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Accessory Publication: MSA sensory testing protocols

Detailed work instructions for product collection, sensory sample preparation, cooking and sensory evaluation are presented by Gee *et al.* (2005). These should be adopted as the primary reference for running taste panels. The following summary describes key elements of the protocol for each cooking method to provide an understanding of the process.

Sensory design aspects

Each of the cooking methods described employs common design elements in relation to sensory testing. In MSA experiments prior to 2004 grills were tested utilising a 180 member taste panel with panellists organised in nine sessions of 20 consumers, arranged as three sessions of 20 on three nights of a week. As steaks from a common sample could be cooked on demand this design arrangement worked well and allowed a 5 steak sample to be spread across 5 sessions.

With roast meats (i.e. oven cooked) and corned meats (i.e. meats cured or pickled in brine), the entire sample must be cooked at one time dictating a single test session or reheating of cooked samples (see details below). Stir fry, thin slice and slow cook methodologies are also more conveniently arranged to cook all sample portions at a common time. In response to these issues, a 60 consumer taste panel was instituted to accommodate testing on a single night. Developmental testing was conducted to establish procedures to maintain cooked product temperature over a 1 to 3 hours allowing product to be served in a number of order positions and to any elected segment of 60 consumers.

A single 60 person roast session was adopted to reduce roast holding times to less than 1 hour and a 3 by 20 consumer basis maintained for stir fry, thin slice and slow cook methods. Yakiniku/Korean BBQ cooking procedures provide for direct cooking with 5 consumers served by each host in a session.

To facilitate automation of operating procedures via software and to apply common sensory design criteria a standard taste panel of 60 consumers testing 36 test samples after 6 first position standard link starter samples was adopted for all cooking methods. The grill design was changed to the 60 consumer format from 2004. The 36 test samples incorporate 6 samples from each of 6 products selected to ensure an eating quality range. In planning any taste panel (pick) the objective is to have minimum eating quality variance between samples within each product and maximum variance between products.

Every consumer is served one sample from each product following the starter link for a total of seven evaluations. While cooking and serving procedures vary to accommodate the particular equipment and characteristics of each method the underlying sensory design is common to all. 10 consumers, treated operationally as five pairs, evaluate each sample tested. The first position link is selected for an expected mid range quality position. Each of the 6 links are served to 5 numerically adjacent pairs. Therefore consumers 1 to 10 eat a common first position product as do 11 to 20 etc.

For the subsequent test samples the 60 consumers are regarded as 5 discreet groups of 12 (six pairs), similar to the original grill protocol of 5 groups of 20. Every sample is tested by 10 consumers (5 pairs). Each pair is allocated from a different subset of 12 (or 20 under the previous grill design) in contrast to the link product. A 6×6 Latin

square design of the form below is used to allocate products to each consumer pair with products allocated in the order designated by column.

1	2	3	4	5	6
2	4	1	6	3	5
3	1	5	2	6	4
4	6	2	5	1	3
5	3	6	1	4	2
6	5	4	3	2	1

Therefore, consumer pair one is served a sample of product 1, followed by products 2, 3, 4, 5 and 6 whereas consumer pair two receive products in the order 2, 4, 1, 6, 3, 5 and so on. A new Latin square is commenced for each sub group of 12 consumers. The 5 individual portions (steaks, roast slices, stir-fry strips etc) of each sample are allocated to 5 different order positions as they are dispersed across the 5 subsets of 12 consumers. The net effect is that every sample is tested in 5 of 6 possible different presentational positions by 5 consumer pairs from 5 sub groups.

As there are 6 Latin squares and 6 products, samples from every product occur an equal number of times (6) in each presentational position and before and after each other product. This provides a balance for frequency, order and carryover effects. The 5 pairs who test any one sample are not combined again for any other sample.

Specialist software was developed to control design aspects and collate data from experiments. The software assists in balanced design of product collections and produces unique identification for samples produced. Samples are inventoried together with all available data in a common database. When a taste panel is to be conducted software routines provide for selection of the 36 samples plus links to be tested. The software then allocates each sample according to the design principles

above and produces all associated paper work, plate labels etc. Sensory results are decoded and added to the database by other routines.

Grilling

Sample preparation

The dissected muscle was denuded of all fat and epimysium and a block measuring 75 × 25 × 150 (mm) prepared. If the muscle was large enough to allow multiple locations position within muscle was recorded. Commencing at the anterior, or proximal end of the block five 25mm thick steaks were cut across the grain, using a cutting guide. Each steak was individually wrapped in plastic, placed in a plastic pouch which had been pre-labelled with a unique reference number (EQSRef), a set number used for product storage and other data. Steaks were placed in the pouches in order, thereby retaining a record of their original position in the primal, the pouches vacuum packed and then frozen at the designated days ageing for storage at −18°C.

Picking

MSA software allocated a steak to a pair of consumers and presentational order using the procedures described in sensory design. The software also produced a printed sheet with EQSref numbers for the 10 steaks within each round printed in position for the 7 rounds The frozen sample pouches were opened and the 5 individual frozen steaks from each sample laid out on the pre numbered acetate sheets. When all10 steaks were in position, each sheet and the frozen steaks was placed in another pouch, vacuum packed and stored at −18°C.

Thawing

When required for a taste panel, the 7 frozen round sheets were thawed at 2°–5°C for 24 hours prior to tasting and transported chilled (< 5°C) to the testing site. The bags were opened 1 hour before cooking and the numbered sheet and 10 steaks transferred to a tray for loading onto the griller. Temperature immediately pre-cooking was < 10°C.

Cooking

Steaks were cooked on a Silex clam shell grill unit, set at 220–230°C with the lid set to position #3 or #4 to achieve a 20 to 25 mm gap, the weight set to position 8 and a top plate ratio of 2.75 to ensure even cooking. The griller was switched on 45 minutes prior to cooking and a set of sacrificed starter steaks used to commence the cooking cycle and stabilise temperature recovery. All cooking operations were conducted with reference to a timing schedule to control cooking and serving sequence. Steaks were placed on the Silex in the same order as on the acetate sheet to maintain sample identification. After cooking, steaks were transferred to a cutting board in the same order. Steaks were held for 2 minutes before halving and placing on pre-numbered serving plates. A cross check was conducted by an independent observer confirming the pre printed EQSRef number on the plates matched the round sheet identification. A further check was conducted by confirming a pre-printed label identification on each consumer score sheet against the plate sticker at the point of serving.

Roasting

Sample preparation

The dissected muscle was denuded of all fat and epimysium and a block measuring 75 × 75 × 150 (mm) prepared. If the muscle was large enough to allow multiple locations position within muscle was recorded. Each block was placed in a pre labelled plastic pouch with a unique reference number (EQSRef), a set number used for product storage and other data. The pouches were vacuum packed and then frozen at the designated days ageing for storage at –18°C.

Picking

Product for each taste panel was selected via MSA software. The software applied the principles described in sensory design aspects to produce cooking, cutting and serving control sheets, plate and questionnaire labels and to allocate each sample slice to consumers.

Thawing

The frozen blocks were thawed by placing in a refrigerator at 2°C to 5°C for 48 hours prior to cooking.

Cooking

A large commercial gas oven was used to cook all roasts for any taste panel at the one time. The oven was preheated to 160°C prior to loading the 42 roast blocks. The blocks were paired for weight and placed in the oven in a designated arrangement related to relative weight and size. The 20 roasts to the front of each pair were fitted with a thermocouple inserted in their geometric centre. All roasts had an ovenproof identification tag pinned to the rear to maintain sample ID during cooking and carving.

Oven temperature was maintained at 160°C throughout the cooking period. Each roast was removed from the oven when an internal temperature of 65°C was reached. This temperature was confirmed with a calibrated thermometer for all roasts with the paired non thermocoupled samples tested at the time of removal of their matched pair. On removal the roasts were placed in a bain marie steamer pan and allowed to stand for a minimum of 5 minutes prior to further preparation.

Post cook preparation

After standing the cooked roasts were trimmed in order of removal from the oven to a standard 65 × 65 × 110 (mm) block using a cutting guide. Once trimmed the blocks were transferred to individual stainless steel keepers incorporating a small cutting board base and a series of tines 10 mm wide separated by gaps of 1mm on either side. A 50 mm spike at one end of the base anchored the sample block in position on the cutting board and between the tines. Each keeper was then transferred to a pre-heated 1/9th bain marie steamer pan. Pans were placed in 1 of 4 bain maries as allocated by the software. The bain maries had been preheated and were maintained at 48°C throughout the test session. An identification sticker was attached to the lid of each pan with the oven proof ID retained within the pan.

Carving and serving

The carving sequence was controlled by software output which implemented the design principles described in sensory design aspects. Four carvers were each allocated to a bain marie carving 9 roasts each for rounds 2 to 7 in accordance with individual timed carving schedules. Link product for round 1 was also carved to a schedule by a single carver prior to commencement of rounds 2 to 7.

Each keeper and attached roast was removed from its pan at designated times for carving.

To control this operation, each of the four Cutters used an incrementing timer. The timer was set to zero and then operated in unison with the other cutter's timers. Each cutter's list showed a sample code and a time for the next pair of plates to be served. Carving times for each station were offset to smooth out the flow of both carving and serving. After removal from the pan a filleting knife was run down between the appropriate pair of keeper tines thereby removing a 10mm slice of roast beef. An initial facing slice was removed immediately prior to taking the first designated sample. The keeper was then returned to the bain marie pan and the lid replaced. In this manner each roast was maintained at temperature and served progressively to nominated consumers in designated order. The removed slice was halved on a cutting board prior to placing on plates for serving. An ID check was made between the plate ID, steamer lid ID and cutting schedule in every case. The total serving operation was completed in 35 minutes.

Corning

Sample preparation, picking and thawing

The procedures described for roasts were identical to those for corned beef prior to cooking.

Cooking

The sample blocks were cooked in four 26 litre aluminium boiler pans on two CookOn double gas burners. A draining rack was placed on the bottom of each boiler pan prior to loading six test blocks. A second rack was then placed on these blocks

and a further five or six blocks placed on this rack to provide uniform cooking of the 36 test samples and 6 links. Each block was identified by an attached heat proof label secured by a stainless steel trussing pin. A thermocouple was attached to the centre of the top rack in each pan to monitor temperature. Tepid water was added to each pan and brought to the boil on full heat. After boiling for ten minutes the heat setting was reduced to simmer for a further 35 minutes maintaining temperature close to 100°C. Each pot was skimmed regularly during cooking to remove scum from the surface and the lid replaced. Sample blocks were then removed from the pans after 45 minutes.

Post cook preparation, carving and serving

All post cooking procedures and equipment were identical to the roast protocols with four carvers serving from bain maries according to software generated cutting lists.

Stir fry

Initial sample preparation

The dissected muscle was denuded of all fat and epimysium and a block measuring 20 × 110 × 75 (mm) along the grain prepared using a cutting guide. If the muscle was large enough to allow multiple locations position within muscle was recorded. Each sample was placed in a plastic pouch which had been pre-labelled with a unique reference number (EQSRef), a set number used for product storage and other data. The pouches were vacuum packed and then frozen at the designated days ageing for storage at −18°C.

Picking

36 samples for each taste panel plus 6 first position links were selected utilising MSA software which allocated samples to consumers and presentational order using the procedures described in sensory design. The software also produced schedules to control cooking and serving routines.

Preparation for cooking

The frozen picked, sample blocks were conditioned for slicing by raising their temperature from −18°C to −4°C, in a 750 watt microwave oven for 30 seconds. This timing was established by testing prior to each trial to ensure blocks were not damaged by inadvertent thawing. The conditioned blocks were then sliced to produce twenty-two 10 × 10 × 75 (mm) strips with the grain running parallel to the 75 mm axis. The sliced strips were placed in a container prior to cooking together with an ID sticker.

Cooking

The stir fry strips were cooked in mild steel woks placed on two CookOn gas cookers at different stages. Cooking oil and glaze composition was developed to produce a neutral taste to consumers. Developmental testing established 2 alternative oil and glaze specifications for Australian versus Japanese consumers. The woks had 20 mL of olive oil added for Australian consumers and a blend of 40% sesame and 60% corn oil for Japanese groups. The oiled woks were brought to full heat on the first gas cooker with all subsequent operations controlled by elapsed timers in accordance with a pre-printed control sheet.

The sample strips were added at 30 seconds elapsed time and stirred while cooking. After cooking the strips for1 minute 10 seconds at full heat the wok was transferred to

the second gas burner set at simmer heat. After 10 seconds on this burner 20 mL of glaze was added and stirred in. For Australian consumers the glaze was made up from 1 litre of water, 62 mL of balsamic vinegar, 125 mL of honey, 125 mL of Kikkoman soy and 125 mL of arrowroot powder. For Japanese consumers the arrowroot powder was replaced by gluten free cornflour. After an elapsed time of 3 minutes the wok was removed to cool. Total cooking time was therefore 2 minutes 30 seconds across the two burners.

The cooked sample was then transferred to a 1/9th bain marie steamer pan and placed in a water bath to cool. When below 45°C and above 40°C the sample was placed in a pre labeled plastic pouch and vacuum packed. The vacuum packed pouch was then rapid chilled to 0°C and stored at this temperature until transferred to the sensory test venue. Identification was maintained at all points by transfer of pre numbered labels.

Serving

The 36 test samples plus 6 links were transferred to 1/9th steamer pans at the test venue after attaching sample identification stickers to each lid and cross checking. The steamer pans were held in bain maries set to 48°C. Serving proceeded against elapsed timers in accordance with a schedule produced by the software dictating the time to serve and consumer for each sample on each occasion. Tongs were used to place two strips of product on the nominated plate with the ID cross checked as listed on the schedule. The software controlled sample allocation to ten consumers in accordance with the design described in sensory design aspects.

Thin slice

Initial sample preparation

The dissected muscle was denuded of all fat and epimysium and a block of sufficient size to allow 22 × 20 × 75 (mm) slices of the designated thickness to be sliced across the grain. On various occasions 2, 4, 6 and 8 mm samples were prepared both along and across the grain for experimental comparison. Standard size was established as 4mm thick sliced across the grain, requiring a 90 × 20 × 75 (mm) block. If the muscle was large enough to allow multiple locations, position within muscle was recorded. Each sample was placed in a plastic pouch which had been pre-labelled with a unique reference number (EQSRef), a set number used for product storage and other data. The pouches were vacuum packed and then frozen at the designated days ageing for storage at −18°C.

Sample conditioning and preparation for cooking

Samples were conditioned to −4°C for slicing using a microwave oven in an identical manner to stir fry strips. The conditioned blocks were then sliced to create 22 strips of the designated thickness for cooking and testing.

Cooking and serving

Cooking, cooling, packing and serving procedures were identical to those described for stir fry cooking. Only the Australian oil and glaze compositions were used as testing was restricted to Australian consumers.

Slow cooking

Sample preparation

The dissected muscle was denuded of all fat and epimysium. Twenty two 21 × 21 × 21 (mm) cubes were then fabricated. If the muscle was large enough to allow multiple

locations position within muscle was recorded. The sample cubes were placed in a plastic pouch which had been pre-labelled with a unique reference number (EQSRef), a set number used for product storage and other data. The pouches were vacuum packed and then frozen at the designated days ageing for storage at −18°C.

Picking and thawing

MSA software was used to retrieve the 36 test samples and 6 links required for each taste panel. The frozen pouches were thawed by placement in a refrigerator at 2°C to 5°C for 24 hours. The software also generated control sheets for cooking and sensory trial operations in accordance with the principles described in sensory design aspects.

Cooking

The sample cubes were browned and cooked prior to delivery to the sensory testing venue. Browning was achieved by heating a stainless steel frypan on full heat with a CookOn gas burner. The 22 cubes from each sample were added and removed as designated by a pre-printed timing control sheet referenced against an elapsed timer. The cubes were sprayed liberally with spray on olive oil and stirred to ensure all sides were browned. Each sample was browned for 90 seconds and then transferred to a $1/9^{th}$ bain marie steamer pan containing 300 mL of liquor.

The liquor was made up from 12 litres of boiling water, 1200 g of defrosted sliced frozen onion, 1200 g of defrosted sliced frozen carrot, 400 g of fresh machine chopped celery and 4 level metric tablespoons of fine salt.

The pans with liquor were placed in bain maries and held at a rolling boil for 30 minutes prior to adding the browned cubes. The cubes were then simmered at 93°C to 95°C for 2 hours in experiments following the standard protocol. Simmering times of

1 and 3 hours were also used in specific experiments conducted to study cooking time effects.

The steamer pans were removed after cooking and placed in a water bath to cool. When below 45°C and above 40°C the sample was placed in a pre labeled plastic pouch and vacuum packed. The vacuum packed pouch was then rapid chilled to 0°C and stored at this temperature until transferred to the sensory test venue. Identification was maintained at all points by transfer of pre numbered labels.

Serving

The 36 test samples plus 6 links were transferred to 1/9th steamer pans at the test venue after attaching sample identification stickers to each lid and cross checking. The steamer pans were held in bain maries set to 48°C. Serving proceeded against elapsed timers in accordance with a schedule produced by the software dictating the time to serve and consumer for each sample on each occasion. Two cubes of product were placed using tongs on the nominated plate with the ID cross checked as listed on the schedule. The software controlled sample allocation to ten consumers in accordance with the design described in sensory design aspects.

Yakiniku/Korean BBQ

Sample preparation

The dissected muscle was denuded of all fat and epimysium and a 90 × 20 × 75 (mm) block, with grain across the 75mm axis, removed. If the muscle was large enough to allow multiple locations, position within muscle was recorded. Each sample was placed in a plastic pouch which had been pre-labelled with a unique reference number

(EQSRef), a set number used for product storage and other data. The pouches were vacuum packed and then frozen at the designated days ageing for storage at −18°C.

Sample conditioning and picking

Samples were conditioned for slicing in an identical manner to stir fry and thin slice strips by conditioning to −4°C in a microwave oven. The conditioned blocks were then sliced to create 11, 4mm thick strips sliced across the grain. (Where 2mm thick strips were trialled 22 strips were prepared) The still frozen strips were stored flat in plastic containers prior to picking. MSA trial software generated pre-printed round sheets with EQSRef identification codes located in set positions reflecting the consumer sample allocation principles described in sensory design aspects. The software also produced master sheets detailing the disposition of samples to sessions, rounds and consumers. The round sheets were then placed within clear plastic pouches laid on gel ice sheets.

Ten strips from each sample were then placed in their individually nominated positions on the round sheets until all 36 samples and 6 links had been placed. The pouches containing the round sheets and samples were then vacuum packed and returned to the freezer for storage at −18°C until transfer to the test venue.

Cooking and serving

In this cooking method samples were directly cooked and served by a host seated at a table with 5 consumers. The frozen round sheets were transferred from iced foam boxes as consumers were seated and thawed in trays at room temperature. Cooking and serving order was controlled by software. This ensured the principles discussed in sensory design aspects were followed. A metal disc cooker was mounted on a

CookOn three ring gas burner with modified controls to facilitate fine adjustment. A thermocouple sensor was mounted to the cooking surface to record plate temperature. A plate temperature between 250°C and 260°C was maintained by continuously running the inner gas ring and adjusting the centre ring as required. Single samples were placed on the hot plate in the prescribed order and turned as moisture pooled on the surface. The sample was served to the nominated consumer when the second side pooled. This visual indicator in combination with temperature control produced a uniform medium degree of doneness in the cooked strip.

Consumer questionnaire and score sheets

The standard consumer questionnaire used in all MSA sensory trials is produced below together with a sample score sheet. Each questionnaire was stapled to 7 sample score sheets, all of which had a software produced unique pre-printed alphanumeric code attached on a sticky label. These codes and the control software provided linkage to all stages of product collection, preparation, cooking and serving. The questionnaire data and sensory scores, measured in mm from the left, were double entered into a software program and crosschecked prior to transfer to the data base.

Date:_____ Group Name:_____ I.D. Number :_____

Thank you for your participation today with our meat tasting.

Before you commence please listen to the instructions on how to use the scales contained in this questionnaire.

In between each sample please cleanse your palate by first taking a sip of diluted Apple Juice then chew a piece of bread and then take another sip of diluted Apple Juice

We are after your opinion and therefore ask that you do not talk to any one else in the room during the research session.

Now just a few questions about yourself, please tick the appropriate box.
(All this information is strictly confidential)

Please write down the postcode of the suburb you normally live in: _____

Age group: 20-25 ( ) 26-30 ( ) 31-39 ( ) 40-50 ( )

Gender: Male ( ) Female ( )

What category best describes your occupation?

Tradesperson (e.g. Plumber, Chef, Mechanic, Plant & Machine Operators) **[ ]**
Professional (e.g. Lawyer, Teacher, Accountant) **[ ]**
Administration (e.g. Manager, Clerical) **[ ]**
Technical (e.g. Computer, Medical, Scientist) **[ ]**
Sales and Personal Service (e.g. Sales Assistant, Bank Teller, Customer Information) [ ]
Labourer **[ ]**
Homemaker **[ ]**
Not currently in paid employment **[ ]**
Student **[ ]**

How often do you eat Beef? (in any form such as Steaks, Roasts, Stews, kebabs, BBQ, etc.)

Daily [ ] 4-5 times a week [ ] 2-3 times a week [ ]
Weekly [ ] Fortnightly [ ] Monthly [ ] Never eat [ ]

How many people normally live in your household? (Adults are aged 18 years and over)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8** or more
Adults	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Children	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Please read the following statements and tick the one statement that applies to you.

- **I enjoy red meat. It's an important part of my diet.** **[ ]**
- **I like red meat well enough. It's a regular part of my diet.** **[ ]**
- **I do eat some red meat although, truthfully it wouldn't worry me if I didn't.** **[ ]**
- **I rarely / never eat red meat.** **[ ]**

When you eat beef, such as steaks, what level of cooking do you prefer?
(please tick [✓] only one response)

Blue [ ] Rare [ ] Medium rare [ ]
Medium [ ] Medium well [ ] Well done [ ]

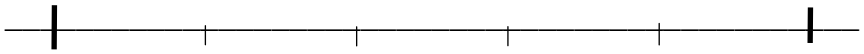
What level of income best categorises your household income?

below $20, 000 per year **[ ]**
between 20,000 and 50,000 per year **[ ]**
above 50,000 per year **[ ]**

All information collected in this survey is strictly confidential.

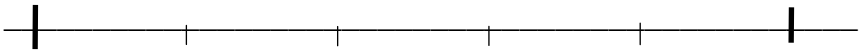
PRODUCT :

Tenderness



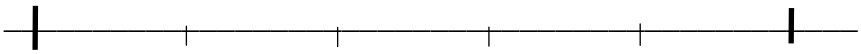
Not Tender — Very Tender

Juiciness



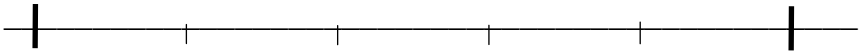
Not Juicy — Very Juicy

Liking of flavour



Dislike Extremely — Like Extremely

Overall Liking



Dislike Extremely — Like Extremely

Please tick ☑ one of the following to rate the quality of the beef sample you have just eaten

Choose **one** only (you must make a choice).

- Unsatisfactory ☐
- Good everyday quality ☐
- Better than everyday quality ☐
- Premium quality ☐