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Meat flavour in pork and beef - from animal to meal

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Eating quality



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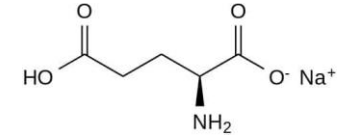
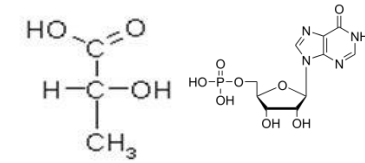
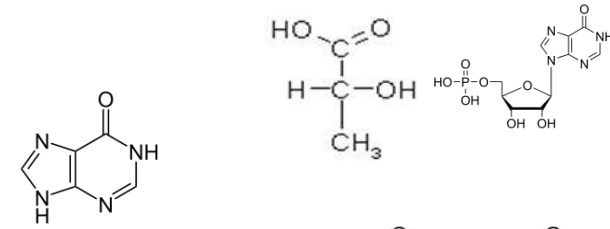
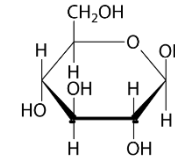
Flavour

Flavour is a combination of taste and volatile compounds



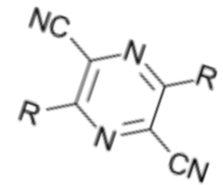
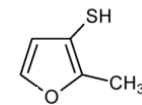
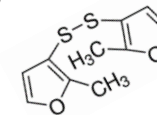
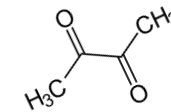
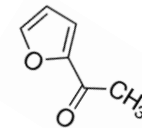
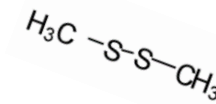
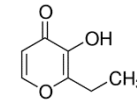
Taste

<i>Sweet</i>	
<i>Sour</i>	<i>Lactate</i>
<i>Bitter</i>	<i>Hypoxanthine</i>
<i>Salt</i>	
<i>Umami</i>	<i>IMP</i>
	<i>MSG</i>



Volatile flavour

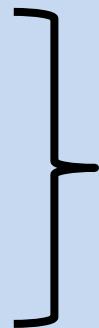
Fried meat
Boiled meat
Meat
Piggy
Nutty
Rancid



Carbohydrate

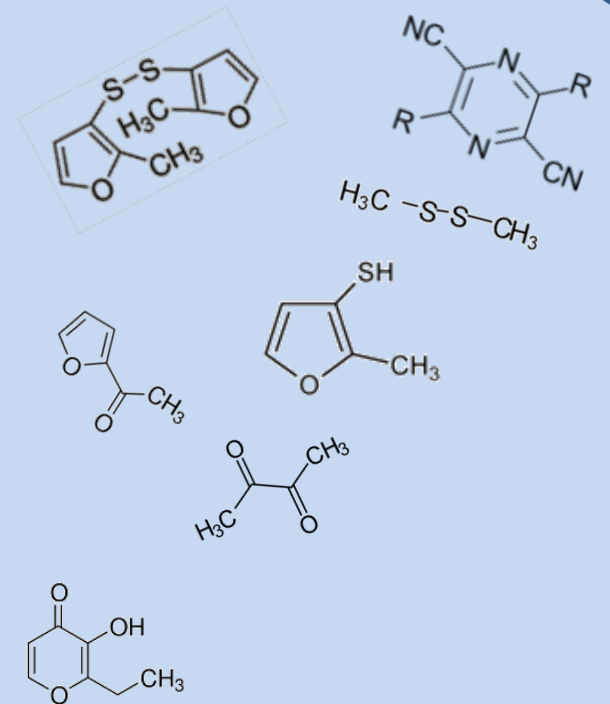
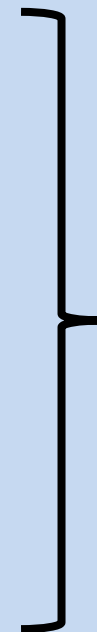
Amino acids

Fatty acids



Maillard
Reaction
Products

Fat degradation
products





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Breed
Feed
Preslaughter
handling

Ageing

Temperature
Time

Animal \Rightarrow Meat \Rightarrow Cooking \Rightarrow Meal

Fatty acids

IMP

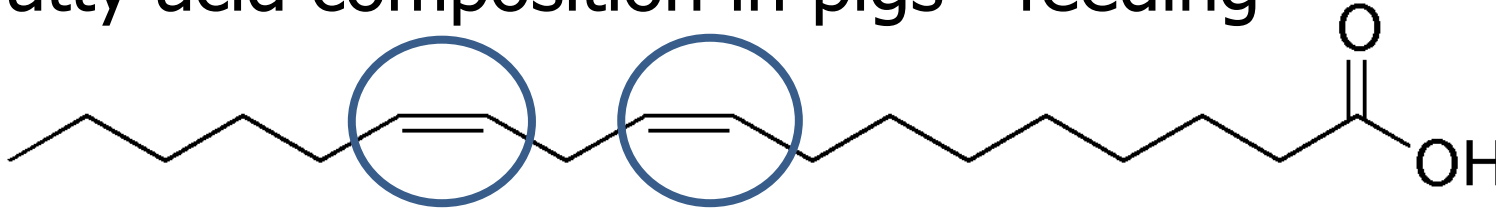
Amino acids

Carbohydrates

Maillard reaction
Lipid degradation

Animal \Longrightarrow Meat \Longrightarrow Cooking \Longrightarrow Meal

Fatty acid composition in pigs - feeding



In the phospholipids:

Saturated:unsaturated is relatively constant

Monounsaturated:polyunsaturated can change due to feeding

Alonso et al, 2012



3% fat in the feed:

Minor significant differences in the composition of PL,
Significant differences in the neutral lipids.

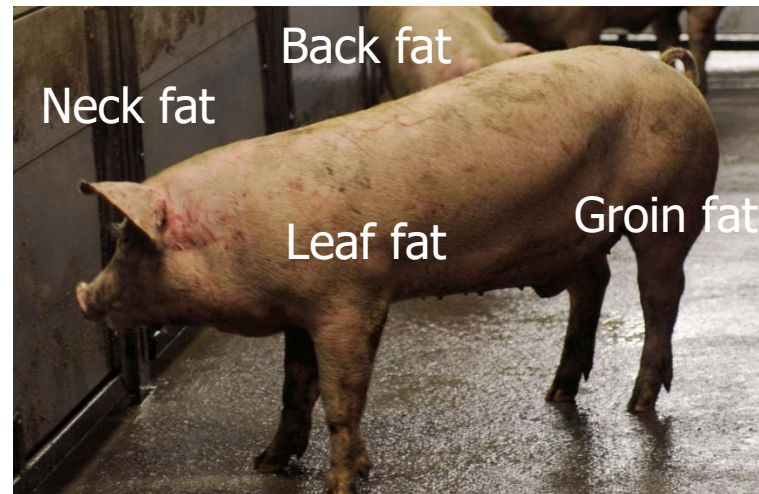
Tikk et al, 2007

Animal \Longrightarrow Meat \Longrightarrow Cooking \Longrightarrow Meal

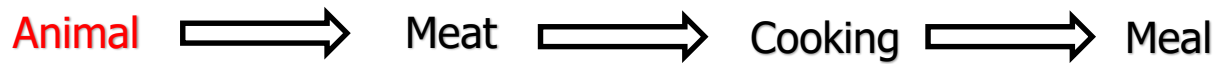
Fatty acid composition in pigs – gender and feed



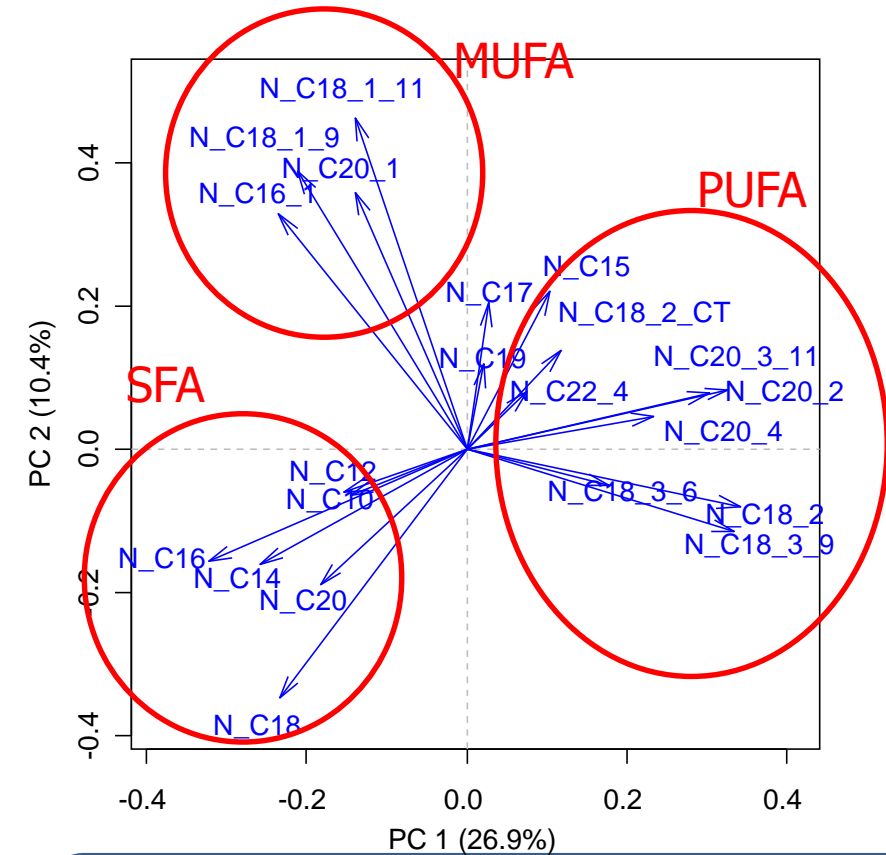
Iodine number in the feed 66 – 72 – 78 – 84 – 90 - 96



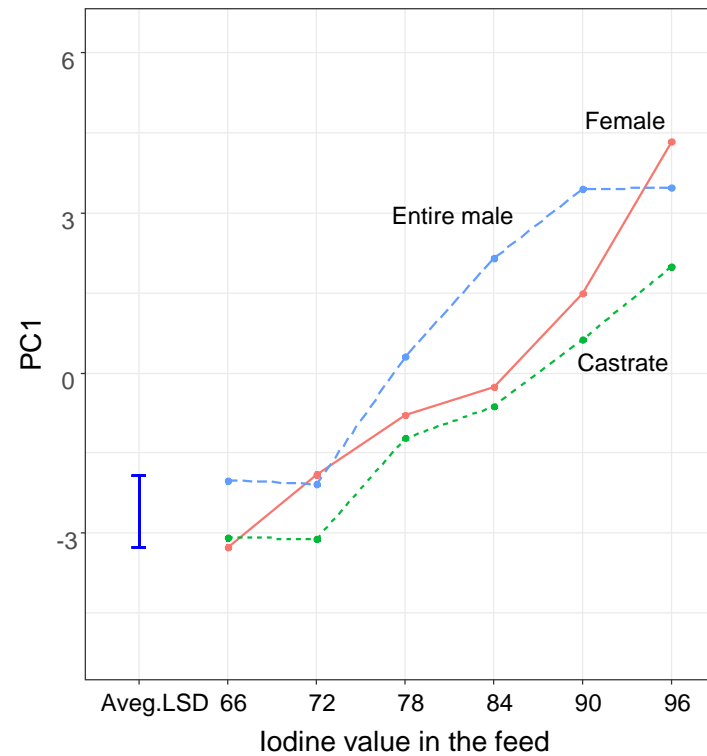
Female
Castrate
Entire males



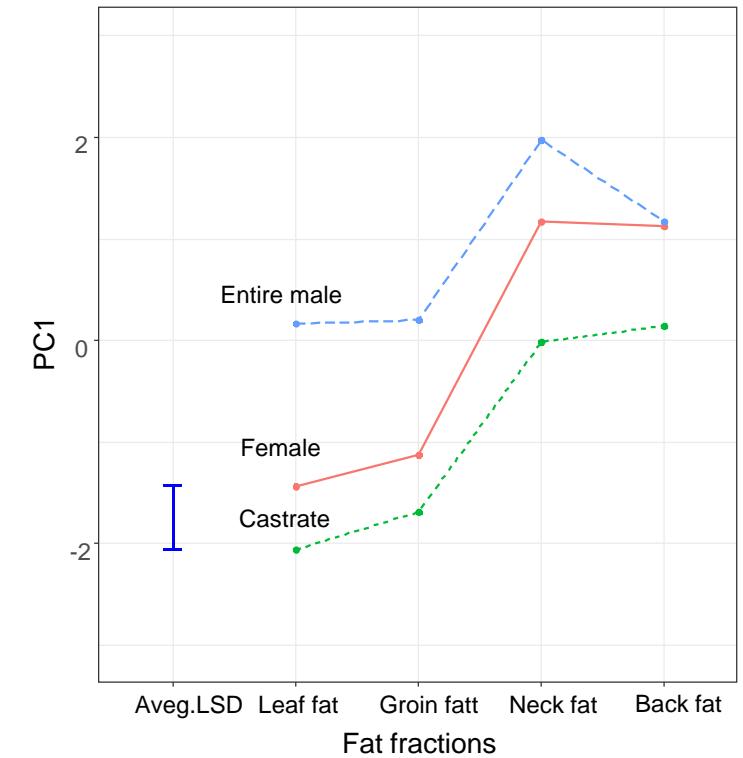
Fatty acid composition depends on both gender and feed



Predicted means for iodine groups by gender



Predicted means for fat fractions by gender



Entire males has a higher concentration of PUFA than female and castrates, BUT it depends on the iodine number in the feed.

Animal → Meat → Cooking → Meal



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Fatty acid composition effect on flavour

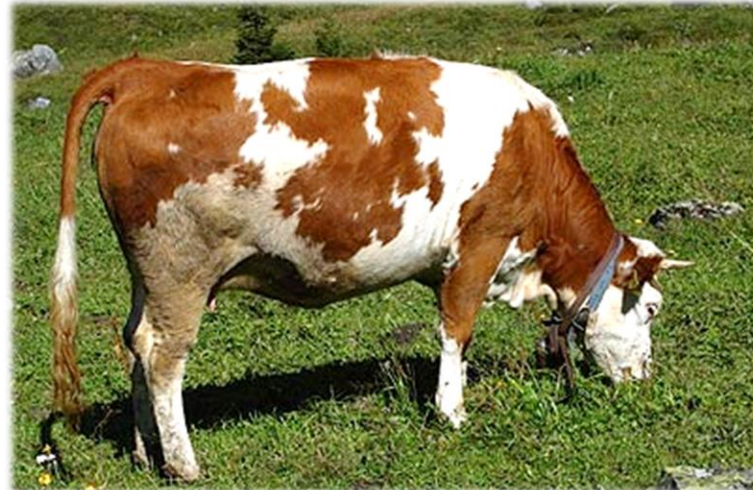


Animal \Rightarrow Meat \Rightarrow Cooking \Rightarrow Meal



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Fatty acid composition in cattle - breed



Breed differences eg Simmentaler higher PUFA concentration than Charolais

Sevane et al, 2014

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Grass feeding

Ω -3 fatty acids \uparrow \Rightarrow Change in volatile composition

An effect on flavour

No effect on flavour

Frank et al. 2016, Tansawat et al, 2013

Jiang et al, 2010, Moloney et al, 2013

Animal \longrightarrow Meat \longrightarrow Cooking \longrightarrow Meal



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Carbohydrates in pork

Glucogen \longrightarrow Glucose

ATP \longrightarrow IMP \longrightarrow Ribose



Glycogen:

Breed (Hampshire high glycogen)

Strategic feeding (reduces glycogen)

Preslaughter handling (reduces glycogen)

ATP:

Preslaughter handling

No effect on flavour or
reduced fried flavour

Animal \longrightarrow Meat \longrightarrow Cooking \longrightarrow Meal



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Ageing of pork - amino acids and carbohydrates

Super chilled (-1.7°C), 58 days: increase in free amino acids.
Sensory properties not investigated.

Ngapo & Vachon, 2016

2°C ageing, 21 days: no effect on flavour, increased bitterness
Free amino acids not investigated.

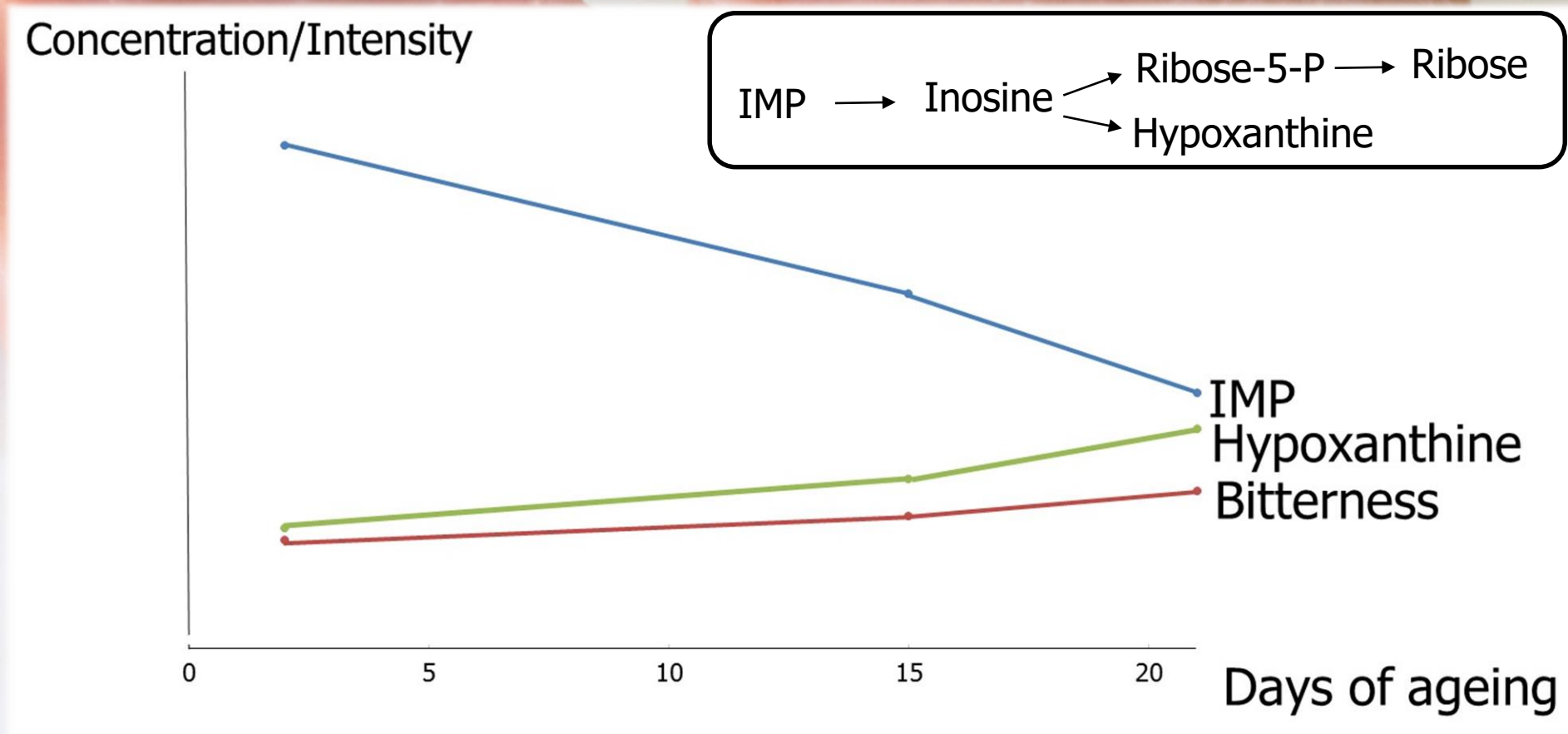
Tikk et al, 2006

Animal \longrightarrow Meat \longrightarrow Cooking \longrightarrow Meal



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Ageing of pork – increased hypoxanthine increased bitterness



Animal → Meat → Cooking → Meal



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Dry ageing of beef - flavour

The effect depends on feeding (2 weeks). No difference or a less intensive beef aroma

Jiang et al., 2010

Slightly increased umami taste and buttery fried meat flavour and reduced metallic effects on flavour (8 and 16 weeks)

Increased flavour and palatability

Story telling

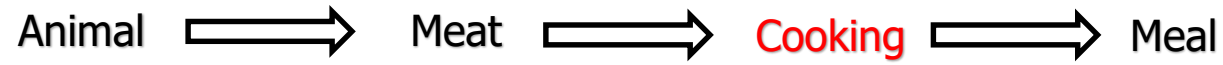


Cooking – Temperature and time



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Temperature



200° C

Burned flavour

*Pyrolysis of amino acids
and carbohydrates*



100° C

Fried flavour

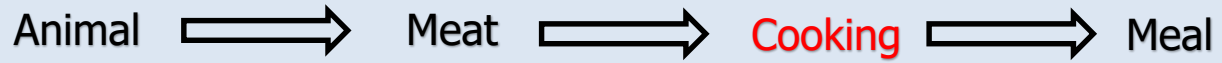
Maillard reaction



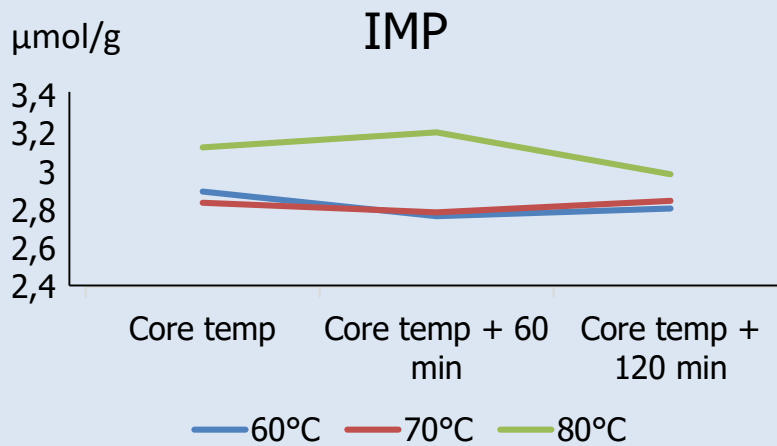
Boiled flavour

Fatty acid degradation



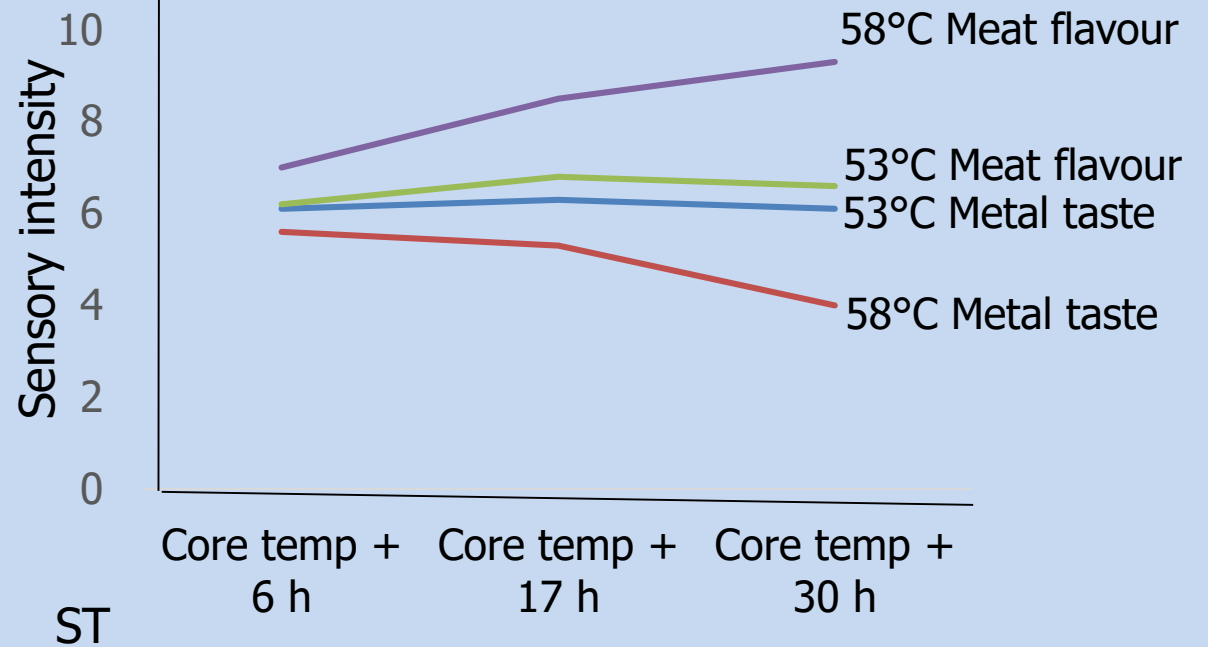


Cooking at low temperatures - pork



LD

Rotola-Pukkila et al. 2015

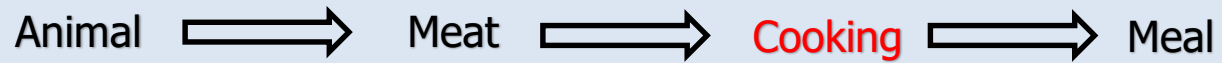


ST

Christensen et al, 2012

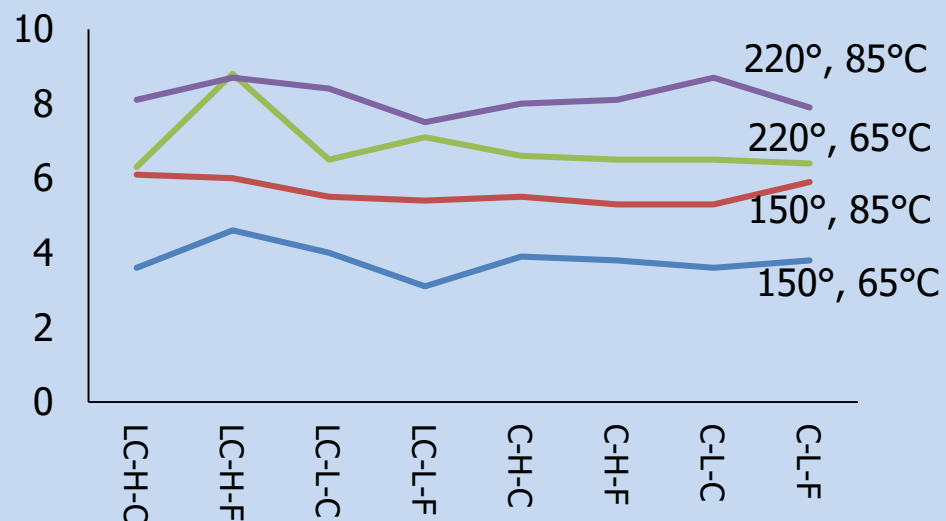
Sous Vide
KAR 1

STRØM & VAND
MAA IKKE LUK



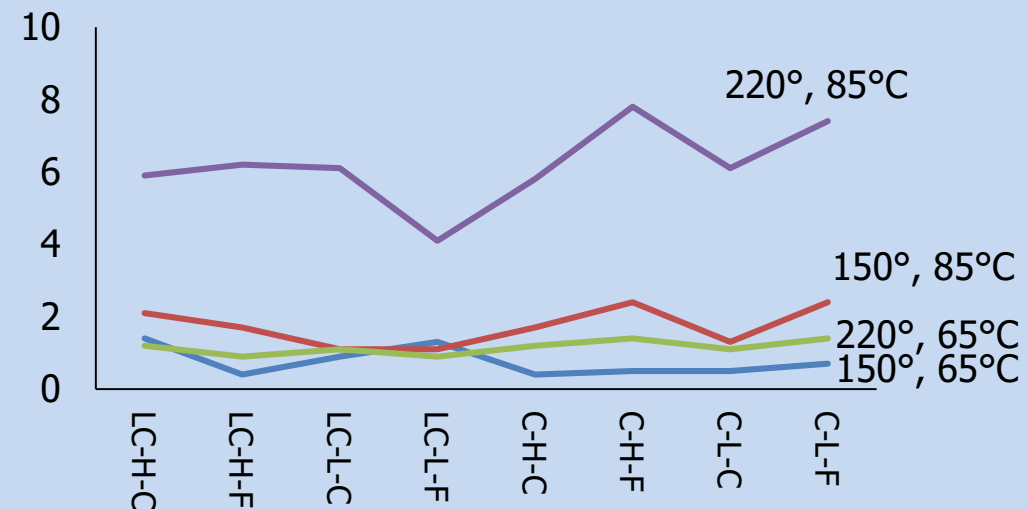
Cooking at high temperatures, pork

Fried meat flavour



LC: Low carbohydrate feed L: Light carcass weight C: Castrate
C: Control feed H: Heavy carcass weight F: Female

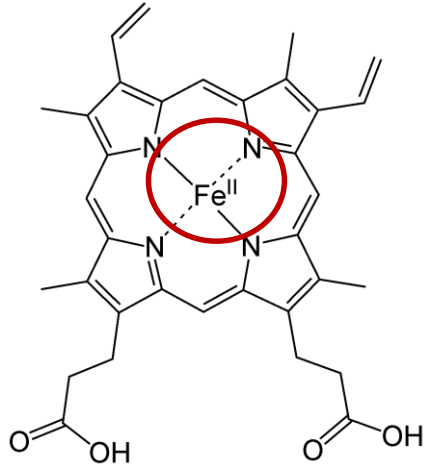
Burnt meat flavour



LC: Low carbohydrate feed C: Castrate L: Light carcass weight
C: Control feed F: Female H: Heavy carcass weight

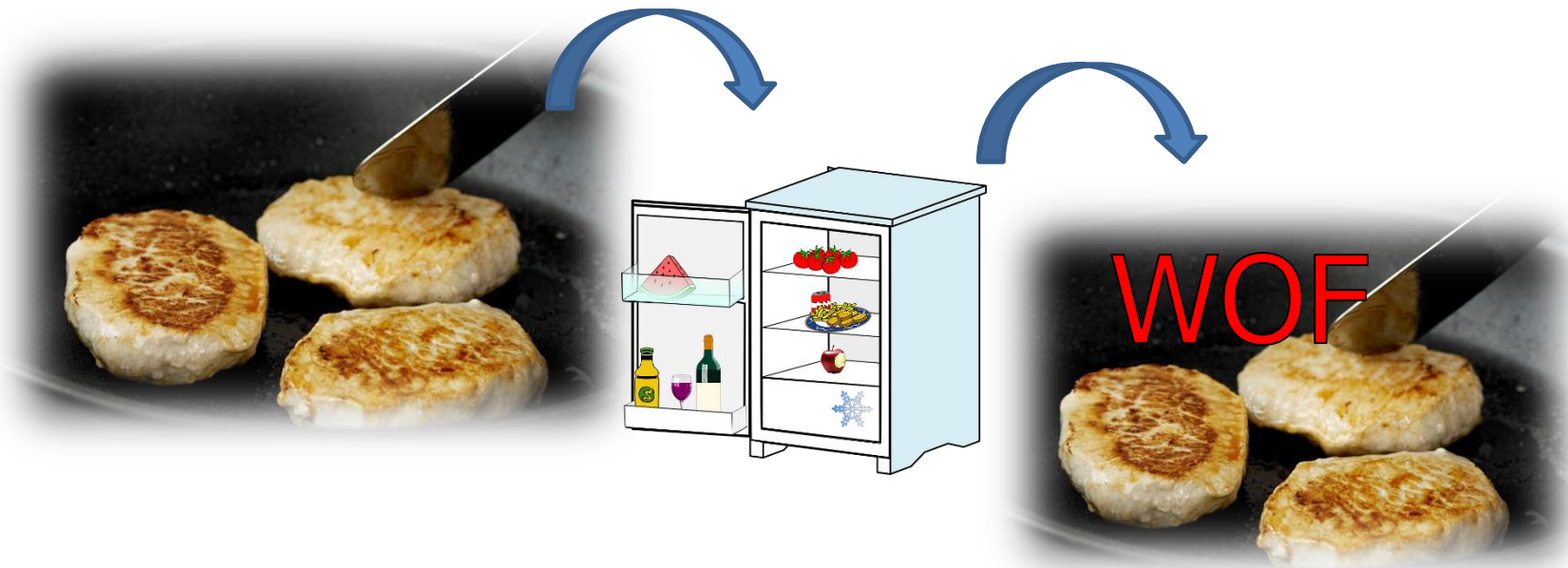
Animal \Longrightarrow Meat \Longrightarrow Cooking \Longrightarrow Meal

Warmed over flavour

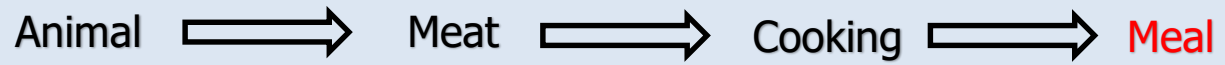


During heating, myoglobin denature and Fe^{II} are no longer fixated

Fe^{II} is a strong pro-oxidant and during storage and especially reheating the lipids and proteins will oxidize

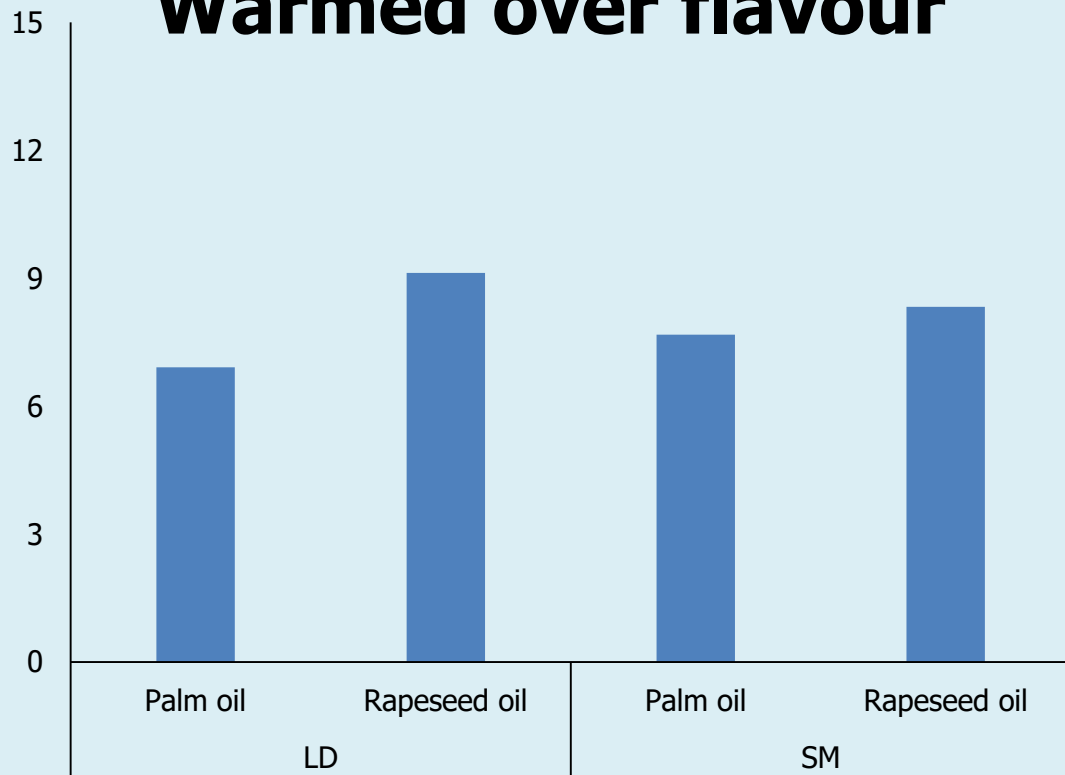


Oily/fatty
Paint
Cardboard
Rancid

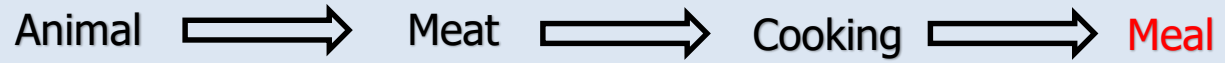


Warmed over flavour

Warmed over flavour



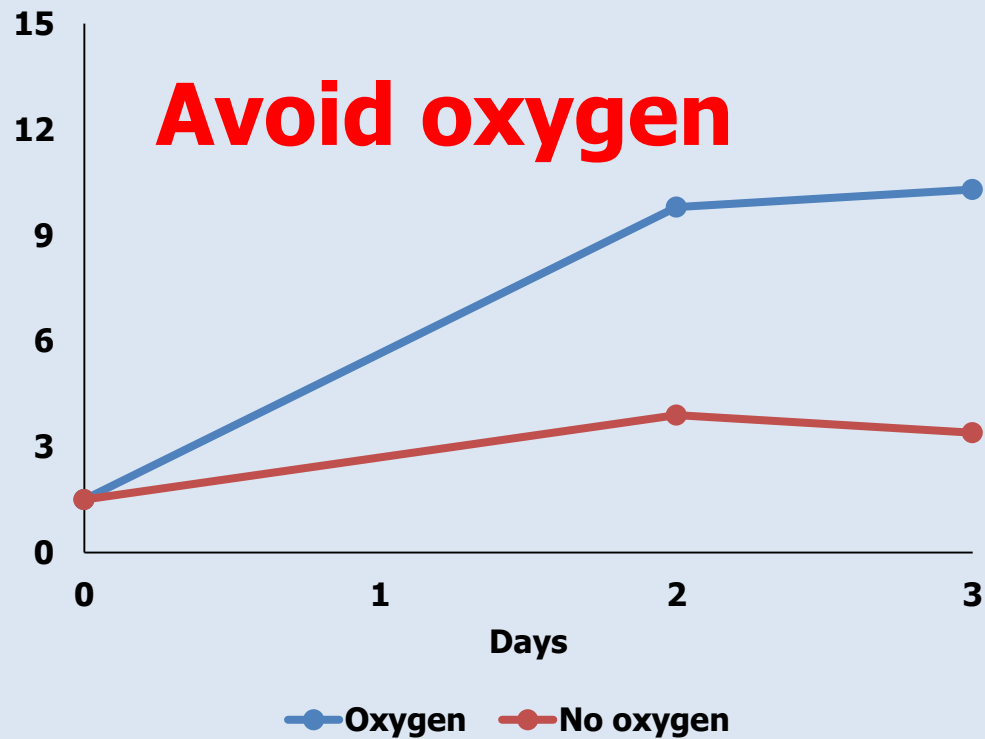
Ω -3 fatty acids increases the development of warmed over flavour



Warmed over flavour

Warmed over flavor

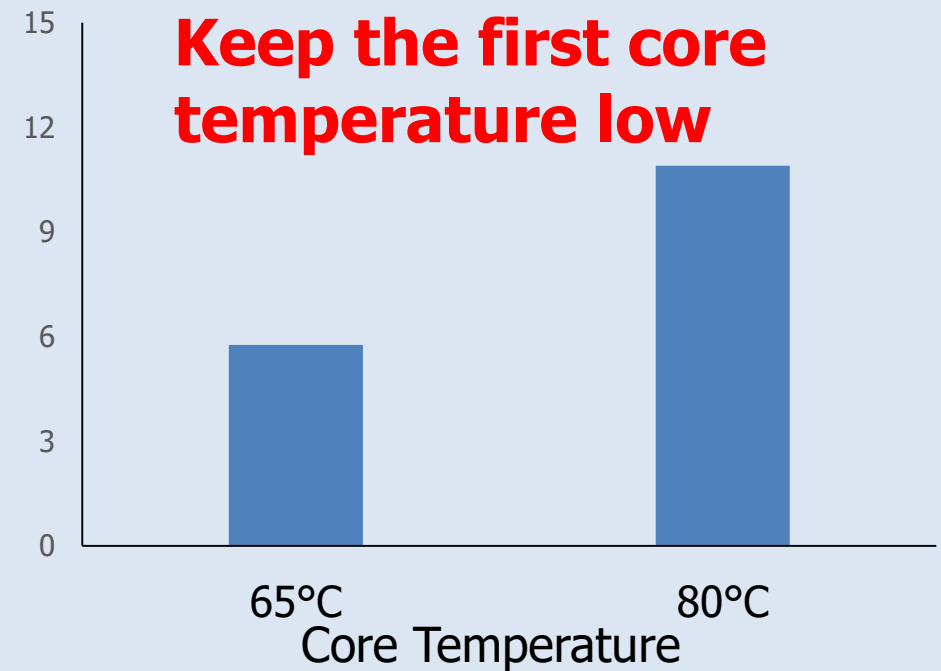
Avoid oxygen



Unpublished data

Warmed over flavour

Keep the first core temperature low



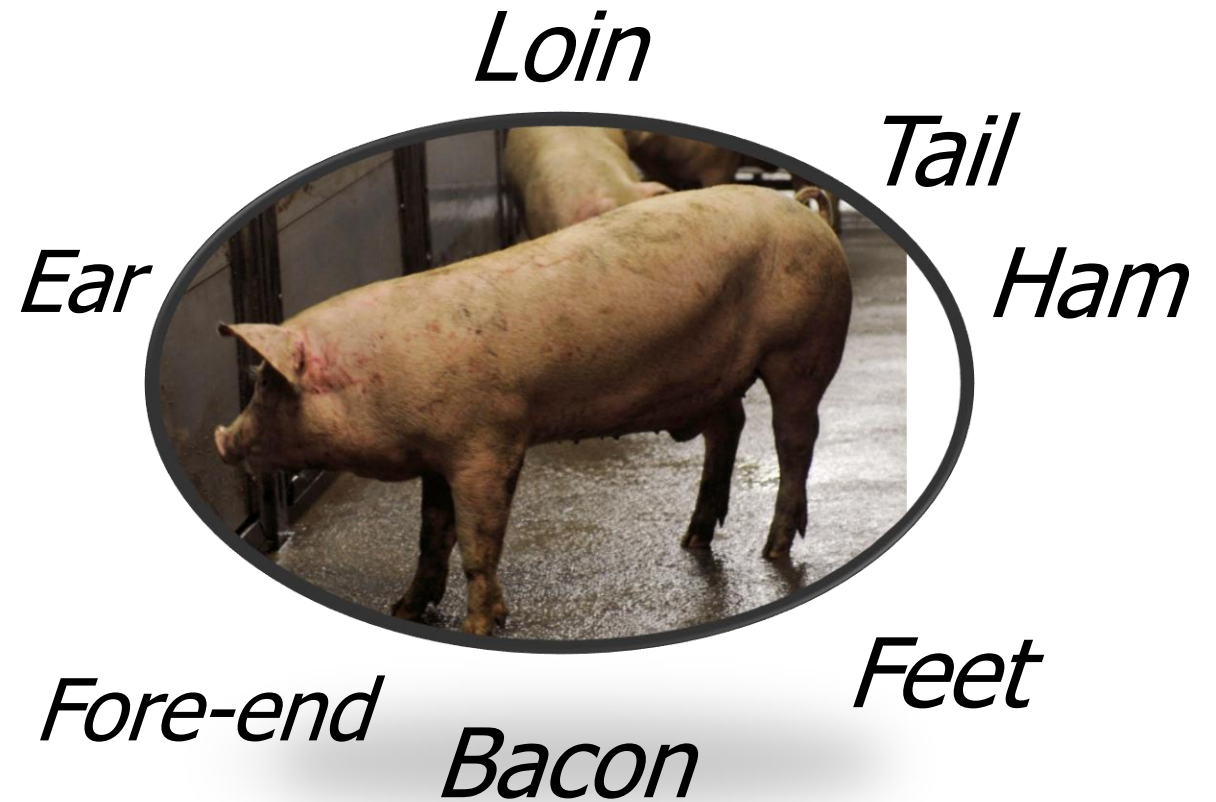
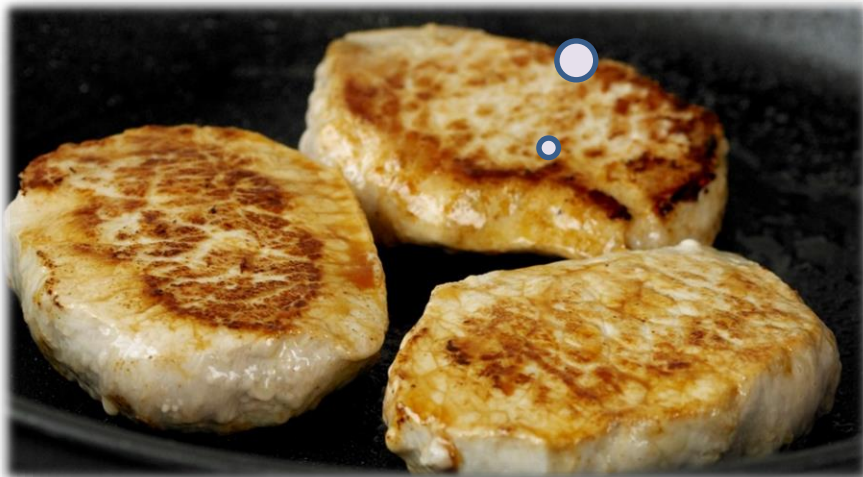
Unpublished data

Animal → Meat → Cooking → Meal

Boar taint – present in the whole carcass

skatole

androstenone



Animal \longrightarrow Meat \longrightarrow Cooking \longrightarrow Meal

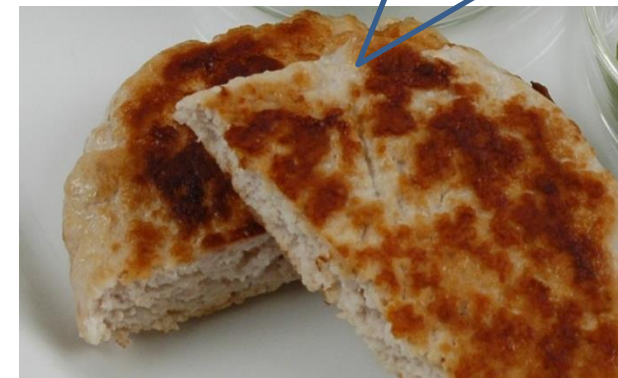
Cooking does not reduce the content of skatole and androstenone

Oven/sous vide, 58°C, 65°C, 75°C
6 hours, +/- vakuum package

[Skatole] = 0.05 $\mu\text{g/g}$
[Androstenone] = 0.15 $\mu\text{g/g}$



[Skatole] = 0.05-0.07 $\mu\text{g/g}$
[Androstenone] = 0.20-0.25 $\mu\text{g/g}$

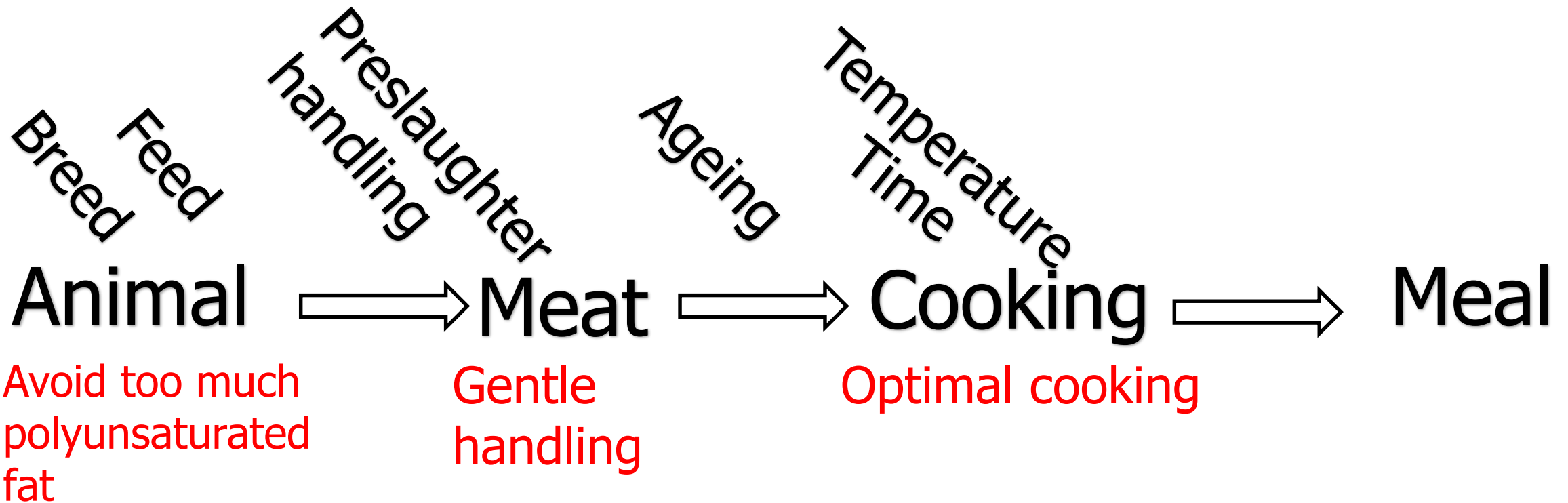


Cooking loss

Still unpublished data



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Thank you for your attention



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