmness	0.406
Firmness and texture Grade	0.406
Brightness	0.386
Beef Colour Grade	0.386
Texture	0.376
JMGA Yield Grade	0.376
Rib thickness	0.312
Rib eye area	0.293
BFS	0.282
Subcutaneous fat	0.197
BCS	0.150
Fats in carcass weight	0.028

Figure 6: Dotplot of consumer allocated quality grade (star) vs JMGA Yield grade (Watson, 2008).

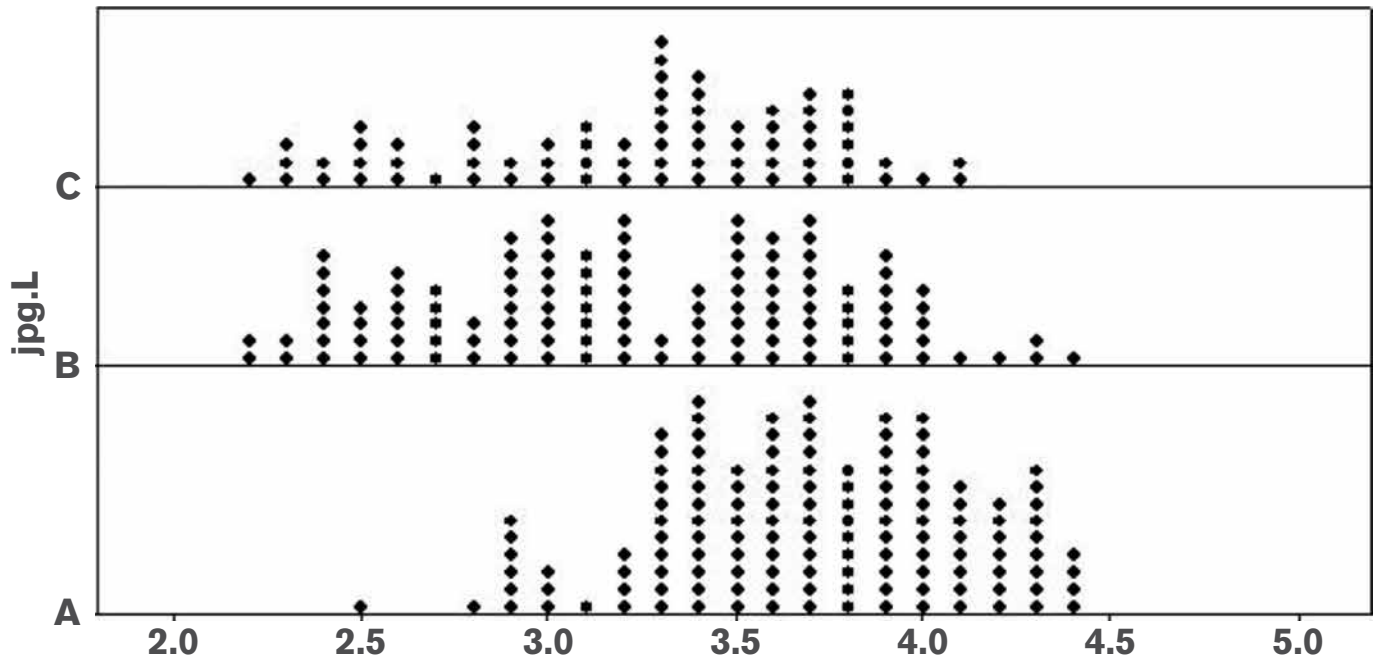
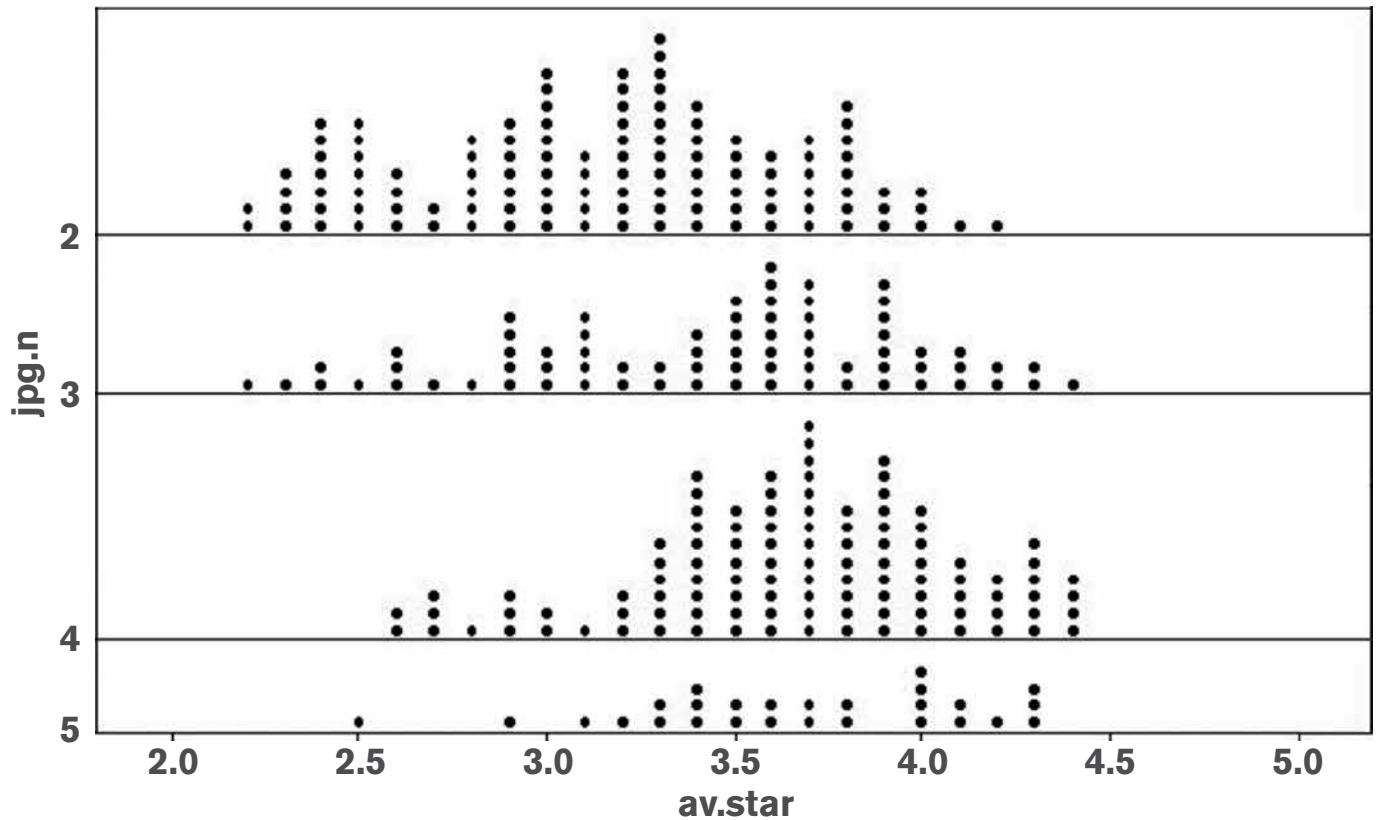


Figure 7: Dotplot of consumer allocated quality grade (star) vs JMGA Quality grade (Watson, 2008).



JAPANESE WHOLESALE AND RETAIL BEEF LANGUAGE

Japanese wholesale and retail beef language embodies a strong emphasis on quality, pristine presentation and provenance factors including many regional identifications and source identification. Individual animal identification

is maintained and included on retail cut labels for grill, yakiniku and shabu shabu although only at batch level for hamburger.

Figure 8: Retail packs for sale in Japanese supermarkets



Slightly different official cut guides exist for Hokkaido and Tokyo and are used for wholesale cut trade. There are 13 common basic cuts then special cuts in addition and derived from the basic group. (Kuchida pers.comm). Trading is in Y/kg with important specification continuing to identify FB (full blood Japanese Black), F1 and Holstein/dairy derived product independent of grade so that a trading specification might be FB A4 momo (round and rump) etc. If Japanese Black is specified it must be 100% derived from full blood cattle with blending prohibited. A restaurant may order A5 Japanese Black sirloin or just

“beef for yakiniku” with brand name often an important value attribute, Kobe and Matsuaka being well known examples. The menu description may simply be Matsuaka beef. The highest quality and reputation brands are in short supply and difficult to source adding to their prestige and price. As an example, given an Australian \$ exchange rate of Y100, the Matsuaka product in the following photograph (Picture 4) is priced at the equivalent of A\$525 per kg. As shown in this example retail pricing is displayed in Yen per 100 gm.

Figure 9: A highly marbled striploin on display in a Japanese butcher shop



The use of cut name varies widely in both restaurant and retail description which may also commonly describe regions of the carcass such as beef rib or hindquarter rather than more detailed cut names. A high percentage of retail beef is presented under a cooking method description such as “Wagyu for curry” or shabu shabu. The presentational standards are exceptional by any measure emphasising the special nature of beef.

Willingness to pay (WTP) data reported from the Tokyo and Osaka study, published by Lyford et al (2010), also supports the strong value association with beef quality and Japanese consumers. Relative to 3* (good everyday quality) Japanese consumers valued unsatisfactory beef

at 48% of the 3* price, 4* (better than everyday) at 169% of 3* and 5* (premium quality) at 286% of 3*. While the ratio of 3* to unsatisfactory and 4* reported was very similar to that for Ireland, USA and Australia the 5* ratio was considerably higher with the other countries reported close to 200% rather than the close to 300% found in Japan. In each of the four countries reported there was essentially no demographic influence on WTP other than a lower value for 5* product with older consumers. For the Japanese, age groups under 39 years rated 5* at over 300% of 3* whereas for those over 40 years old the premium reduced to 290% (41–50) and to 266% over 51 years old. This indicates that beef quality will continue to be a very strong driver in future.

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FOR FURTHER INFORMATION

Contact//

MLA head office

Level 1, 40 Mount Street,
North Sydney NSW 2060

Postal address:

PO Box 1961

North Sydney NSW 2059

General enquiries

T: 02 9463 9333

Free call: 1800 023 100

(Australia only)

F: 02 9463 9393

E: info@mla.com.au

www.mla.com.au