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Pork quality: a complex concept!

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► **To cite this version:**

Bénédicte Lebret. Pork quality: a complex concept!. Webinar Meat quality, All about Feed; Pig progress, Jul 2023, Online (Electronic Conference), Netherlands. hal-04353508

HAL Id: hal-04353508

<https://hal.inrae.fr/hal-04353508>

Submitted on 19 Dec 2023

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WEBINAR

Meat Quality

ALL ABOUT FEED





Pork quality: a complex concept!

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ALL ABOUT FEED


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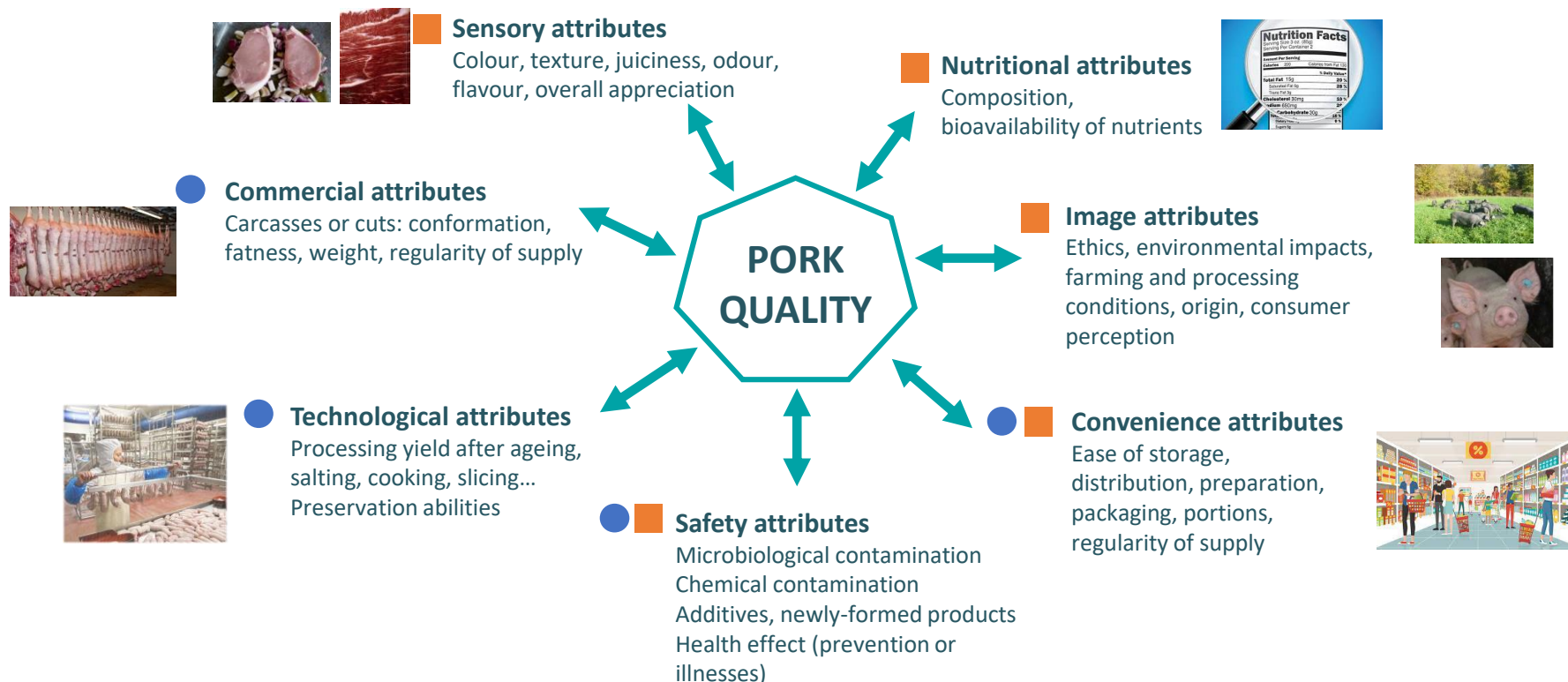
UMR **PEGASE**


➤ Pork quality : what does it mean?



➤ The quality attributes of animal-source foods: pork

Collective scientific assessment (INRAE)



● Producers, processing actors ■ Consumers ↔ Contribute to



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Pork quality: a complex concept

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Prache et al., 2022

➤ Main factors determining « intrinsic » pork quality: commercial, sensory, nutritional and technological attributes

Genetic factors

- genetic background, breed
- major genes

Rearing conditions

- feeding
- housing
- production system



Slaughtering and processing

- pre-slaughter handling of pigs
- slaughtering
- carcass and meat processing



Animal performance

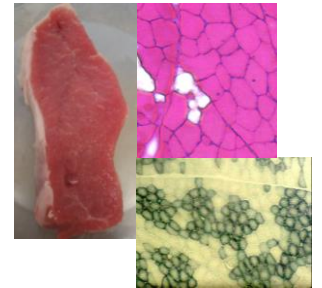
Carcass composition

Meat and product quality

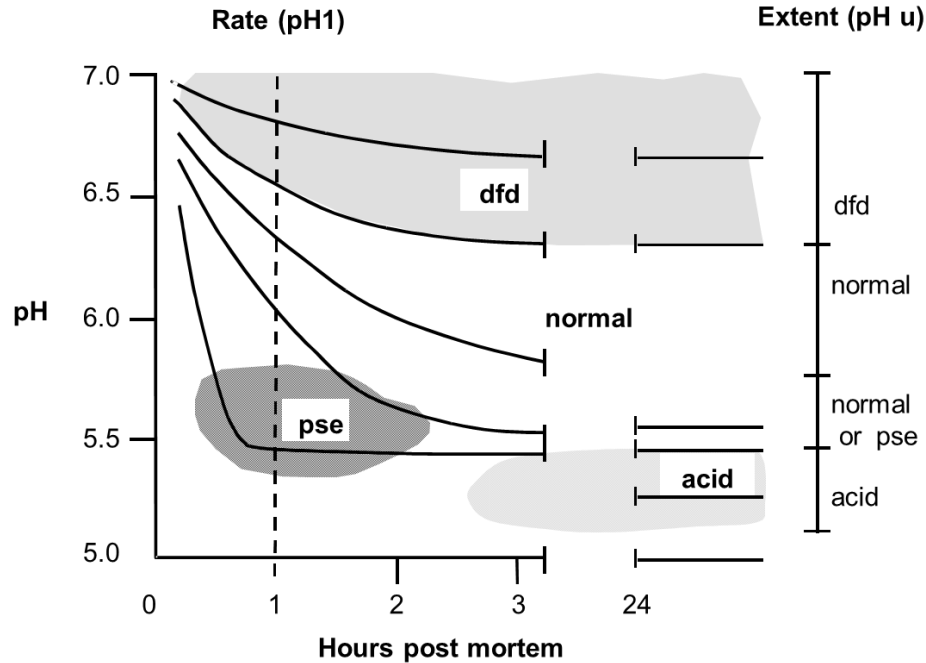


➤ Pork : a great diversity of products - but common major quality indicators

- ✓ **Pork: mainly consumed as processed products in Europe**
55-60% of pork consumption in Italy, 75% in France, 80% in the UK
- ✓ Historically: **promoting preservation** of pork → **variety of procedures**: curing, smoking, cooking, drying, fermenting... for integral cuts (ham) or minced meat (sausages...) and **recipes** according to regions, climatic conditions, cultural habits...
- Diversity of products -> **various quality expectations for the raw material** according to process
- **However, some major physical and biochemical traits affect pork quality**
 - ✓ Intramuscular fat content (**IMF**)
 - ✓ Glycogen content
 - ✓ Properties of muscle fibres and muscle microstructure
 - ✓ Processing of muscle into meat : post-mortem **pH** decline, proteolysis



➤ Influence of post-mortem pH decline on pork technological and eating quality



Monin (2004)



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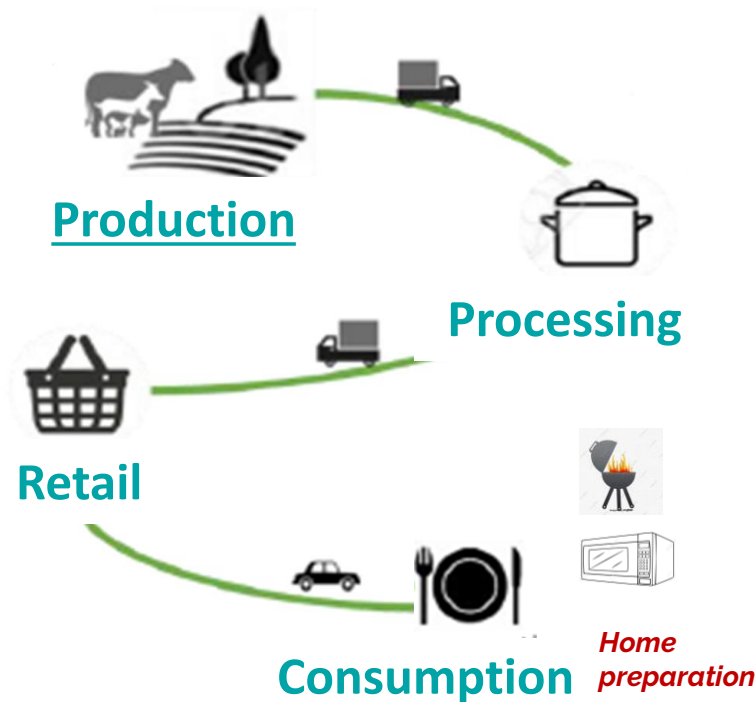
Pork quality: a complex concept

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➤ Quality of pork and processed products : a complex concept!



-> Diversity of pig production systems, products, and attributes



- **Quality** is **built** but can be **impaired** at all steps from **farm to fork**
- Some **antagonisms** but also **synergies** can be found between **steps**, and between quality **attributes**

*Lebret and Candek-Potokar, 2022 a, b
Prache et al., 2022*

- Combining genetic and nutritional strategies to improve intrinsic and extrinsic quality attributes of pork



➤ Objectives and partnership of the project

➤ Multi-actor project : Pork quality development from farm to fork

- **Objectives** : improving the **sensory** and **nutritional attributes** of pork while contributing to the **relocation of feed resources** -> image
- **Partnership**: public research, pork producers, animal feed and processing industries; regional funding

➤ From State-of-the art we know that

- Effects of **individual genetic** and **production factors**: e.g. feeding on intrinsic **on-pork quality attributes are relatively well established** (Warner et al 2017; Lebret & Candek-Potokar, 20221)
 - *Duroc pure or crossbred pigs: good sensory (tenderness) and technological properties (Plastow et al 2005, Gispert et al 2007, Morales et al 2013, Kowalski et al 2020)*
 - *Protein/energy intake and composition of dietary fat -> carcass traits, composition of muscle and fat tissues, and nutritional properties of pork (Lebret 2008, Guillevic et al 2009)*
- **Origin of feed protein resources** : **critical point** in the objective of **relocation** of food production and for the global improvement of the **sustainability** of pork production

➤ Combining production factors: a way to jointly improve pork quality attributes?

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➤ Experimental design

- ✓ **Two pig genotypes (G) : 60 crossbred females** (Large White x Landrace) X boars
 - **Duroc (D)** selected on growth, feed intake and intramuscular fat content
 - **Pietrain NN (P)** selected on growth, feed efficiency, carcass leanness & pork technological pork quality
- ✓ **Two feeding regimen (F) : differing on origin of feed ingredients** (Fr vs imported) **and nature of protein and fat resources** / same proportion of cereals (wheat, maize, barley, wheat bran)
 - **Roc+ (R)** : extruded faba beans and lineseed (n-3) + vit E : relocation of resources, pork nutritional value
 - **Control (C)** : oilseed meal (soybean, rapeseed, sunflower peeled)
 - **Precision feeding: DLys/NE adjusted weekly** on average requirements of each group: blend of high and low protein diets within C & R, distributed ad libitum

4 experimental groups (n=15/group, individual pens)

Duroc Roc +
DR

Duroc Control
DC

Pietrain Roc +
PR

Pietrain Control
PC

➤ Results – Growth performance and carcass traits

Effects of genotype : G and feeding regimen : F

	DR	DC	PR	PC	
Slaughter weight, kg	116.6	108.6	122.0	119.0	G***, F***
Average daily gain, g/j	989	898	1052	1002	G***, F**
Av. Feed intake, kg/j	2.88	2.73	2.74	2.71	Gt, F*
Feed efficiency	0.34	0.33	0.38	0.37	G**, F*
Carcass dressing, %	76.6	75.7	79.2	78.3	G***, Ft
Lean meat content, % (at similar carcass weight)	60.2	60.5	61.9	61.5	G***

↗ growth rate and feed efficiency for P vs D pigs and for R vs C diet

↗ dressing for P vs D pigs (and R vs C)

↗ carcass leanness (↘ backfat) for P vs D pigs

*** : P<0.001; ** : P<0.01; * : P<0.05; t : P<0.10

➤ Meat quality traits: pH, water holding capacity and color

		DR	DC	PR	PC	
Loin Longissimus	pH 30 min	6.33	6.24	6.32	6.29	
	pH 24 h	5.94	5.89	5.80	5.83	G*
	Drip loss, 1-4 d p.m., %	3.2	3.7	4.7	4.7	G**
Ham	pH 24 h, Semimembranosus	5.95	5.82	5.82	5.88	
	pH 24 h, Gluteus superficialis	5.98	5.87	5.79	5.86	G*



No PSE meat defect
D vs P : ↗ pHu and WHC => higher technological quality esp. in loin

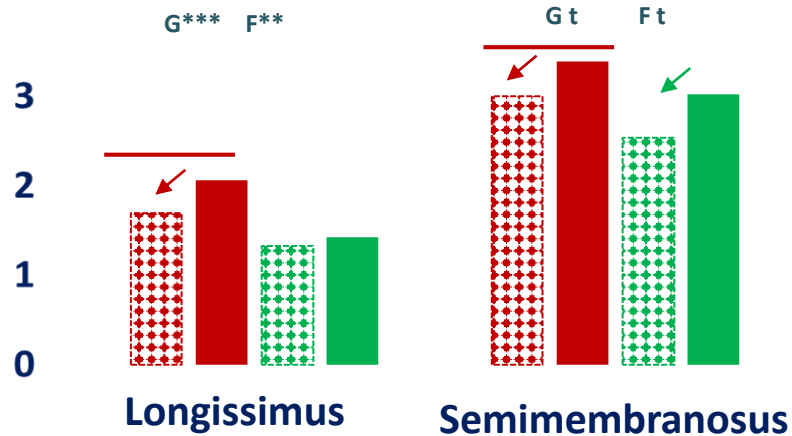


Colour: greater effect in ham muscles
D : less light and redder meat esp for DR pigs



➤ IMF content and fatty acid profile

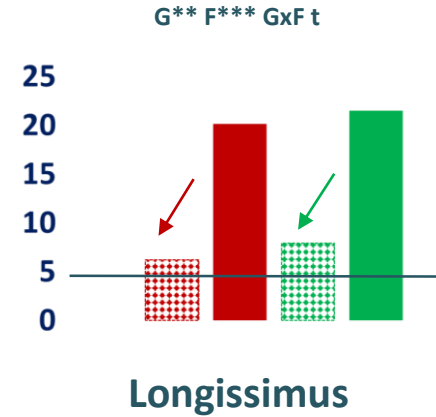
Intramuscular fat : IMF, %



↗ IMF in D vs P (↗ SFA & MUFA) esp. loin
but moderate IMF content

↘ IMF with R vs C feeding = ↘ MUFA
(-24% in D, -11% in P)

C18:2 n-6/C18:3 n-3



Nutritional recommendation (Fr) < 5

R feeding: ↗ ↗ n-3 FA and SFA/n-3

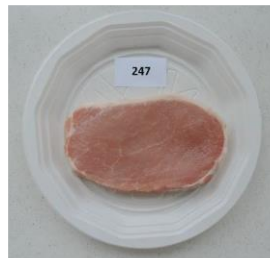
↗ pork nutritional value for D and P pigs
R feeding fits nutritional recommendations
and quality label specifications

➤ Sensory quality of loin – trained panel

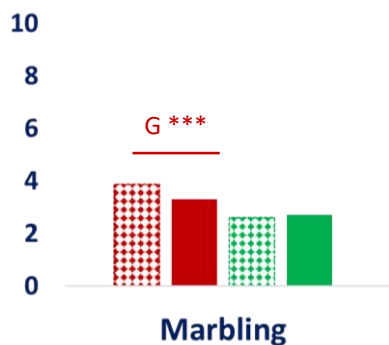
12 panelists

Loin meat, 8 days ageing

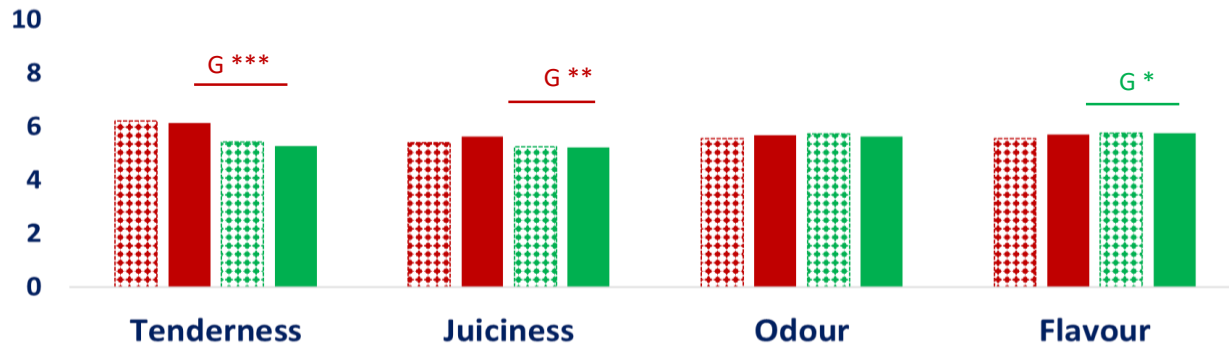
Scale: 0 (low) to 10 (high)



Appearance of raw meat



Texture and flavour of roasted meat



Meat from D vs P pigs:

↗ marbling, ↗ tenderness and juiciness (↘ shear force, pH)

P: ↗ flavour (PUFA?)

Feeding : no effect on sensory traits



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➤ Economic indicators

Economic context : experiment (October 2019), actual carcass weights

- **Feeding costs**, Control diets: world prices, R diets: no-GMO soya or sunflower, French origin
- **Carcass output prices**: french pig market + for R pigs: premium for nutritional quality label (Bleu Blanc Cœur)

	DR	DC	PR	PC	
Cold carcass (CC) weight, kg	87.7	80.3	94.5	91.7	G***, F***, GXF*
Output price/kg CC, €	1.86	1.79	1.92	1.87	G***, F***
Feed cost/kg CC, €	0.64	0.62	0.60	0.56	G***, F***
Added value (output – feed)/kg CC, €	1.22	1.17 ^{+5 ct}	1.32	1.31	G***, Ft
Added value (output – feed)/pig, €	107.2	94.2	124.5	120.3	G***, F***, GxFT

Genotype and feeding affect economic parameters

Higher added value for P vs D pigs

↗ added value with R feeding for D pigs, less for P pigs

➤ Conclusions and perspectives



Duroc vs Pietrain crossbred pigs

- Higher technological and sensory quality
- Lower (satisfactory) growth performance and carcass lean meat content, lower economic gain

Roc+ vs Control feeding

- Slightly improved growth performance, but similar carcass composition, ~~higher feeding cost~~
- Marked improvement in pork nutritional value, contributes to relocation of resources

Combining genetic and nutritional strategies

- **DR pigs**: jointly improve the sensory, technological, nutritional and image quality attributes of pork – but needs better valuation of their higher sensory quality

Perspectives

- Evaluation of **environmental impacts** of the 2 genotypes X 2 feeding systems (in progress)
- **Multidimensional evaluation** : identify synergies or trade-off between quality attributes in a holistic, « **One Quality** » approach



Thank you for your attention!

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WEBINAR
Meat Quality

Thank you
for joining us!

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The logo for Topigs Norsvin, featuring a stylized pink and grey pig head icon to the left of the text "Topigs Norsvin" in black.

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