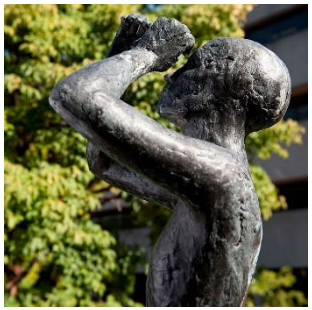

Cross cultural sensory driven product optimisation for international markets

Dr. Maurice O'Sullivan,
University College Cork

A TRADITION OF INDEPENDENT THINKING

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Coláiste na hOllscoile Corcaigh

Background to Cross-Cultural Research

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

Dr. Maurice. G. O'Sullivan, UCC

Dr. Salma Mohamad Yusop -University Kebangsaan Malaysia (The Ministry of Higher Education of Malaysia)

Publications

- Yusop, S, M., O'Sullivan, M. G., Kerry, J. F. and J. P. Kerry (2009a). Sensory evaluation of Indian-style marinated chicken by Malaysian and European naïve assessors. Journal of Sensory Studies, 24, 269-289.

- Yusop, S, M., O'Sullivan, M. G., Kerry, J. F. and J. P. Kerry. (2009b). Sensory evaluation of Chinese-style marinated chicken by Chinese and European naïve assessors. Journal of Sensory Studies, 24, 512-533.

Universiti Kebangsaan Malaysia
National University of Malaysia

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University College Cork, Ireland
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Background

- 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 consitancy, repeat purchase, market success and longevity

Sensory Quality-The East

- **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.

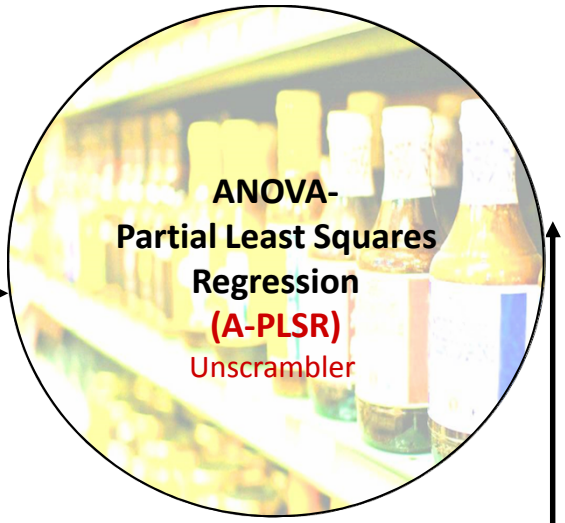
Sensory evaluation of Chinese-style marinated chicken by European and Chinese naïve assessors.

Journal of Sensory Studies 24: 512-533.

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



Instrumental

- Marinade uptake
- Cook loss
- Maximum force
- Cooked *L* (lightness), a* (redness), b** (yellowness) surface colour value

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

Results

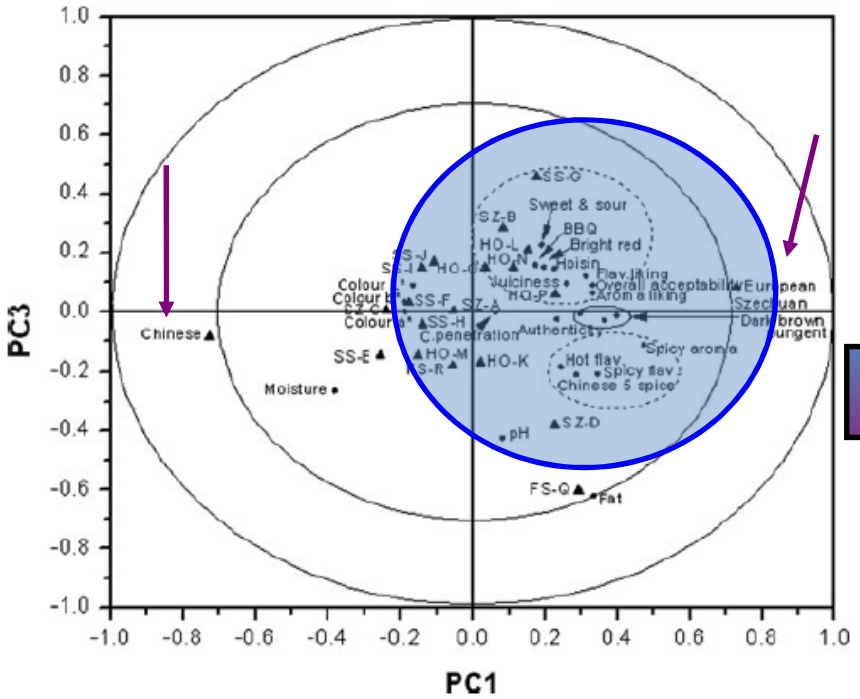


FIG. 1. AN OVERVIEW OF THE VARIATION FOUND IN THE DATA FROM THE ANALYSIS OF VARIANCE PARTIAL LEAST SQUARES REGRESSION CORRELATION LOADINGS PLOT FOR BOTH NAÏVE ASSESSOR GROUPS (EUROPEAN/CHINESE). SHOWN ARE THE LOADINGS FOR THE X- AND Y-VARIABLES FOR PRINCIPAL COMPONENT 1 (PC1) VERSUS PRINCIPAL COMPONENT 3 (PC3)
The dotted ellipse highlights samples and attributes that are highly correlated to each other. Concentric circles represent 100 and 50% explained variance, respectively.
▲, sample marinade; SZ, Szechuan; SS, Sweet and Sour; HO, Hoisin; FS, Chinese 5 Spice;
●, sensory descriptor (physical and instrumental variables).

- A large difference in terms of aroma and flavour perceptions of Chinese marinated chicken between the European and the Chinese naïve assessor groups was observed.

TABLE 4.
A SUMMARY OF SIGNIFICANT REGRESSION COEFFICIENTS ($P < 0.05$) OF CHINESE-STYLE MARINADES DERIVED FROM ANALYSIS OF VARIANCE PARTIAL LEAST SQUARES REGRESSION AS PERCEIVED BY GROUP OF NAÏVE EUROPEAN AND CHINESE ASSESSORS

Attribute/group	European		Chinese	
	+	–	+	–
Color				
Bright red	SS-G**[f], HO-N*, FS-Q*	SZ-C*, SS-E*, SS-I*, HO-M*	ns	ns
Dark brown	SS-G**, FS-Q***	SS-E*, HO-M*, FS-R*	ns	ns
Penetration			HO-P*	SS-H*
Aroma				
Liking		, SS-F*,	HO-P*	SS-H*
Pungent			ns	ns
Spicy		***, SS-F**,	HO-P**, FS-Q*	SS-H*
Flavor				
Liking		HO-M**	ns	SS-H*
		, SS-I*,	ns	ns
	, FS-Q	SS-E*, SS-I**, SS-J*, HO-O*	ns	ns
ratings				
Szechuan	SZ-D*, SS-G**, FS-Q***	SZ-C**, SS-E**, SS-I**, HO-M**	ns	ns
Sweet and Sour	SS-G***, HO-N*	SS-E**, HO-M*	ns	ns
Hoisin	SS-G**, HO-N**	SS-E**, HO-M*	ns	ns
Barbeque	HO-N*	–	ns	ns
Chinese 5 Spice	SZ-D**, FS-Q**	SZ-C**, SS-I*, HO-M**, HO-O*	ns	ns
Authenticity	SZ-D*, SS-G**, HO-L*, HO-N**, HO-P*, FS-Q****	SZ-C**, SS-E***, SS-F*, SS-I**, HO-M*	ns	ns
Juiciness	ns	SS-E*	ns	ns
Overall acceptability	SS-G***, HO-N**, FS-Q***	SZ-C*, SS-E***, SS-I*, HO-M**	HO-L**	SS-H*

[f] Significance of regression coefficients; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P < 0.0001$.
+/–, positive/negative correlation relationship; SZ, Szechuan; SS, Sweet and Sour; HO, Hoisin; FS, Chinese 5 Spice.
ns, no significant results.

SZ-D, SS-G. HO-N, FS-Q were identified according to their specific flavours by the European!

NONE WERE IDENTIFIED!!!!

- 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 naïve assessors were very different: <u>what is considered authentic in Europe is proved to be not at all authentic by Chinese standards.</u>

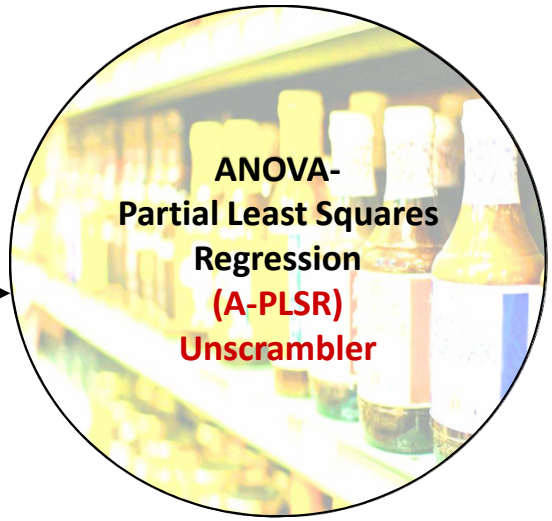
Sensory evaluation of Indian-style marinated chicken by Malaysian and European naïve assessors.

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



Instrumental

- Marinade uptake
- Cook loss
- Maximum force
- Cooked *L* (lightness), a* (redness), b** (yellowness) surface colour value

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)

Results

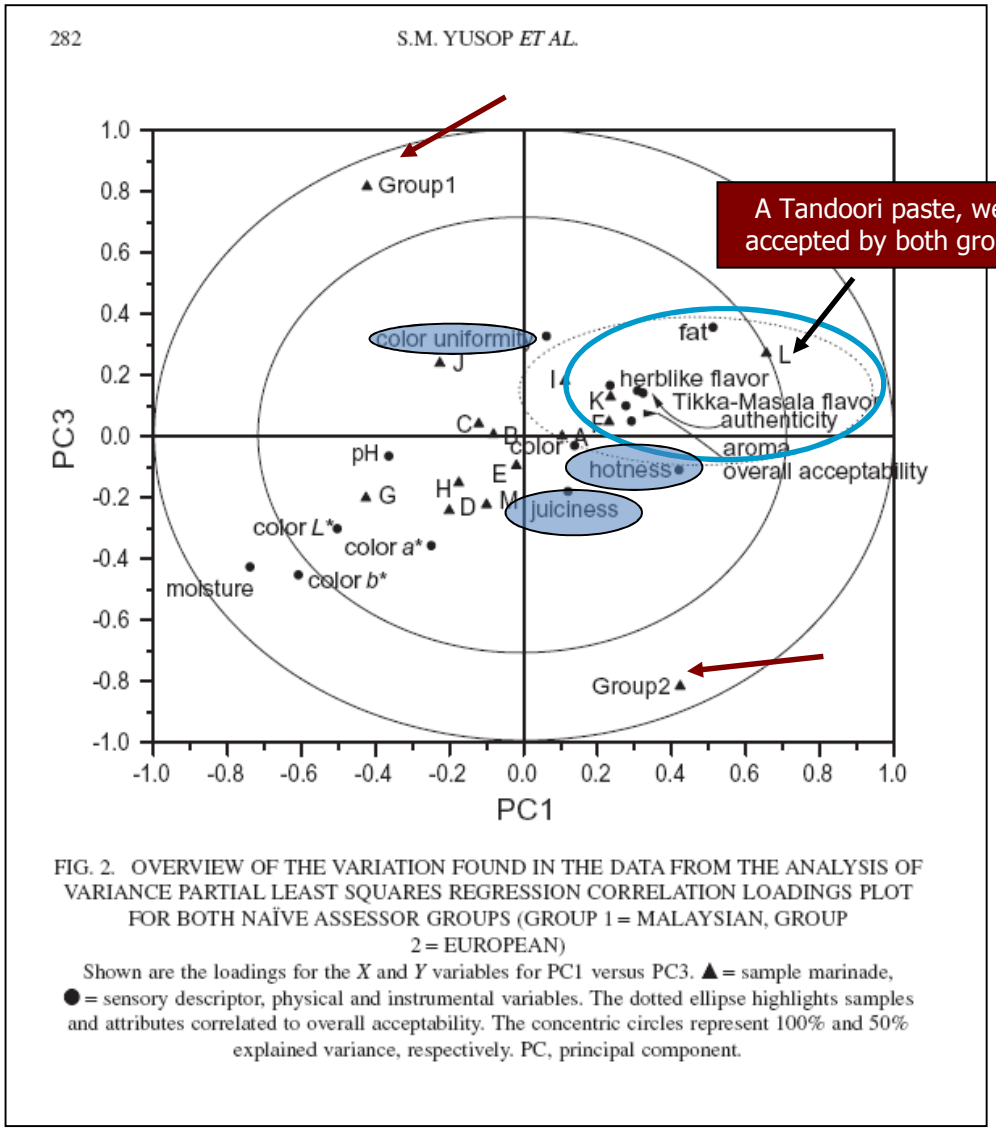


FIG. 2. OVERVIEW OF THE VARIATION FOUND IN THE DATA FROM THE ANALYSIS OF VARIANCE PARTIAL LEAST SQUARES REGRESSION CORRELATION LOADINGS PLOT FOR BOTH NAÏVE ASSESSOR GROUPS (GROUP 1 = MALAYSIAN, GROUP 2 = EUROPEAN)

Shown are the loadings for the *X* and *Y* variables for PC1 versus PC3. ▲ = sample marinade, ● = sensory descriptor, physical and instrumental variables. The dotted ellipse highlights samples and attributes correlated to overall acceptability. The concentric circles represent 100% and 50% explained variance, respectively. PC, principal component.

A Tandoori paste, well-accepted by both groups

- 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.
- Authenticity is an important driver.
- 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.

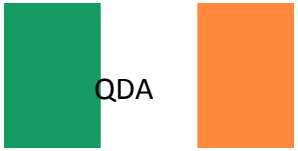
Irish Panel:
USA cheeses = creamy, buttery, and processed flavours, pungent, rancid, mould, onion, salty taste, and acid taste

Ireland
QDA™ method 100 mm line scale Definitions for all terms Food and/or chemical references for all terms Panel evaluates Cheddar cheese occasionally, lots of different products evaluated per week

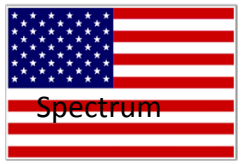
NZ Panel:
USA+Irish cheeses (Aged) = savoury, butyric, fruity, fermented , maturity flavour, salty, acid taste

New Zealand
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

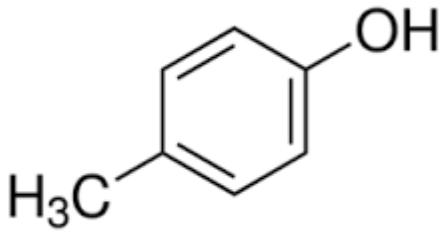
United States of America
Spectrum™ Method 15 point Spectrum™ scale Definitions for all terms Food and/or chemical references for all terms Panel evaluates Cheddar cheese several times per week



Descriptive Analysis



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



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

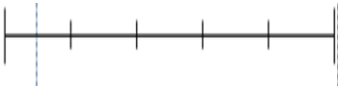
Aroma associated with barns and animal sheds

Reminiscent of ruminant sweat and urine

Cowy/Barny
Isolvaleric acid and p-cresol

USA Panel:
NZ Cheeses = mothball flavours

Quality



Low High

E-Tongue

Phyico-Chemical

GCMS

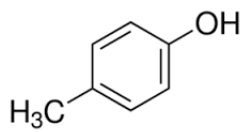
Expert

Descriptive (QDA, Spectrum)

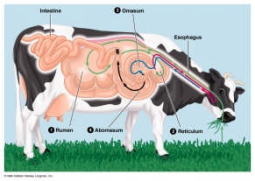
Rapid Methods (RDA)

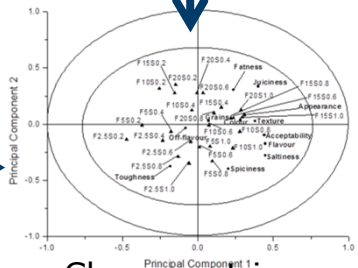
Hedonic (Liking)Methods

P-Cresol



Cowy/Barny





Chemometrics

Consumers

Western Consumers
- Sensory Optimised
- Regulatory compliant
- Traceable

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

Use MVA to link Grader-Descriptive-Hedonic Phisico-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

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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.

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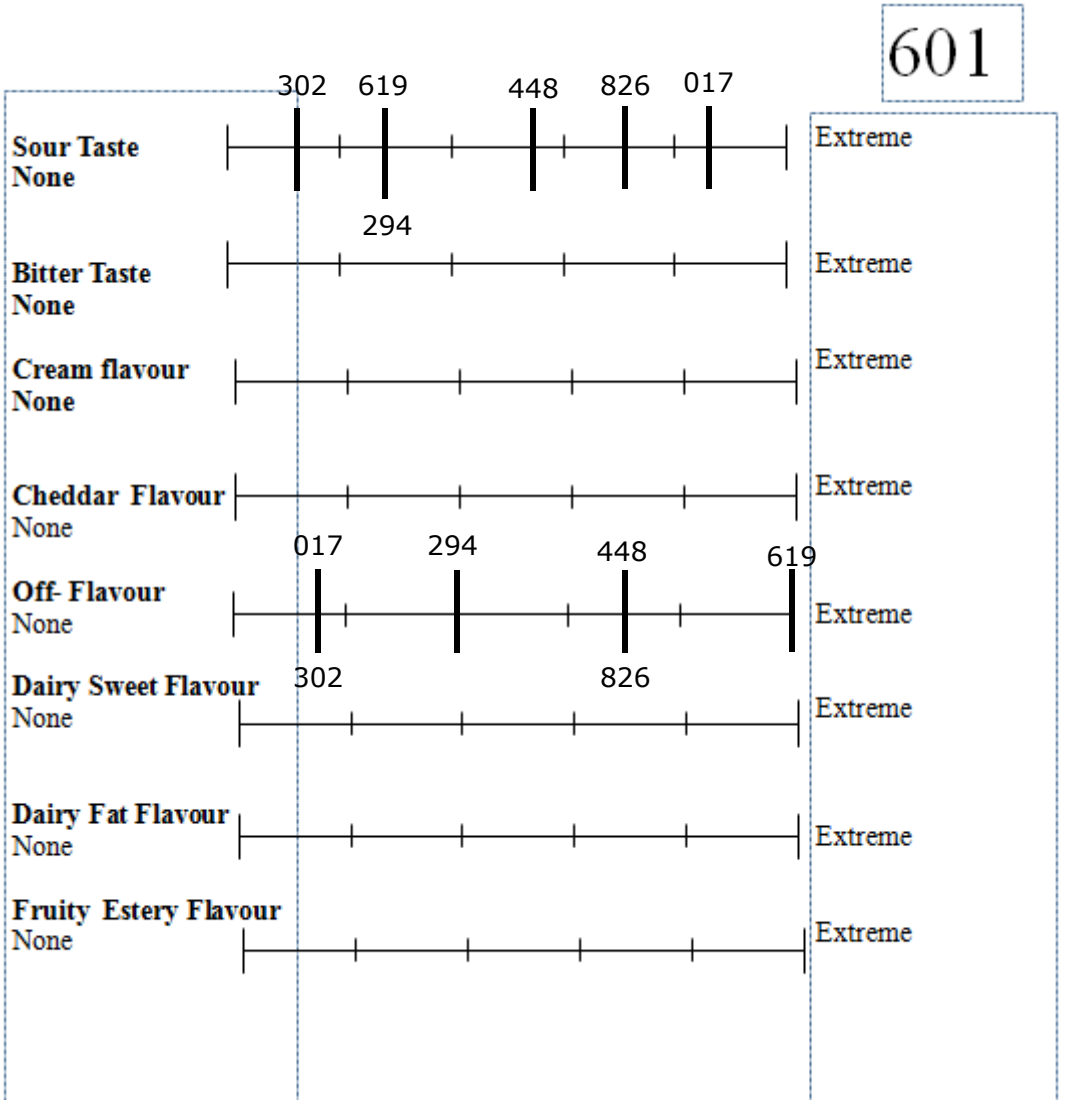
Table.1 Sensory terms for the affective and descriptive evaluation of whole and skim milk powder

Attribute	Definition	Scale
Hedonic		
Appearance-Liking	The liking of appearance	0 = extremely dislike10 = extreme
Flavour-Liking	The liking of flavour	0 = extremely dislike10 = extreme
Aroma-Liking	The liking of aroma	0 = extremely dislike10 = extreme
Texture-Liking	The liking of texture	0 = extremely dislike10 = extreme
Overall acceptability	The acceptability of the product	0 = extremely unacceptable10 = ex acceptable
Intensity		
Appearance-colour	Appearance-Ivory to orange colour	0 = Pale, 10 = Yellow
Sweet aroma	The smell associated with dairy sweet milky products	0 = none, 10 = extreme
Creamy aroma	The smell associated with creamy/milky products	0 = none, 10 = extreme
Cooked/ aroma	The smell associated with cooked milk products	0 = none, 10 = extreme
Oxidised (cardboard) aroma	The smell associated with rancid or oxidised products	0 = none, 10 = extreme
Painty aroma	The smell associated with rancid paint type notes	0 = none, 10 = extreme
Chalky Texture	Chalk like texture in the mouth	0 = none, 10 = extreme
Powdery Texture	Powdery texture in the mouth	0 = none, 10 = extreme
Viscosity	Thick texture in the mouth	0 = none, 10 = extreme
Sweet taste	Fundamental taste sensation of which sucrose is typical	0 = none, 10 = extreme
Sour	Fundamental taste sensation of which Lactic acid is typical	
salty	Fundamental taste sensation of which Sodium chloride solution is typical	
Cream flavour	The flavour associated with creamy/milky products	0 = none, 10 = extreme
Dairy sweet flavour	The flavours associated with sweetened cultured dairy products such as fruit yoghurt	0 = none, 10 = extreme
Carmelized Flavour	Intensity of caramel	0 = none, 10 = extreme
Oxidised (cardboard)	The flavour associated with rancid or oxidised products	0 = none, 10 = extreme
Rancid butter	The flavour associated with rancid or oxidised butter	0 = none, 10 = extreme
Painty Flavour	The flavour associated with rancid paint type notes	0 = none, 10 = extreme
Grassy/Hay	The flavours associated with grass, hay	0 = none, 10 = extreme
Cooked flavour	The flavour associated with cooked milk products	0 = none, 10 = extreme
Off-flavour	Off-flavour	0 = none, 10 = extreme
Astringent after-taste	Fundamental taste sensation of which aluminium sulphate is typical	0 = none, 10 = extreme

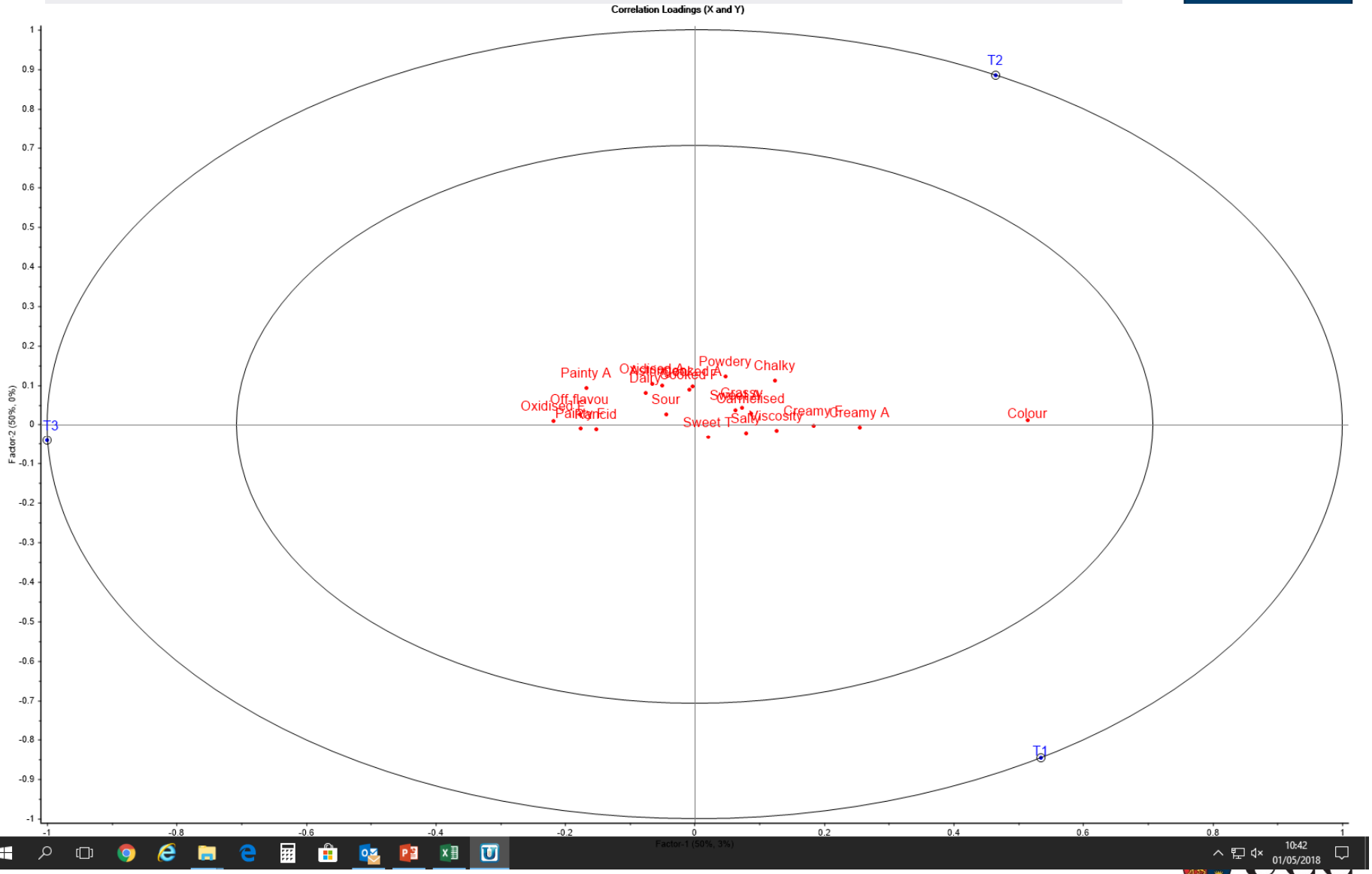
Descriptive analysis (RDA)

Rinse mouth with water between tastings



RDA-SMP

ANOVA-Partial Least Squares regression (APLSR)



RDA-SMP

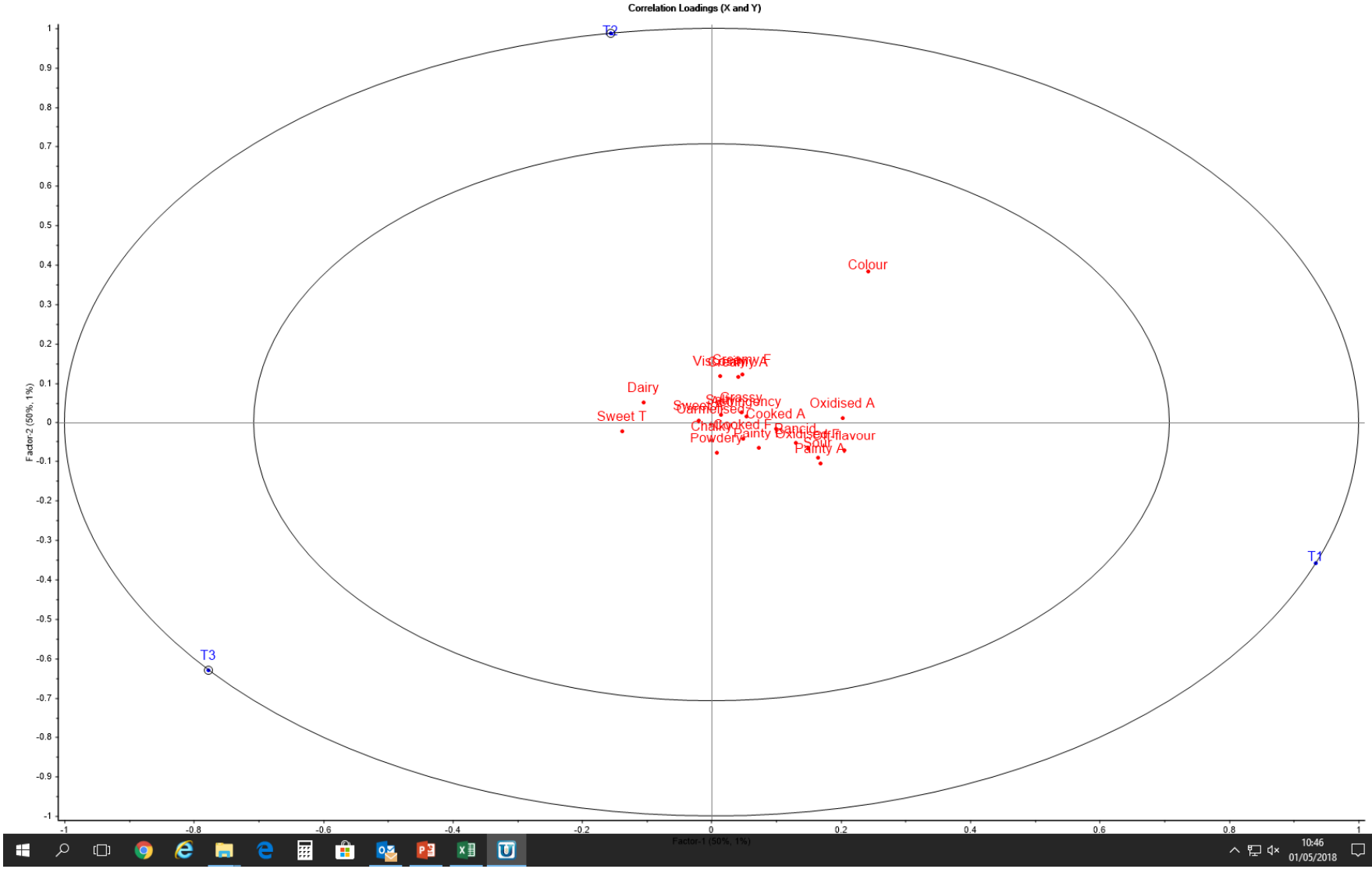
ANOVA values of regression coefficients from APLSR for RDA sensory terms

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

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

RDA-WMP

ANOVA-Partial Least Squares regression (APLSR)



RDA-WMP

ANOVA values of regression coefficients from APLSR for RDA sensory terms

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

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

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

请打开试验台上的转盘，并举手示意在场老师或工作人员您将准备开始进行感官试验。一旦您完成一种样品感官评价，请将该样品放回转盘并旋转转盘进行下一样品的感官评价。

请观察样品_____并回答下列关于样品外观的问题

1. 下列哪个描述词能最好的表达您对该样品外观的感受？

极度不喜欢	非常不喜欢	不喜欢	稍微不喜欢	一般	稍微喜欢	喜欢	非常喜欢	极度喜欢

2. 下列哪个描述词能最好地表达您对该样品香味的感受？

极度不喜欢	非常不喜欢	不喜欢	稍微不喜欢	一般	稍微喜欢	喜欢	非常喜欢	极度喜欢

现在请品尝样品_____并回答下列问题

1. 下列哪个描述词能最好得表达您对该样品的**总体喜好**程度？

极度不喜欢	非常不喜欢	不喜欢	稍微不喜欢	一般	稍微喜欢	喜欢	非常喜欢	极度喜欢

2. 下列哪个描述词能最好地表达您对该样品**风味**的感受？

极度不喜欢	非常不喜欢	不喜欢	稍微不喜欢	一般	稍微喜欢	喜欢	非常喜欢	极度喜欢

3. 下列哪个描述词能最好地表达您对该样品**新鲜**程度的感受？

根本不新鲜		新鲜		极度新鲜

4. 下列哪个描述词能最好地表达您对该样品是否具有**牛奶煮熟风味**的感受？

根本无煮熟味		一般		极度强烈煮熟味

5. 下列哪个描述词能最好地表达您对该样品是否具有**变质**风味的感受？

没有呈现出变质风味		一般程度的变质风味		极度强烈煮熟味

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

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

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely

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

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely

Now please taste sample _____ and answer the following questions:

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

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely

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

Dislike Extremely	Dislike Very Much	Dislike Moderately	Dislike Slightly	Neither Like nor Dislike	Like Slightly	Like Moderately	Like Very Much	Like Extremely

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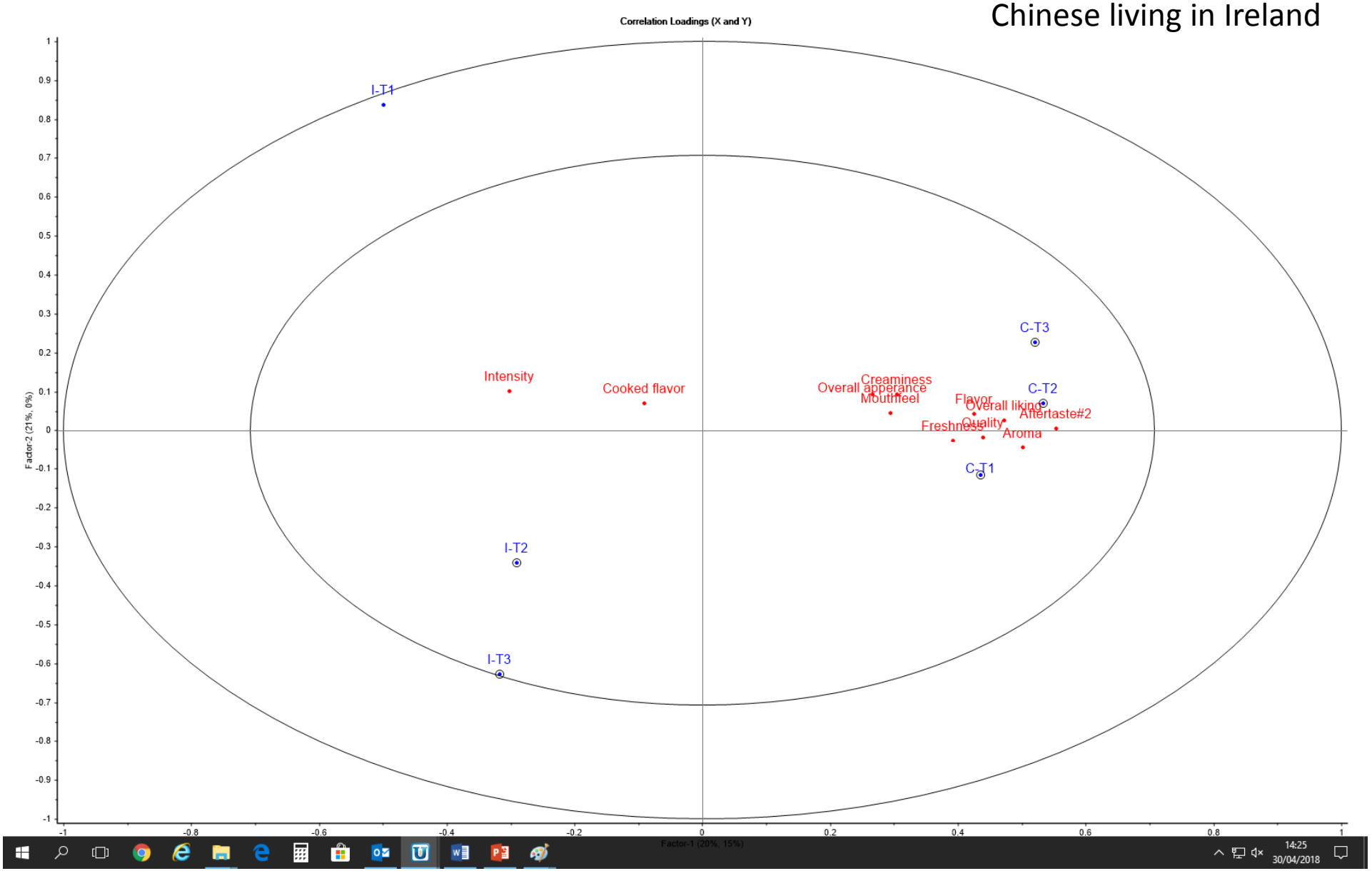
APLSR-WMP

Consumers
Irish
Chinese living in Ireland



P Values WMP (Whole Milk Powder)

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

Treatment	
T1	**Grass**
T2	**Clover**
T3	**TMR (Total Mixed Ration)**
I = Irish, iC=Chinese consumers residing in Ireland <6Mths	

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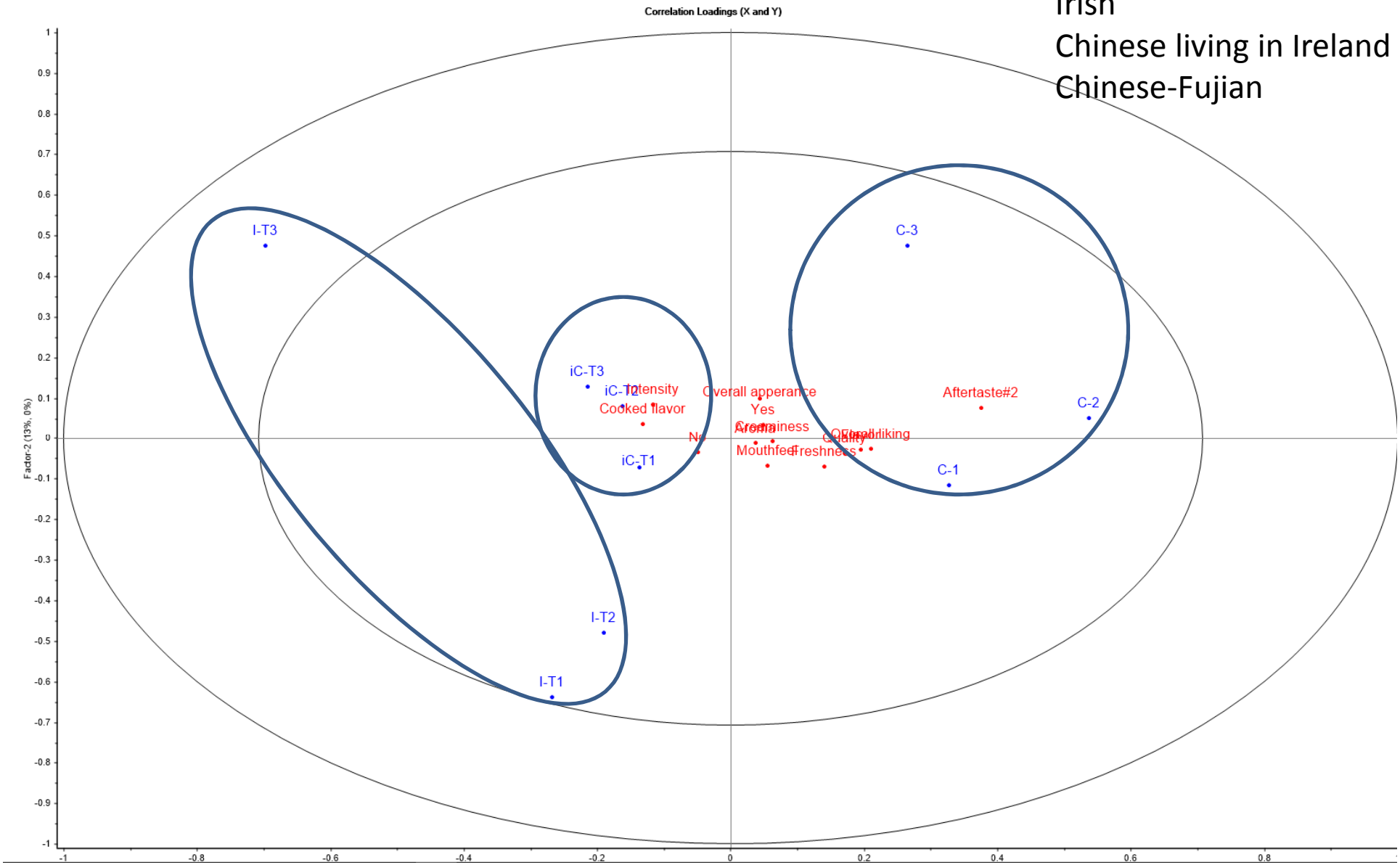
APLSR-SMP

Consumers
Irish
Chinese living in Ireland
Chinese-Fujian



P Values SMP (Skim Milk Powder)

	Overall apperance	Aroma	Overall liking	Flavor	Freshness	Cooked flavor	Mouthfeel	Creaminess	Yes	No	Aftertaste#2	Intensity	Quality
iC-T1	0.5381	0.5277	0.3554	0.3523	0.3560	0.3653	0.4402	0.4278	0.4815	0.4815	0.3628	0.4024	0.3692
iC-T2	0.4252	0.4269	0.1726	0.1761	0.1643	0.1816	0.3090	0.2860	0.3783	0.3783	0.1804	0.3086	0.1864
iC-T3	0.3501	0.3717	0.0613	0.0646	0.0865	0.0698	0.2253	0.1938	0.3526	0.3526	0.0710	0.2115	0.0942
I-T1	0.5377	0.4262	0.3412	0.3370	0.3165	0.3381	0.3366	0.4243	0.4606	0.4606	0.3498	0.2736	0.3398
I-T2	0.7208	0.7159	0.6807	0.6827	0.6817	0.6833	0.6832	0.6706	0.7065	0.7065	0.6846	0.6995	0.6775
I-T3	0.2180	0.3490	0.0031	0.0034	0.0247	0.0111	0.1717	0.0926	0.1131	0.1131	0.0001	0.2857	0.0052
C-T1	0.3109	0.2859	0.0065	0.0087	0.0234	0.0320	0.1307	0.0888	0.2432	0.2432	0.0055	0.2122	0.0038
C-T2	0.3031	0.3284	0.0001	0.0001	0.0010	0.0017	0.1591	0.1137	0.2183	0.2183	0.0000	0.1939	0.0038
C-T3	0.3709	0.4290	0.0509	0.0502	0.0641	0.0374	0.1737	0.1531	0.2540	0.2540	0.0488	0.2373	0.0529

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

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

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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

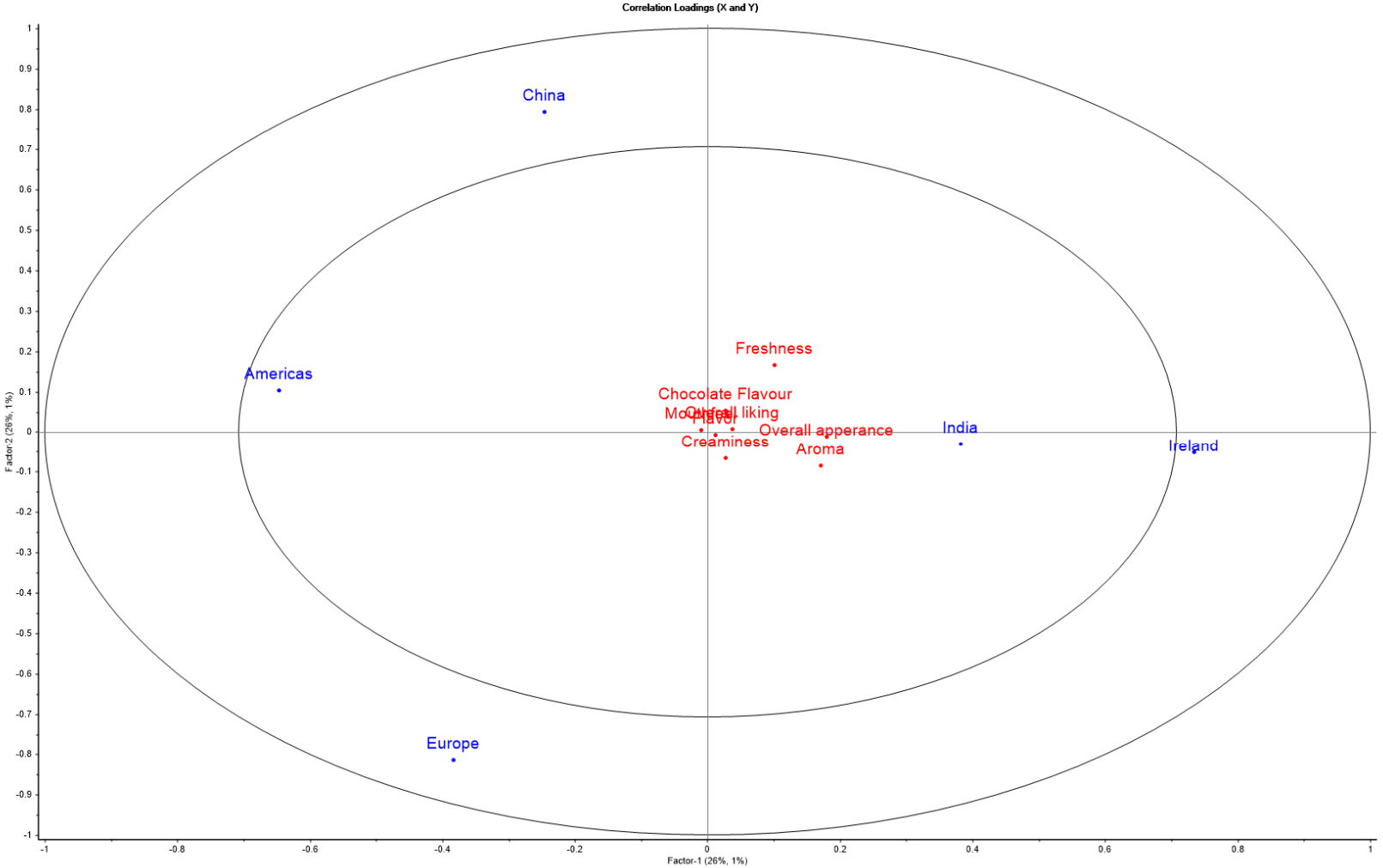
- Irish, Chinese and Chinese-Ireland residents were clearly separated by the APLSR
- Chinese consumers liked the SMP the most, followed by the Chinese-Ireland residents and then Irish

- Reason- Chinese consumers adapted to poor quality dairy products in market thus also adapted to off-flavour

Chinese Market

Cork, Ireland

Consumer study sweet chocolate (n=110)



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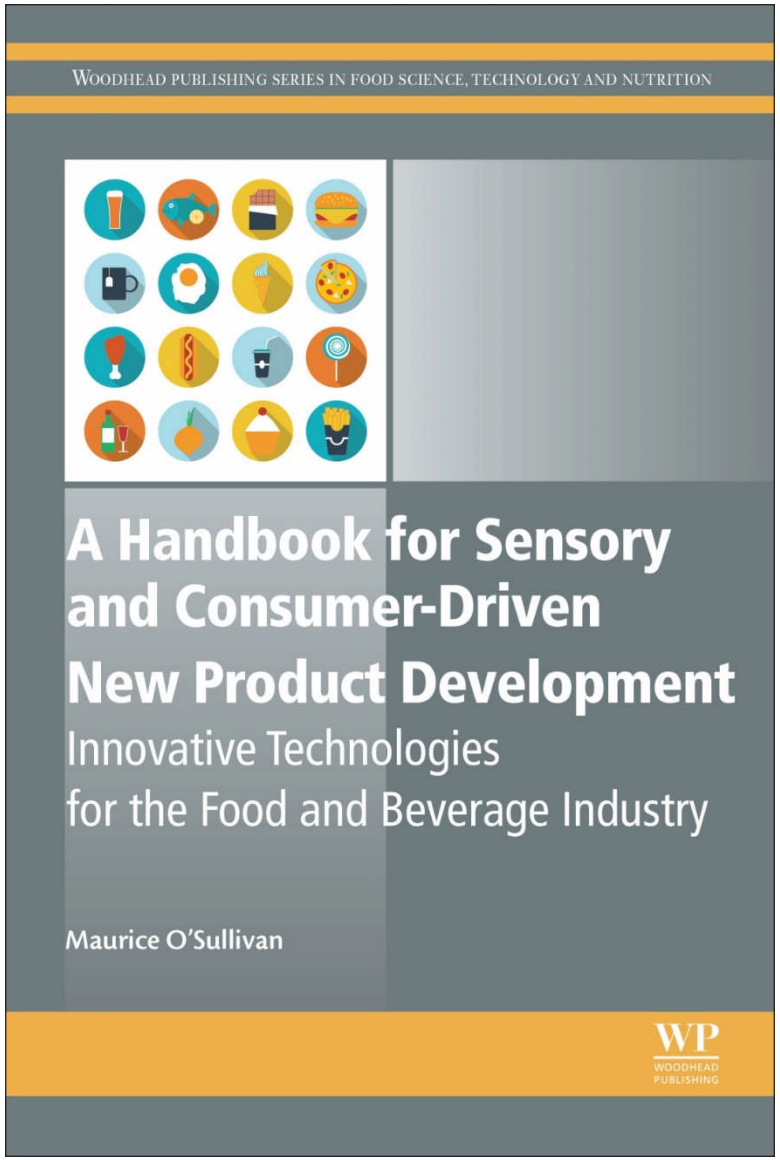
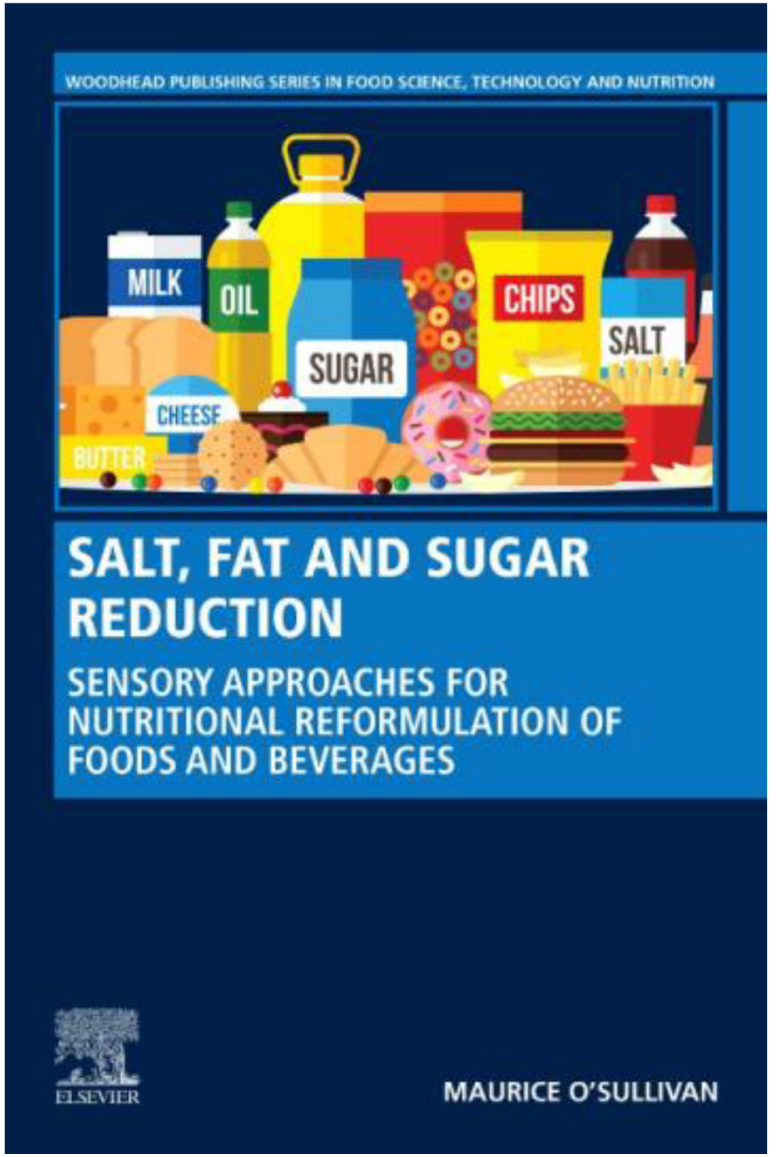
Conclusions

P Value

	Overall apperance	Aroma	Overall liking	Flavor	Mouthfeel	Creaminess
Ireland	0.046	0.029	0.211	0.361	0.491	0.133
China	0.843	0.077	0.820	0.520	0.370	0.041
Europe	0.512	0.591	0.595	0.721	0.428	0.822
India	0.000	0.164	0.552	0.537	0.897	0.883
Americas	0.000	0.004	0.729	0.596	0.112	0.480

Dark Green Significantly positively correlated
Dark Red Significantly negatively correlated
Light Green positively correlated (NS)
Beige negatively correlated (NS)





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