Cross cultural studies between Irish and Asian assessors

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Background to Cross-Cultural Research

Project: Optimisation of Intercultural sensory perception for successful adoption in cross-cultural markets

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Publications


In the last 30 years, Chinese consumers’ shopping habits have changed dramatically - incomes have risen and new products and concepts have entered the Chinese market.

Older generation generally maintains “traditional” spending habits.

Middle-aged Chinese oscillate between tradition and new trends.

The younger generation is becoming more Westernized and quality conscious.
Sensory Quality- The West

• Products are developed-Consumer optimized

• Safe, nutritious, regulated across all jurisdictions, EU, USA

• Accurate labeling, traceability (mostly), consumer confidence

• Sensory profile and sensory quality ensure product constancy, repeat purchase, market success and longevity
• **Product safety mistakes can be devastating**
  Food and product safety problems exposed in the media can strongly influence Chinese consumers.

• E.g Clenbuterol in pork, melamine-tainted milk incident in 2008-infant formula.

• Counterfeit- high-end Bordeaux wines etc. Baby formula (1-6% ptotein)

• Chinese Olympic team preventing from eating meat for fear of testing positive for illegal hormones.

• Literally every day brings the announcement of a new consumer scam.
Sensory Quality-The East

- **Product safety** food safety the top concern amongst Chinese consumers.

- Western media report that China's middle class snap up western brands.

- Chinese consumers who can *afford* to are spending extra to avoid counterfeits and food safety issues.

- Not brand advocates it's fear purchasing. It says less about Western brands than about China's landscape
Sensory evaluation of Chinese-style marinated chicken by European and Chinese naïve assessors.


**Objective**

To determine the sensory variation and acceptance of two cultural groups, naïve European and Chinese assessors, for chicken breast fillet marinated with retail and commercially available Chinese-style marinades from the Irish-market place.
Material and methods

ANOVA - Partial Least Squares Regression (A-PLSR) Unscrambler

Sensory Evaluation

- 18 commercially available Chinese-style marinades (Szechuan, Sweet & Sour, Hoisin & Chinese 5 Spice).
- Chicken fillets were used as carrier system.
- 49 naïve panellists of European (25) and Chinese (24)
- 17 terms were assessed

Affective - Hedonic
- liking of flavour, appearance, authenticity, Overall acceptability

Flash - Descriptive
- Colour (bright red, dark brown, colour penetration)
- Aroma (l pungency, spiciness)
- Flavour (liking, spiciness, hotness)
- Specific flavour ratings (Szechuan, Sweet and Sour, Hoisin, Barbeque, Chinese 5 Spice)
- Juiciness

Instrumental
- Marinade uptake
- Cook loss
- Maximum force
- Cooked L* (lightness), a* (redness), b* (yellowness) surface colour value
A large difference in terms of aroma and flavour perceptions of Chinese marinated chicken between the European and the Chinese naive assessor groups was observed.

Unlike the Chinese naïve assessors, the European effectively discriminated and rated the presented Chinese-style marinated chicken according to specific Chinese-style marinade flavours.

The differences and levels of acceptability of Chinese-style flavour between European and Chinese naive assessors were very different: what is considered authentic in Europe is proved to be not at all authentic by Chinese standards.
Sensory evaluation of Indian-style marinated chicken by Malaysian and European naïve assessors.

Journal of Sensory Studies 24: 269-289

Objective

To determine the sensory acceptability of chicken breast fillets marinated with 13 different commercially available Indian-style marinades available in Irish-marketplace.
Material and methods

ANOVA-
Partial Least Squares
Regression
(A-PLSR)
Unscrambler

Sensory Evaluation

- 13 commercially available Indian-style marinades (Tikka Masala & Tandoori flavour).
- Chicken fillets were used as carrier system.
- 34 naïve assessors
- Malaysian Vs European
- Affective-Hedonic acceptability, authenticity
- Descriptive-Flash-8 terms were selected and assessed (colour, colour uniformity, aroma, tikka-masala flavour, herblike flavour, hotness, juiciness)

Instrumental

- Marinade uptake
- Cook loss
- Maximum force
- Cooked $L^*$ (lightness), $a^*$ (redness), $b^*$ (yellowness) surface colour value
Despite differences in cultural and dietary habits between Malaysians (Group 2) and Europeans (Group 1), a similar pattern of sensory acceptability between the two groups toward Indian-style marinated chicken was observed.

A significant difference ($P < 0.05$) in colour uniformity, hotness and juiciness (Table not shown) could be due to a cultural difference in food perception.

Aroma-flavour related attributes and fat content were considered as the most important criteria in determining Indian-style marinated chickens’ acceptability.
Conclusions

Both studies showed that consumer familiarity and exposure towards the product affected consumer acceptability, thereby strengthening the importance of flavour authenticity in ethnic-style marinated product development.

Results suggested that colour quality could be the second most important factor after flavour-related attributes and should not be neglected in production.
Case Study – Dairy Products (P-Cresol and Cowy/Barny flavours)

• Premise; Drake et al., (2005) - Compared Cheddar cheeses from Ireland, NZ, and the USA. Using trained panels from these countries.

• Overall differentiation of the cheeses by each panel was similar, using QDA (IE), GDA (NZ) and Spectrum (USA).

• Cheeses were grouped by each site by country of origin suggesting international differences in Cheddar cheese flavour.

• Irish cheeses (NZ also) were negatively perceive by USA panels.
Methodology

- Dairy products will be tested for sensory optimisation to develop high quality and optimally consumer acceptable products.

- The final outcomes from such a study will enable dairy products to be optimised for these specific markets – Irish, UK, China, and US.
**Irish Panel:**
USA cheeses = creamy, buttery, and processed flavours, pungent, rancid, mould, onion, salty taste, and acid taste

**USA Panel:**
USA Cheeses = cooked, whey, diacetyl, and free fatty acid, brothly, nutty, sour taste, and umami

**NZ Panel:**
USA+Irish cheeses (Aged) = savoury, butyric, fruity, fermented, maturity flavour, salty, acid taste

**USA Panel:**
Irish Cheeses = catty, cowy/barny and mothball flavours

**Aroma associated with barns and animal sheds**

**Reminiscent of ruminant sweat and urine**

**Cowy/Barny**
Isovaleric acid and p-cresol

**USA Panel:**
NZ Cheeses = mothball flavours

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**Legend:**
- **QDA**
- **Spectrum**
- **GDA**

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**General descriptive analysis**
9 point scale
Definitions for all terms
Food and/or chemical references for all terms
Panel evaluates Cheddar cheese several times per week
Hedonic (Liking) Methods

Rapid Methods (RDA)

Descriptive (QDA, Spectrum)

Expert

Quality

Low

High

e-Tongue

Phyico-Chemical

GCMS

P-Cresol

Cowry/Barny

Chemometrics

Consumers

Western Consumers
- Sensory Optimised
- Regulatory compliant
- Traceable

Chinese Consumers
- Young - Westernised
- Old - traditional
- Middle aged - in between
- Buy for Safety not sensory
- Scams, scares, fakes

Use MVA to link Grader-Descriptive-Hedonic
Phyico-chemical-Instrumental-Animal-Pasture-Data
Issues

• Cheddar cheese proved problematic

• Required refrigerated transport to eastern China, logistically difficult

• Decided to first look at SMP, WMP (Skim and Whole Milk Powder)

• SMP-Stable, easily transported

• Cold chain less of an issue

• Once transport protocol established (Customs, paperwork) can look at other products
UCC-University Fujian Memorandum of Understanding

Co-operation Agreement

2015
RDA, Ranking Descriptive Analysis

• Twenty five panellists were recruited in University College Cork, Ireland.
• Age range of assessors was 22-48 years old.
• Selection criteria for panellists were availability and motivation to participate on all days of the experiment and that they were milk consumers.
• Panellists used the sensory Intensity descriptors in Table 2 for samples (Table 1).
• Ranking Descriptive analysis (RDA) (Richter et al, 2010; Dairou & Sieffermann, 2002) was carried out in panel booths conforming to international standards (ISO 8589: 2007)
• Samples were immediately served to panellists simultaneously for separate time points.
• Each assessor was presented with triplicate samples (over separate sessions) and asked to assess the intensity of the attributes (Table), according a 10 cm line scale ranging from 0 (none) at the left to 10 (extreme) at the right and rating subsequently scored in cm from left.
• The order of the presentation of all test samples was randomized to prevent first order and carryover effects.
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Definition</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hedonic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance-Liking</td>
<td>The liking of appearance</td>
<td>0 = extremely dislike 10 = extremely</td>
</tr>
<tr>
<td>Flavour-Liking</td>
<td>The liking of flavour</td>
<td>0 = extremely dislike 10 = extreme</td>
</tr>
<tr>
<td>Aroma-Liking</td>
<td>The liking of aroma</td>
<td>0 = extremely dislike 10 = extreme</td>
</tr>
<tr>
<td>Texture-Liking</td>
<td>The liking of texture</td>
<td>0 = extremely dislike 10 = extreme</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>The acceptability of the product</td>
<td>0 = extremely unacceptable 10 = extremely</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance-colour</td>
<td>Appearance-Ivory to orange colour</td>
<td>0 = Pale, 10 = Yellow</td>
</tr>
<tr>
<td>Sweet aroma</td>
<td>The smell associated with dairy sweet milky products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Creamy aroma</td>
<td>The smell associated with creamy/milky products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Cooked aroma</td>
<td>The smell associated with cooked milk products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Oxidised (cardboard) aroma</td>
<td>The smell associated with rancid or oxidised products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Painty aroma</td>
<td>The smell associated with rancid paint type notes</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Chalky Texture</td>
<td>Chalk like texture in the mouth</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Powdery Texture</td>
<td>Powdery texture in the mouth</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Thick texture in the mouth</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Sweet taste</td>
<td>Fundamental taste sensation of which sucrose is typical</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Sour</td>
<td>Fundamental taste sensation of which Lactic acid is typical</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>salty</td>
<td>Fundamental taste sensation of which Sodium chloride solution is typical</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Creamy flavour</td>
<td>The flavour associated with creamy/milky products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Dairy sweet flavour</td>
<td>The flavour associated with sweetened cultured dairy products such as fruit yoghurt</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Carmelized Flavour</td>
<td>Intensity of caramel</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Oxidised (cardboard) Oxidised Flavour</td>
<td>The flavour associated with rancid or oxidised products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Rancid butter</td>
<td>The flavour associated with rancid or oxidised butter</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Painty Flavour</td>
<td>The flavour associated with rancid paint type notes</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Grass/Hay</td>
<td>The flavour associated with grass, hay</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Cooked flavour</td>
<td>The flavour associated with cooked milk products</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Off-flavour</td>
<td>Off-flavour</td>
<td>0 = none, 10 = extreme</td>
</tr>
<tr>
<td>Astringent after-taste</td>
<td>Fundamental taste sensation of which aluminium sulphate is typical</td>
<td>0 = none, 10 = extreme</td>
</tr>
</tbody>
</table>
Descriptive analysis (RDA)

Rinse mouth with water between tastings.
RDA-SMP  ANOVA-Partial Least Squares regression (APLSR)
RDA-SMP

ANOVA values of regression coefficients from APLSR for RDA sensory terms

<table>
<thead>
<tr>
<th>SMP</th>
<th>Colour</th>
<th>Creamy A</th>
<th>Oxidised A</th>
<th>Painty A</th>
<th>Sour</th>
<th>Creamy F</th>
<th>Oxidised F</th>
<th>Off-flavour</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>0.003</td>
<td>0.120</td>
<td>0.152</td>
<td>0.034</td>
<td>0.619</td>
<td>0.305</td>
<td>0.151</td>
<td>0.180</td>
</tr>
<tr>
<td>T2</td>
<td>0.003</td>
<td>0.213</td>
<td>0.518</td>
<td>0.950</td>
<td>0.977</td>
<td>0.367</td>
<td>0.290</td>
<td>0.495</td>
</tr>
<tr>
<td>T3</td>
<td>0.000</td>
<td>0.005</td>
<td>0.531</td>
<td>0.123</td>
<td>0.652</td>
<td>0.041</td>
<td>0.034</td>
<td>0.085</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Grass</td>
</tr>
<tr>
<td>T2</td>
<td>Clover</td>
</tr>
<tr>
<td>T3</td>
<td>TMR (Total Mixed Ration)</td>
</tr>
</tbody>
</table>
RDA-WMP ANOVA-Partial Least Squares regression (APLSR)
RDA-WMP

ANOVA values of regression coefficients from APLSR for RDA sensory terms

<table>
<thead>
<tr>
<th>WMP</th>
<th>Colour</th>
<th>Creamy A</th>
<th>Oxidised A</th>
<th>Painty A</th>
<th>Sour</th>
<th>Creamy F</th>
<th>Oxidised F</th>
<th>Off-flavour</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>0.307</td>
<td>0.975</td>
<td>0.045</td>
<td>0.044</td>
<td>0.069</td>
<td>0.996</td>
<td>0.088</td>
<td>0.025</td>
</tr>
<tr>
<td>T2</td>
<td>0.000</td>
<td>0.243</td>
<td>0.824</td>
<td>0.154</td>
<td>0.201</td>
<td>0.215</td>
<td>0.340</td>
<td>0.289</td>
</tr>
<tr>
<td>T3</td>
<td>0.000</td>
<td>0.270</td>
<td>0.088</td>
<td>0.502</td>
<td>0.436</td>
<td>0.241</td>
<td>0.442</td>
<td>0.212</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Grass</td>
</tr>
<tr>
<td>T2</td>
<td>Clover</td>
</tr>
<tr>
<td>T3</td>
<td>TMR (Total Mixed Ration)</td>
</tr>
</tbody>
</table>
Hedonic Analysis-Consumer Testing

• 100 consumers Ireland

• 100 consumers China

• 50 consumers- Chinese living in Ireland (<6months)

• Reconstitution-SMP 10%, WMP ~15% (Based on fat). Samples prepared day before, rotated 50 times, stored 4°C

• Questionnaire translated in to Chinese
Questionnaire

Please LOOK at sample _______ and answer the following questions regarding appearance.

Which statement best describes your impression of the OVERALL APPEARANCE of this product?

<table>
<thead>
<tr>
<th>Dislike Extremely</th>
<th>Dislike Very Much</th>
<th>Dislike Moderately</th>
<th>Dislike Slightly</th>
<th>Neither Like nor Dislike</th>
<th>Like Slightly</th>
<th>Like Moderately</th>
<th>Like Very Much</th>
<th>Like Extremely</th>
</tr>
</thead>
</table>

Which statement best describes your impression of the AROMA of this product?

<table>
<thead>
<tr>
<th>Dislike Extremely</th>
<th>Dislike Very Much</th>
<th>Dislike Moderately</th>
<th>Dislike Slightly</th>
<th>Neither Like nor Dislike</th>
<th>Like Slightly</th>
<th>Like Moderately</th>
<th>Like Very Much</th>
<th>Like Extremely</th>
</tr>
</thead>
</table>

Now please taste sample _______ and answer the following questions:

Which statement best describes your impression of the OVERALL LIKING of this product?

<table>
<thead>
<tr>
<th>Dislike Extremely</th>
<th>Dislike Very Much</th>
<th>Dislike Moderately</th>
<th>Dislike Slightly</th>
<th>Neither Like nor Dislike</th>
<th>Like Slightly</th>
<th>Like Moderately</th>
<th>Like Very Much</th>
<th>Like Extremely</th>
</tr>
</thead>
</table>

Which statement best describes your impression of the FLAVOR of this product?

<table>
<thead>
<tr>
<th>Dislike Extremely</th>
<th>Dislike Very Much</th>
<th>Dislike Moderately</th>
<th>Dislike Slightly</th>
<th>Neither Like nor Dislike</th>
<th>Like Slightly</th>
<th>Like Moderately</th>
<th>Like Very Much</th>
<th>Like Extremely</th>
</tr>
</thead>
</table>
APLSR-WMP
Consumers
Irish
Chinese living in Ireland

Correlation Loadings (X and Y)
## P Values WMP (Whole Milk Powder)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Overall appearance</th>
<th>Aroma</th>
<th>Overall liking</th>
<th>Flavor</th>
<th>Freshness</th>
<th>Cooked flavor</th>
<th>Mouthfeel</th>
<th>Creaminess</th>
<th>Aftertaste#2</th>
<th>Intensity</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC-T1</td>
<td>0.0028</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0207</td>
<td>0.0001</td>
<td>0.5438</td>
<td>0.0065</td>
<td>0.0045</td>
<td>0.0000</td>
<td>0.0007</td>
<td>0.0060</td>
</tr>
<tr>
<td>iC-T2</td>
<td>0.0011</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0806</td>
<td>0.0007</td>
<td>0.0010</td>
<td>0.0000</td>
<td>0.0101</td>
<td>0.0000</td>
</tr>
<tr>
<td>iC-T3</td>
<td>0.0001</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.6217</td>
<td>0.0004</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0064</td>
<td>0.0000</td>
</tr>
<tr>
<td>I-T1</td>
<td>0.2436</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0382</td>
<td>0.0086</td>
<td>0.0504</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>I-T2</td>
<td>0.0025</td>
<td>0.0002</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0245</td>
<td>0.5565</td>
<td>0.0854</td>
<td>0.0477</td>
<td>0.0000</td>
<td>0.3928</td>
<td>0.0057</td>
</tr>
<tr>
<td>I-T3</td>
<td>0.0064</td>
<td>0.0011</td>
<td>0.0000</td>
<td>0.0001</td>
<td>0.0027</td>
<td>0.5150</td>
<td>0.0008</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0928</td>
<td>0.0020</td>
</tr>
</tbody>
</table>

### Treatment
- **T1**: Grass
- **T2**: Clover
- **T3**: TMR (Total Mixed Ration)

I = Irish, iC=Chinese consumers residing in Ireland <6Mths
APLSR-SMP
Consumers
Irish
Chinese living in Ireland
Chinese-Fujian
# P Values SMP (Skim Milk Powder)

<table>
<thead>
<tr>
<th></th>
<th>Overall appearance</th>
<th>Aroma</th>
<th>Overall liking</th>
<th>Flavor</th>
<th>Freshness</th>
<th>Cooked flavor</th>
<th>Mouthfeel</th>
<th>Creaminess</th>
<th>Yes</th>
<th>No</th>
<th>Aftertaste#2</th>
<th>Intensity</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC-T1</td>
<td>0.5381</td>
<td>0.5277</td>
<td>0.3554</td>
<td>0.3523</td>
<td>0.3560</td>
<td>0.3653</td>
<td>0.4402</td>
<td>0.4278</td>
<td>0.4815</td>
<td>0.4815</td>
<td>0.3628</td>
<td>0.4024</td>
<td>0.3692</td>
</tr>
<tr>
<td>iC-T2</td>
<td>0.4252</td>
<td>0.4269</td>
<td>0.1726</td>
<td>0.1761</td>
<td>0.1643</td>
<td>0.1816</td>
<td>0.3090</td>
<td>0.2860</td>
<td>0.3783</td>
<td>0.3783</td>
<td>0.1804</td>
<td>0.3086</td>
<td>0.1864</td>
</tr>
<tr>
<td>iC-T3</td>
<td>0.3501</td>
<td>0.3717</td>
<td>0.0613</td>
<td>0.0646</td>
<td>0.0865</td>
<td>0.0698</td>
<td>0.2253</td>
<td>0.1938</td>
<td>0.3526</td>
<td>0.3526</td>
<td>0.0710</td>
<td>0.2115</td>
<td>0.0942</td>
</tr>
<tr>
<td>I-T1</td>
<td>0.5377</td>
<td>0.4262</td>
<td>0.3412</td>
<td>0.3370</td>
<td>0.3165</td>
<td>0.3381</td>
<td>0.3366</td>
<td>0.4243</td>
<td>0.4606</td>
<td>0.4606</td>
<td>0.3498</td>
<td>0.2736</td>
<td>0.3398</td>
</tr>
<tr>
<td>I-T2</td>
<td>0.7208</td>
<td>0.7159</td>
<td>0.6807</td>
<td>0.6827</td>
<td>0.6817</td>
<td>0.6833</td>
<td>0.6832</td>
<td>0.6706</td>
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<td>0.0502</td>
<td>0.0641</td>
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<td>0.1531</td>
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<td>0.2540</td>
<td>0.0488</td>
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**Treatment**

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<table>
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<tr>
<td>T1</td>
<td>Grass</td>
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<tr>
<td>T2</td>
<td>Clover</td>
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<tr>
<td>T3</td>
<td>TMR (Total Mixed Ration)</td>
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</table>

I = Irish, iC=Chinese consumers residing in Ireland <6Mths, C=Chinese consumers Fujian
Conclusions

WMP
• Chinese consumer (Ireland) liked the WMP
• Irish consumer disliked the WMP samples
• Post test analysis-powder slightly oxidised
• Chinese had difficulty identifying off-flavour

SMP
• Irish, Chinese and Chinese-Ireland residents were clearly separated by the APLSR
• Chinese consumers liked the SMP the most, followed by the Chinese-Ireland residents and then Irish

• Reason- Chinese consumers adapted to poor quality dairy products in market thus also adapted to off-flavour
Chinese Market
A Handbook for Sensory and Consumer-Driven New Product Development
Innovative Technologies for the Food and Beverage Industry

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