



Achieving consistency in desirable pork quality: Australian initiatives and experience

实现理想猪肉品质的一致性：澳大利亚倡议和经验

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Setting the scene – focussing on differentiation

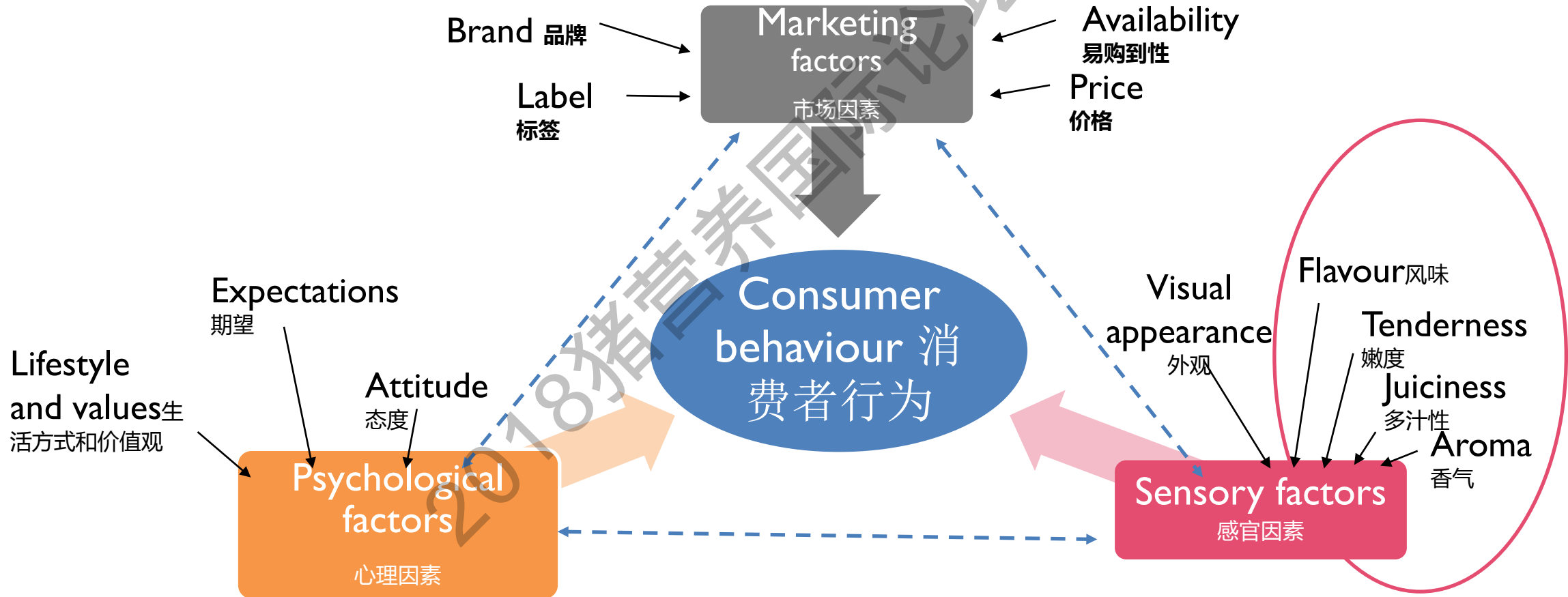
设置场景——聚焦差异

- Australian pork industry: 澳大利亚猪肉行业
 - Accounts for ~0.5% global pig production 约占全球养猪产量0.5%
 - 279,000 sows; 5.38 million pigs slaughtered / year (July 2018)
279,000头母猪; 每年屠宰538万头猪 (截止2018.7)
 - Domestic focussed - ~10% exported 聚焦国内——约10%出口
 - Production systems 生产系统



Factors influencing consumer behaviour

对消费者行为影响的因素

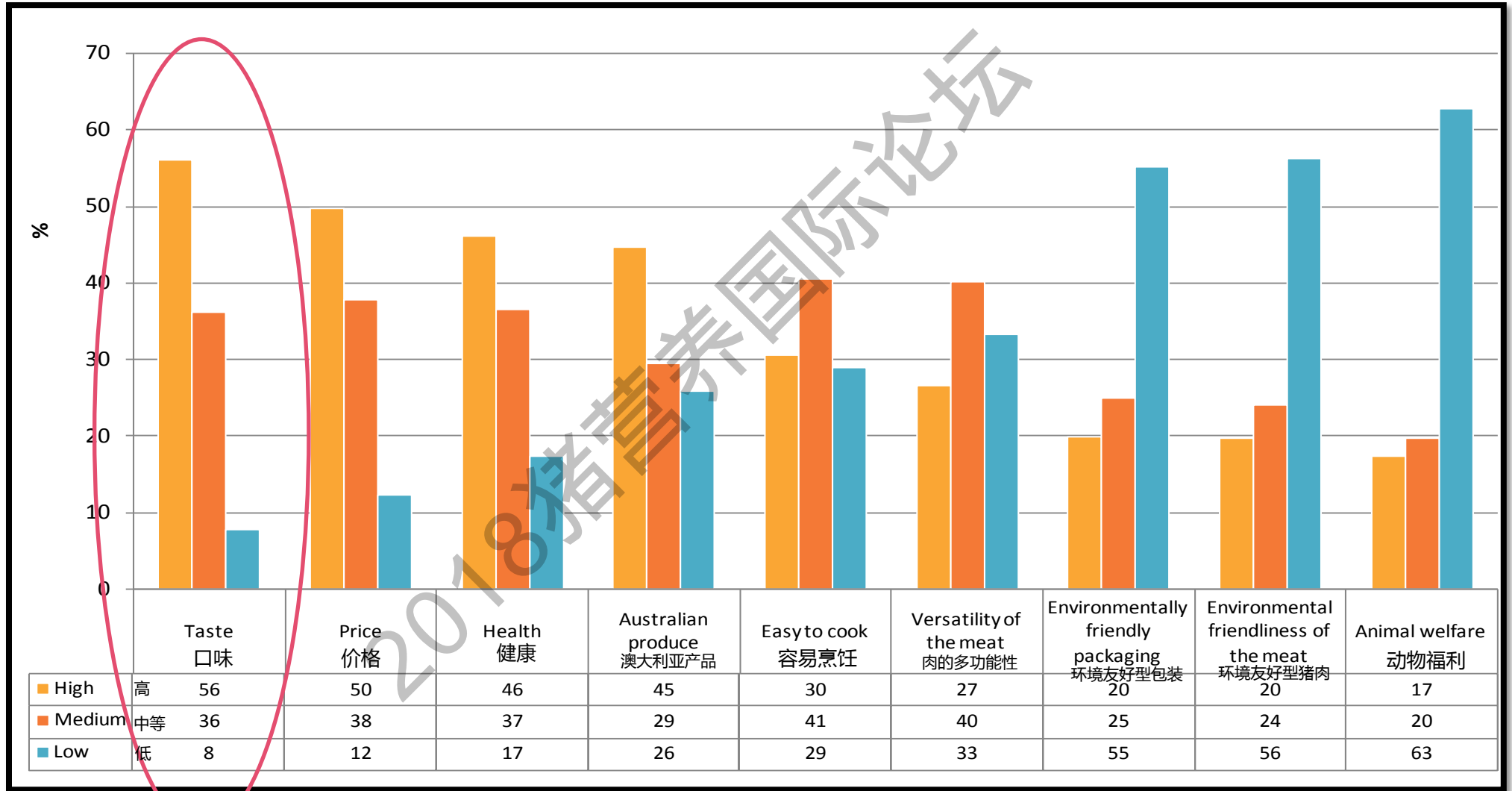




Meeting consumer needs – importance of ‘taste’



满足消费者需求 - '口味'的重要性





Contributors of inconsistent pork eating quality

使猪肉食用品质不一致的一些原因

Flavour (and odour) issues

-boar taint 风味 (和气味) 问题
-公猪膻味

Overcooking -
to 'well done' (>75°C)
烹饪过熟 - "全熟" (>75°C)

Low intramuscular fat levels
肌内脂肪含量低

Incidence of pale, soft and
exudative pork
PSE猪肉的发生率

Inadequate ageing
老化不充分



**Inconsistent
eating quality**

食用质量不一致

Primarily loin data
主要是里脊肉数据



What have our competitors done?

我们的竞争对手做了什么？

- Meat Standards Australia (MSA) program guarantees the eating quality of beef and sheepmeat on a cut type x cooking method basis
澳大利亚肉类标准 (MSA) 计划以切块类型x烹饪方法为基础保证牛肉和羊肉的食用品质
- Pathway approach - involves whole supply chain 路径法 - 涉及整个供应链
- Beef – individual carcasses 牛肉 - 个体胴体
- Sheepmeat – mob based system 羊肉-基于群体的系统
- **Cuts-based (cut type x cooking method)** 切块-基于 (切块类型x烹饪方法)



2018年猪肉行业研讨会



What we are doing to build consumer demand and trust in Australian pork

为满足消费者对澳大利亚猪肉的需求和信任我们正在采取的措施

By implementing: 采取实施 :

1. a **non-prescriptive**, cost-effective **cuts-based** system to deliver pork of consistently high eating quality to our consumers.
以切块为基础的一种非规范的、具有成本效益的系统，为消费者始终如一地提供高品质猪肉。
2. an **accurate, robust and reliable** system, known as Physi-Trace™, to extend our traceability system for pork to property of origin (raw pork) and “Australian or not” (ham and bacon).
Physi-Trace™是一个准确、强大和可靠的猪肉追溯系统，可将猪肉追溯到原产地（生猪肉）或‘是否澳大利亚生产’（火腿和培根）。

‘Short cutting’ ... use of existing data to develop an eating quality model ‘短切’ ...利用现有数据开发食用品质模型

- Meta-analysis – primarily paired comparisons 元分析 - 主要是配对比较
- Random effects meta-regression – 294 studies (1968 – 2016)
随机效应元回归 - 294项研究 (1968年 - 2016年)
 - All sensory mean data converted to a 0-100 scale
– 所有感官平均数据转换为0-100等级
 - Estimate means and effect sizes for sensory traits in response to different pathway factors 估计不同路径因素导致的感官性状的平均值和效应大小
 - Criterion for study inclusion established including measures of variation 建立研究的标准, 包括变异量
 - Determine significant differences between means for sensory traits 确定感觉性状平均值之间的显著差异

Channon et al. (2017) Channon 等(2017)

Random-effects meta-regression: variables assessed

随机效应元回归：变量评估

Parameter参数	Explanatory variables 解释变量
Sex性别	Female, entire male, surgical castrate, immunocastrate 雌性、完全雄性，手术阉割，免疫去势雄性
Genotype group 基因型组	Berkshire, Duroc, Hampshire, Pietrain, White>50% 伯克夏，杜洛克、汉普夏、皮特兰、白猪≥ 50%
Halothane gene 氟烷基因	NN, Nn, nn纯合显性，杂合子，纯隐性
Housing 猪舍	Indoor/conventional, barn/ecoshelter, outdoor/free range 室内/常规，牲口棚/生态猪舍，户外/放养
Feeding level 饲养水平	Ad libitum GF; Ad lib G & Restr F; Restr G & Ad lib F; Restr GF 自由活动采食、自由活动和限制采食，限制活动和自由采食，限制活动和采食
Metabolic modifiers 代谢调节剂	pST/no PST and ractopamine (5-10 ppm)/no ractopamine 猪生长激素/不给猪生长激素，莱克多巴胺 (5-10 ppm) /不给莱克多巴胺
Stunning 击晕	CO ₂ , Electrical 二氧化碳，，电流
Ageing period 老化期	≤2 days, 3-7 days, > 7 days ≤2天，3-7天，>7天
Electrical stimulation 电流刺激	None, electrical stimulation 无，水分输注
Moisture infusion 水分输注	None, moisture infusion 无，水分输注
Hanging method 悬挂方法	Aitchbone (tender stretch) 胫骨 (嫩度牵拉)
Endpoint temperature 终点温度	65-69°C, 70-74°C, 75-79°C, ≥80°C 65-69°C，70-74°C，75-79°C，≥80°C
Cut type (loin) 切割类型 (里脊)	Chop/steak, roast 带骨肉排/肉排，烤肉



Key pathway parameters influencing pork sensory traits: meta-regression outcomes

影响猪肉感官特征的关键途径参数：元回归结果

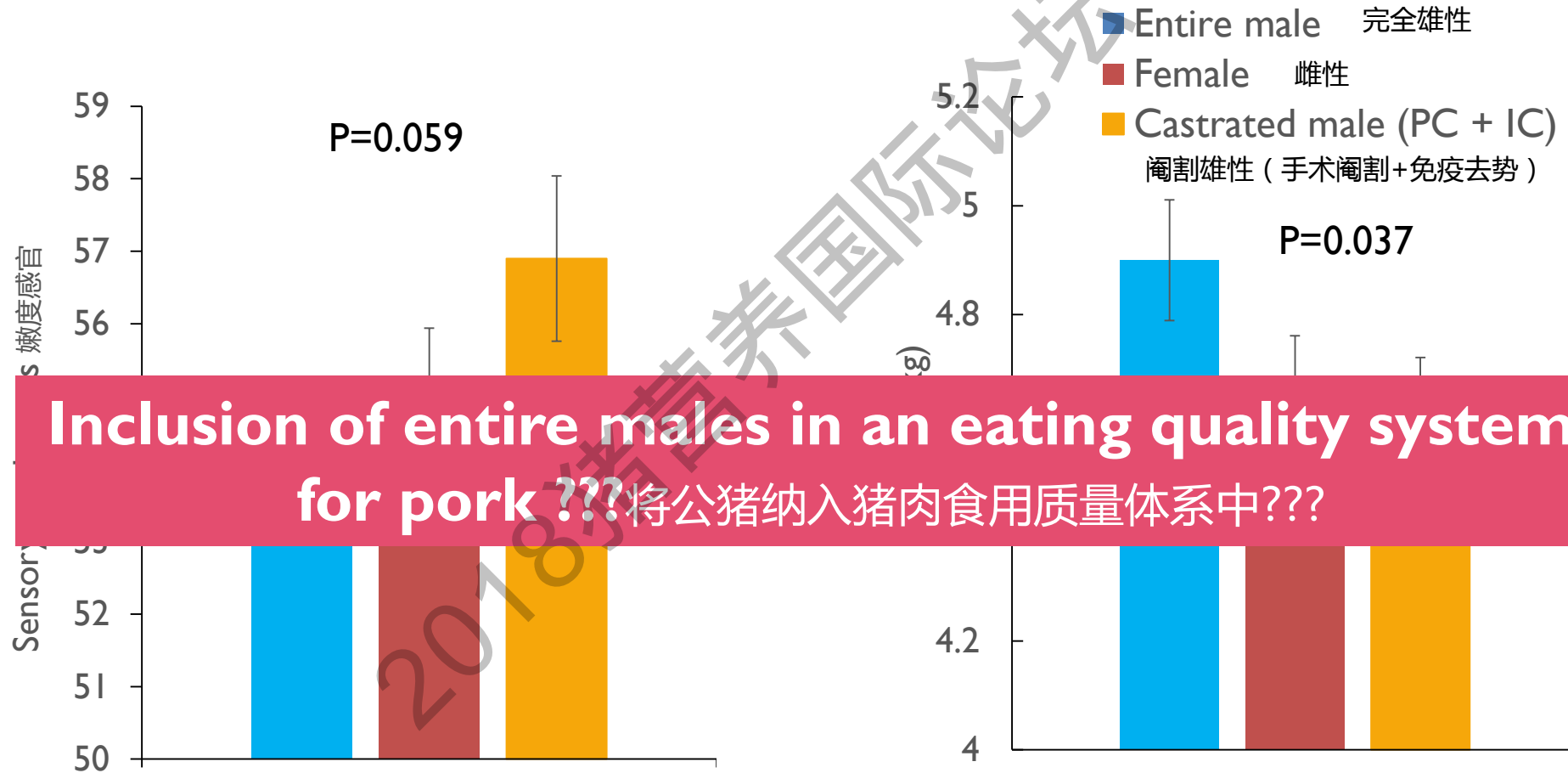
Parameter参数	Tenderness嫩度	Flavour风味	Juiciness多汁性
Genotype基因型	*	**	
Halothane status氟烷状态		**	
pST猪生长激素	***		*
Electrical stimulation电流刺激		n.d.	*
Hanging method悬挂方法	**	n.d.	
Ageing period (days)老化期(天)	**		***
Moisture infusion水分注入	***	*	***
Endpoint temperature终点温度	*	**	***
Cut type切割类型	***		

•P<0.05; ** P<0.01, ***P<0.001; n.d. – not determined; loin data only
 n.d.-非决定性的；数据仅限里脊

Channon et al. (2017)
 Channon等 (2017)
 CSIS 2018

Additional data is required for gender

对于性别需要额外的数据



Inclusion of entire males in an eating quality system for pork ??? 将公猪纳入猪肉食用质量体系中的???

Channon et al. (2017)



Building an eating quality system - determining effects of pathway factors (and their interactions)

建立食用质量体系 - 确定路径因素的影响 (及其相互作用)



Gender, age/liveweight, genotype, halothane status, nutrition (diet composition, soy lecithin), housing type 性别, 年龄/活体重, 基因型, 氟烷状态, 营养 (日粮构成, 大豆卵磷脂), 猪舍类型

Time off feed, transport conditions, loading and unloading, mixing, lairage 停料时间, 运输条件, 装卸, 混合, 猪栏

Stunning, electrical stimulation, scalding & dehairing, hanging method, chilling 击晕, 电流刺激, 烫毛和脱毛, 悬挂方法, 冷却

Ageing period, moisture infusion, packaging method 老化期, 水分注入, 包装方法

Muscle, cut type, cooking method, endpoint temperature, ultimate pH 肌肉, 切块类型, 烹饪方法, 终点温度, 最终PH





Building an eating quality system - determining effects of pathway factors (and their interactions)

建立食用质量体系 - 确定路径因素的影响 (及其相互作用)



Gender, age/liveweight, genotype, halothane status, nutrition (diet composition, soy lecithin), housing type
性别, 年龄/活体重, 基因型, 氟烷状态, 营养 (日粮构成, 大豆卵磷脂), 猪舍类型

Time off feed, transport conditions, loading and unloading, mixing, lairage
停止进料, 运输条件, 装卸, 混合, 猪栏

Stunning, electrical stimulation, scalding & dehairing, hanging method, chilling
击晕, 电流刺激, 烫毛和脱毛, 悬挂方法, 冷却

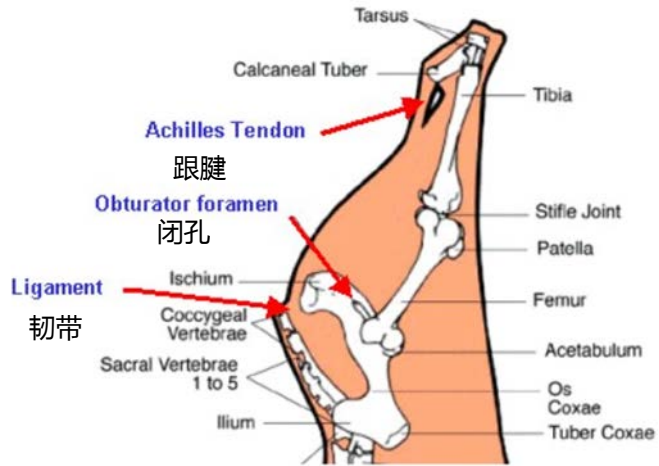
Ageing period, moisture infusion, packaging method
老化期, 水分注入, 包装方法

Muscle, cut type, cooking method, endpoint temperature, ultimate pH
肌肉, 切块类型, 烹饪方法, 终点温度, 最终PH

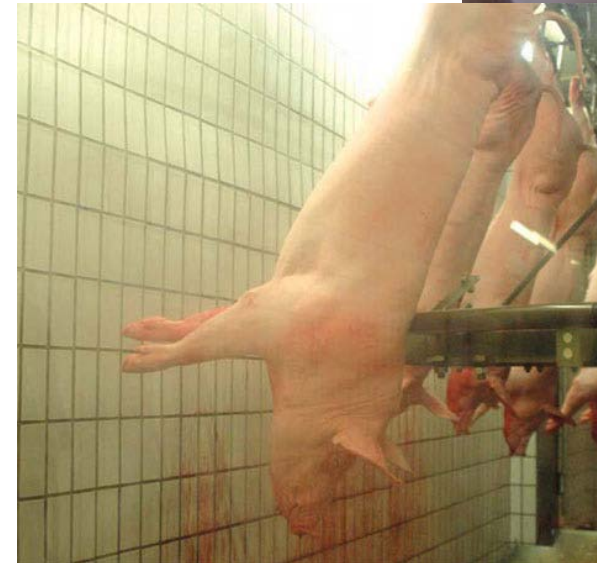


Processing interventions

加工干预



Aitchbone hanging / tenderstretching
耻骨悬吊/嫩度牵拉



Electrical stimulation
电流刺激

Processing interventions

加工干预



Ageing pork (in vacuum packaging) as steak or small roasts

老化猪肉（真空包装）作为肉排或小烤肉

Moisture infusion

水分注入

Consumer assessments

消费者评估

- **Tenderness, juiciness, aroma, flavour and overall liking**

嫩度，多汁性，香气，风味和整体喜好

0

dislike extremely, not juicy, not tender
非常不喜欢，不多汁，不嫩

100

like extremely, very juicy, very tender
非常喜欢，非常多汁，非常嫩

- **Quality grade** 质量等级 -

1. Unsatisfactory

不满意

2. Below average

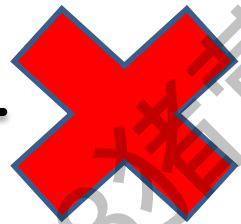
低于平均值

3. Average 平均值

4. Above average

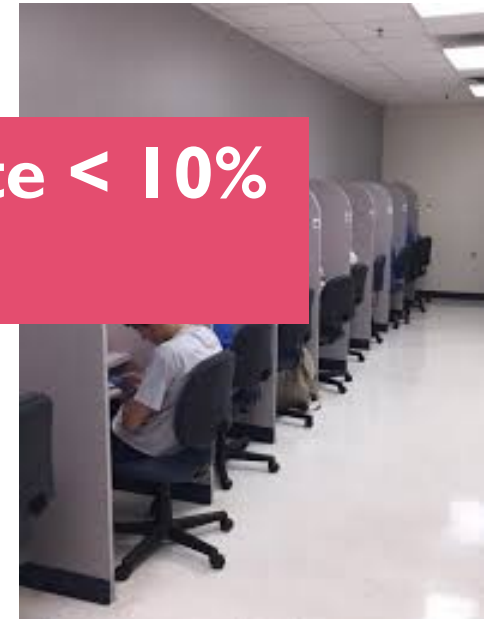
高于平均水平

5. Excellent 优秀



Target – Fail rate < 10%

目标 - 失败率 < 10%



Higher fail rates for entire males – Australian data

正常公猪的失败率更高 - 澳大利亚数据

	Fail rate (%) 失败率 (%)				P value P值	Boar taint 公猪膻味
	Entire males 正常公猪	Females 雌性	Surgical castrates 手术阉割	IC 免疫去势		
Channon et al. (2016) Channon等 (2016)	23.0	19.1	17.7		0.005	15% 10%
Channon et al. (2018a) Channon等 (2018A)	17.8			15.7	n.s.	
Akit et al. (2016) Akit等 (2016)	13.8	10.0		10.0	n.s.	
Jose et al. (2013) Jose等 (2013)	23.8	19.4			n.s.	
Moore et al. (2017) Moore等 (2017)	29.8			20.7	0.007	
Channon et al. (2015) Channon等 (2015)		19.6		15.8	0.004	
Channon et al. (2018b) Channon等 (2018b)		21.9		18.7	0.031	
Channon et al. (2018c) Channon等 (2018c)		19.1		18.5	n.s.	

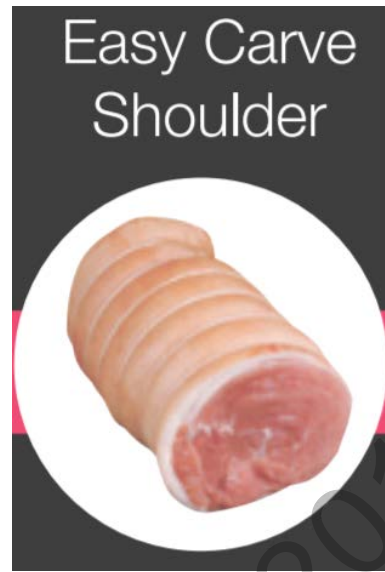
Cuts used for eating quality studies

切块方法用于食用质量研究

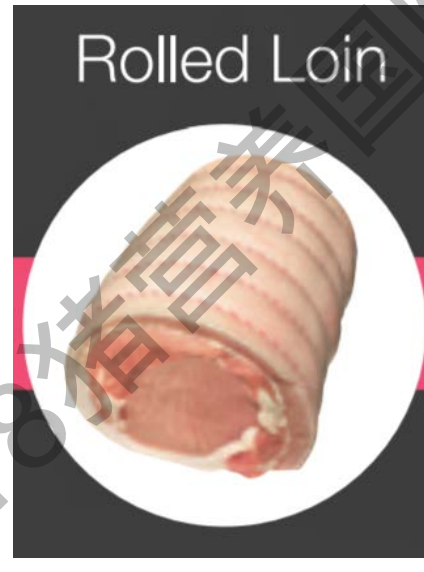
易切薄片烤腿肉



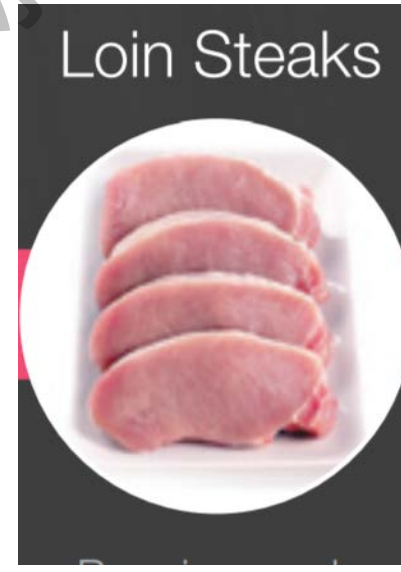
易切薄片肩胛肉



卷里脊



里脊肉排



翻炒条



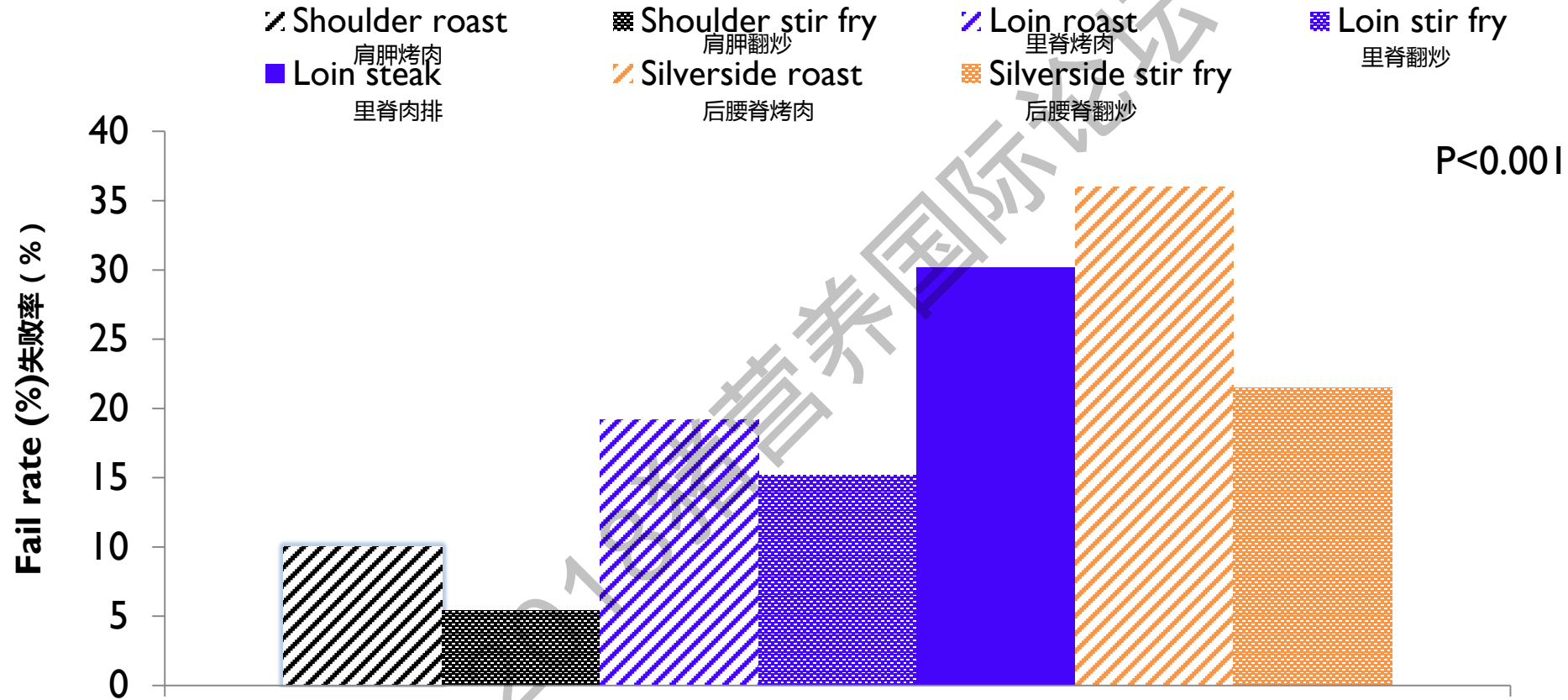
Source: Australian Pork Cuts Chart

资料来源：澳大利亚猪肉切块图



Fail rates vary due to cut type x cooking method

失败率因切割类型 x 烹饪方法而异



Channon et al. (2016) Meat Sci. 121:216
 Channon等 (2016) 肉类科学. 121:216



Ageing pork for up to 28 days did not affect fail rates of Australian pork (across all cuts)

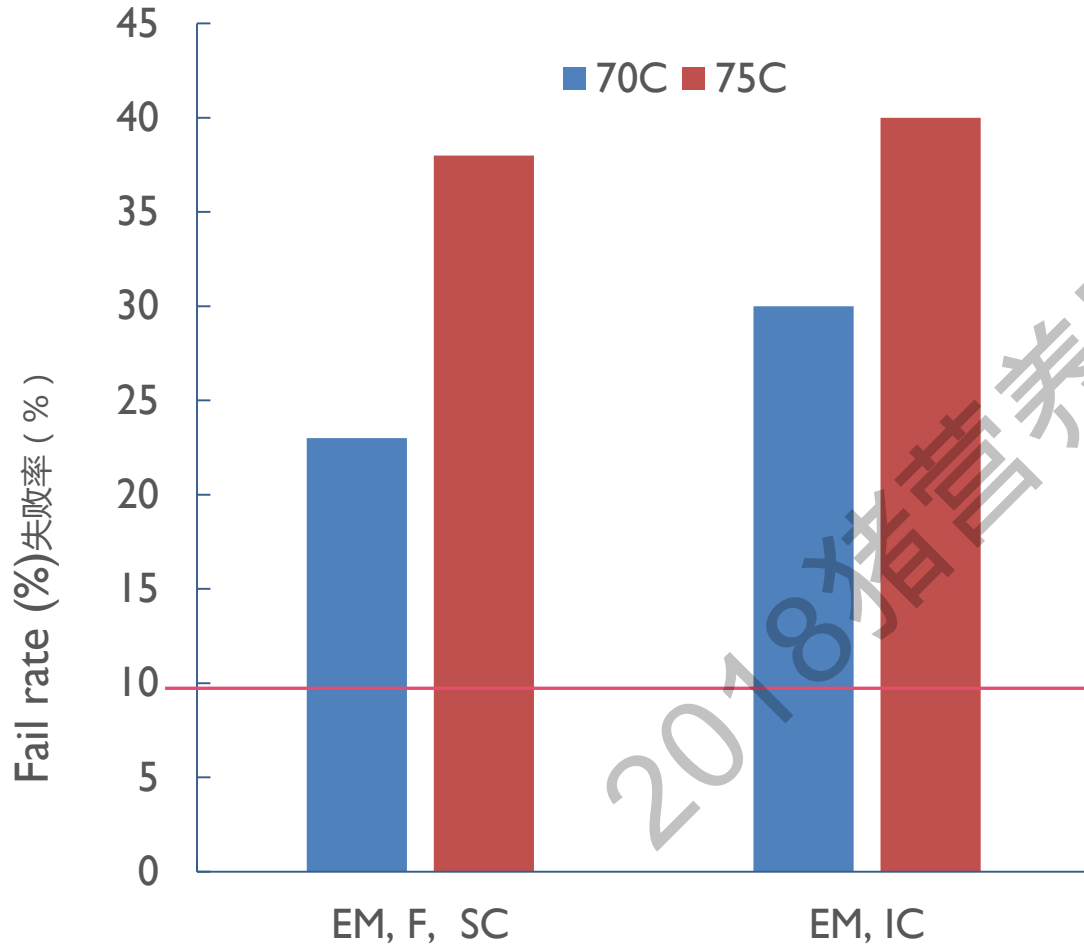
老化期长达28天的猪肉不影响澳大利亚猪肉的失败率（所有切块）

	Fail rate (%) 失败率 (%)				P value P值
	2 d	7 d	14 d	28 d	
Channon et al. (2015)	19.8	17.4			n.s.
Channon et al. (2016)	20.9	18.9			n.s.
Channon et al. (2018b)	17.1	16.4			n.s.
Channon et al. (2018a)		17.2		17.0	n.s.
Channon et al. (2018c)	20.3	23.4			n.s.
Channon et al. (2018d)	21.7		20.0		n.s.



Loin steaks cooked to 75°C had higher fail rates

煮至75°C的里脊肉排有较高的失败率



"6-2-2" FOR SUCCULENT PORK STEAKS

"6-2-2" 多汁的猪排

6

1. Pre-heat a pan, griddle pan or BBQ plate just like you would for any other steak. Cook on one side for **6 minutes**.

1. 将平底锅，铛或烧烤盘预热，就像你煮其他牛排一样当一边6分钟。

2

2. Turn once and cook for **2 more minutes**.

2. 翻转一次，再煮2分钟

2

3. Now just take the pork steak out of the pan and without turning, let it rest for **2 final minutes**, allowing the juices to settle so it's nice and tender.

3. 现在只需将肉排从锅中取出，不要翻动让它静置2分钟让汁沉淀，使它变得味美柔嫩



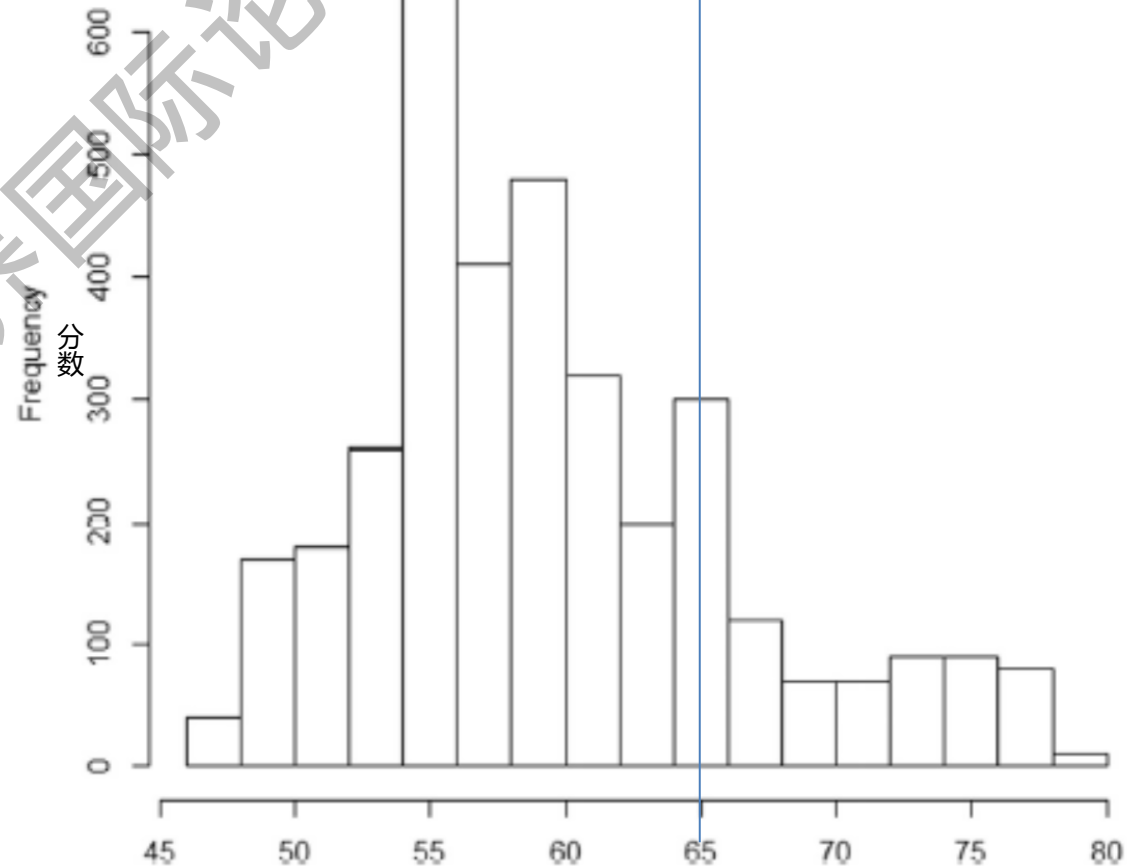
Distribution of cut-off scores

(10 studies, n=3564 samples, 14,208 consumer responses)

截止分数的分布 (10项研究, n = 3564个样本, 14,208份消费者回复)

PQS (pork quality score) 猪肉质量得分

- ≤ 35 - Unsatisfactory/below average
 ≤ 35 -不满意/低于平均分
- 36-65 - Average 36-65-平均分
- 66-87 - Above average 66-87-平均分以上
- ≥ 88 - Excellent ≥ 88 -优秀





Pathway factor 途径因素	Pathway variable 路径变量	Base PQS*PQS得分	Effect影响 Change变化	Effect change due to interactions相互作用效果发生变化	
				70°C	75°C Cut type x cooking method切割类型x烹饪方法
Gender性别	Entire male完全雄性	52.4		0.0	0.0
	Female雌性			2.1	-2.2
Ageing period老化期	Physical castrate物理阉割	免疫去势雄性		3.5	3.3
	Immunocastrated male			2.4	0.7
	1 day 1天			0.0	n.a.
	2 days 2天			-0.3	-0.3
	5 days 5天			-0.5	n.a.
	7 days 7天			1.4	-0.8
	14 days 14天			3.3	-2.9
Cut type x cooking method 切割式 x 烹饪方法	28 days 28天			3.4	-3.0
	Loin roast 里脊烤肉			0.0	0.0
	Loin stir fry 里脊煎炒			2.9	1.5
	Loin steak (grilled) 里脊肉排(煎肉)			-3.2	-8.5
	Shoulder roast 肩胛烤肉			7.4	3.8
	Shoulder stir fry 肩胛翻炒			15.0	17.5
	Silverside roast 后腰脊烤肉			-9.1	-3.2
	Silverside stir fry 后腰脊翻炒			-3.4	2.9
Endpoint temperature终点温度	75°C (vs 70°C)		1.0		
Moisture infusion水分输注	Moisture infusion 水分输注		7.8		
			13.4		
Electrical stimulation电流刺激	Yes - 150 mA for 30 sec 是的150毫安30秒		1.8		
			6.1		
			4.4		
Hanging method悬挂方法 最终PH(72小时)	Aitchbone (vs.Achilles) 耻骨(对比跟腱)		4.4		
		Ultimate pH (72 hours) 5.5-5.7 (vs. <5.5)		4.3	

• refers to a non-moisture infused loin roast sample from a non-electrically stimulated, Achilles hung entire male carcass aged for 1 day with ultimate pH of < 5.5 cooked to an endpoint temperature of 70°C.

n.a – not available.
参考非电刺激的非注水里脊烤肉样品，跟腱悬挂正常公猪胴体老化1天最终 pH <5.5，烹饪至终点温度70°C。
n.a-不可用

除了里脊烤肉和里脊翻炒肉块

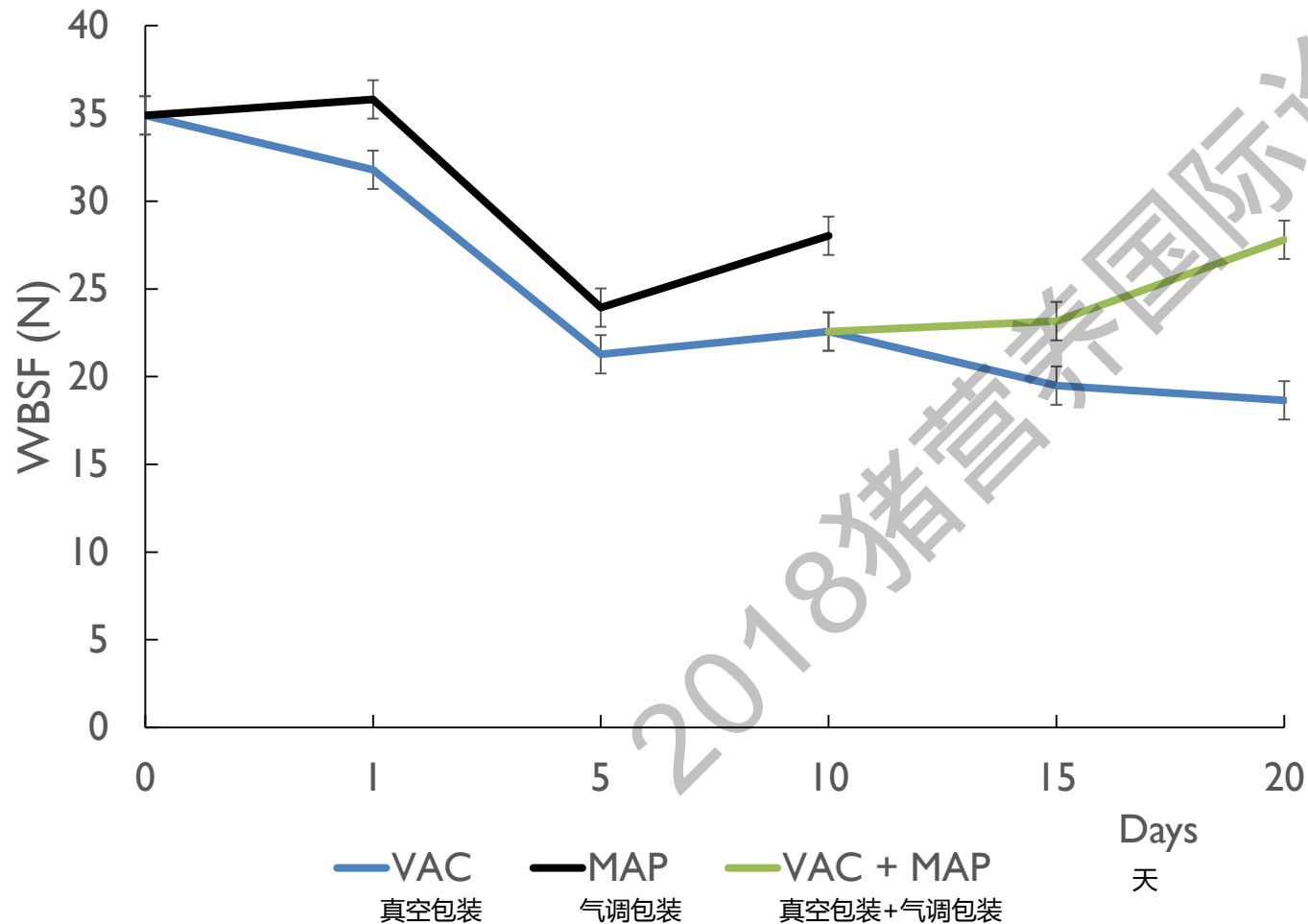
All cuts except loin roast & loin stir fry
Loin roast & stir fry 里脊烤肉和里脊翻炒

All cuts except roasts除了里脊所有切块
Roasts only仅烤肉



Ageing x packaging method interactions on WB shear force

老化期x包装方法对WB剪切力的相互作用

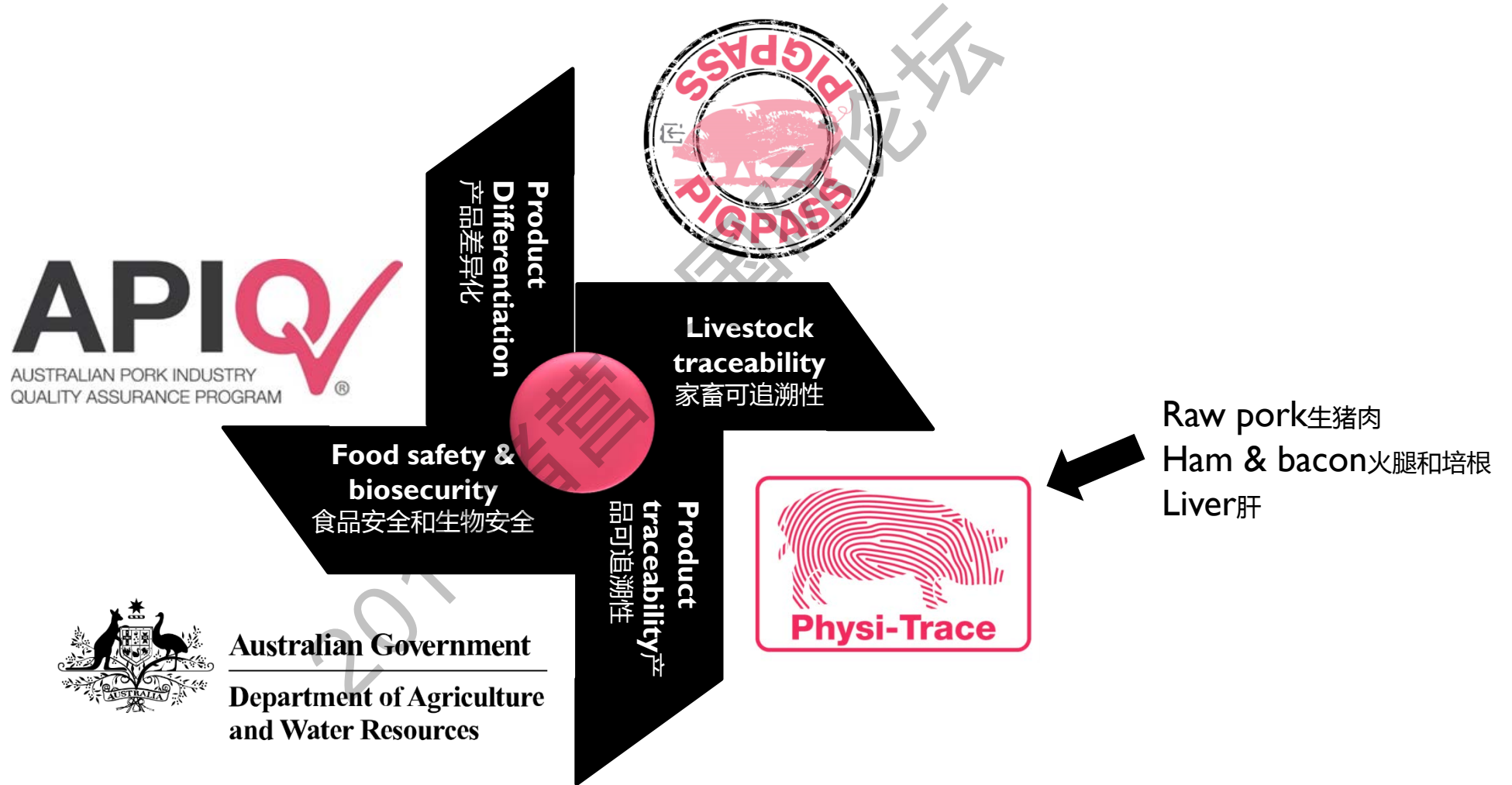


- Negative impact on overall colour and water holding capacity of MAP steaks compared to VAC 与真空包装相比，气调包装对肉排的总体颜色和保水能力有负面影响
- Protein and lipid oxidation of steaks in HiOxMAP 高氧气调包装中肉排的蛋白质和脂质氧化
- Impact on sensory scores and fail rate ...? 对感官评分和失败率的影响.....?



Assuring consumer and community confidence and trust in Australian pork products.

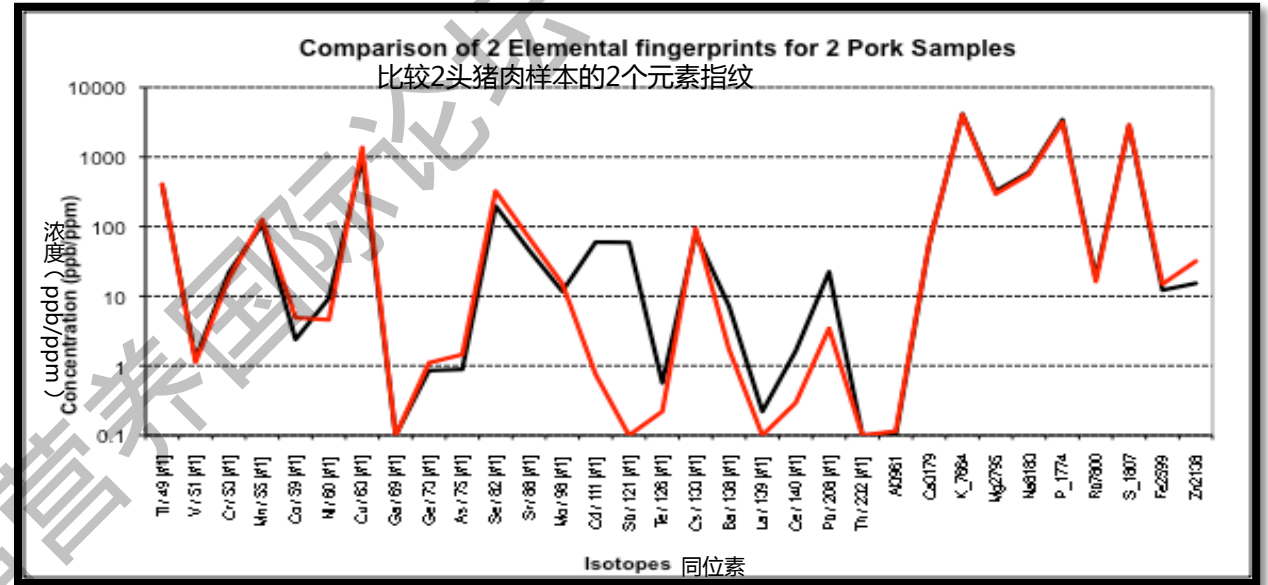
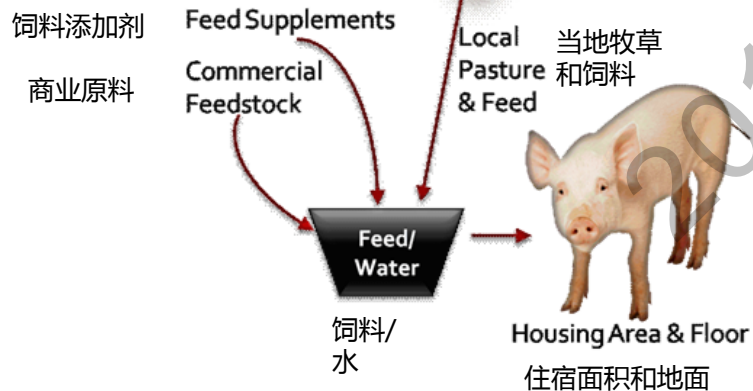
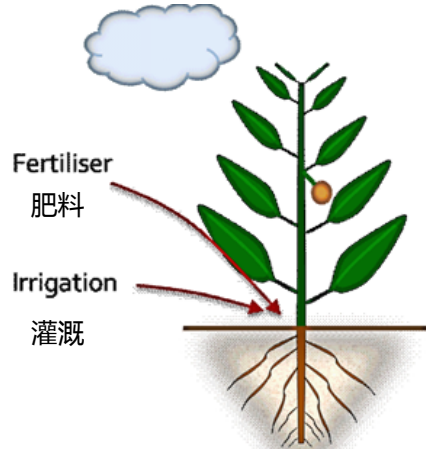
确保消费者和社区对澳大利亚猪肉产品的信心和信任。



Physi-Trace: Trace elemental discrimination

生理追溯：微量元素鉴别

“We are what we eat”
“我么吃了什么”





Assuring consumer trust in Australian pork

确保消费者对澳大利亚猪肉的信任

Australian 澳大利亚 ✓

Region of origin 原产地 ✓

Farm of origin - production factors
(eg. free range, gender, ractopamine use) ✓

原产场 - 生产要素 (例如: 自由放养, 性别, 使用莱克多巴胺)

Animal welfare 动物福利 ✓

Food safety 食品安全 ✓

Management practices 管理规范 ✓

Environmental standards 环境标准 ✓

Compliance with movement reporting requirements 符合移动报告要求 ✓

Eating quality assured 保证食用质量 ✓✓





Issues remaining to be addressed

有待解决的问题

- Why is Australian pork not ageing 为什么澳大利亚猪肉不老化
- Challenges remain – need to identify additional pathway interventions 挑战依然存在- 需要确定其他的干预途径
- Critical control points needed to carefully control rate of muscle pH and temperature decline and low ultimate pH?
关键控制点需要仔细控制肌肉pH、温度下降曲线和低最终pH值?
- Packaging method 包装方法
- Other cut type x cooking methods ...
其他 切割类型x烹饪方法.....



Conclusions 结论

- **Enabling differentiated market positioning of consistently high quality Australian pork**
实现始终如一的高品质澳大利亚猪肉的差异化市场定位
- **Supply chain consultation - system implementation**
供应链咨询 - 系统实施
- **Focusing on consumers and market opportunities**
关注消费者和市场机会
- **Ongoing eating quality model refinement and R&D**
持续食用质量模型改进与研发
- **Consistent delivery of 'taste'** 提供一致的“口味”



Questions

2018猪营国际论坛