



**HAL**  
open science

## Pork quality: a complex concept!

Bénédicte Lebret

► **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

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License



WEBINAR

# Meat Quality

**ALL ABOUT FEED**





# Pork quality: a complex concept!

Bénédicte Lebet, PhD  
Senior scientist INRAE

**ALL ABOUT FEED**

  
RÉPUBLIQUE  
FRANÇAISE  
*Liberté  
Égalité  
Fraternité*

**INRAE**

 L'INSTITUT  
agro Rennes  
Angers

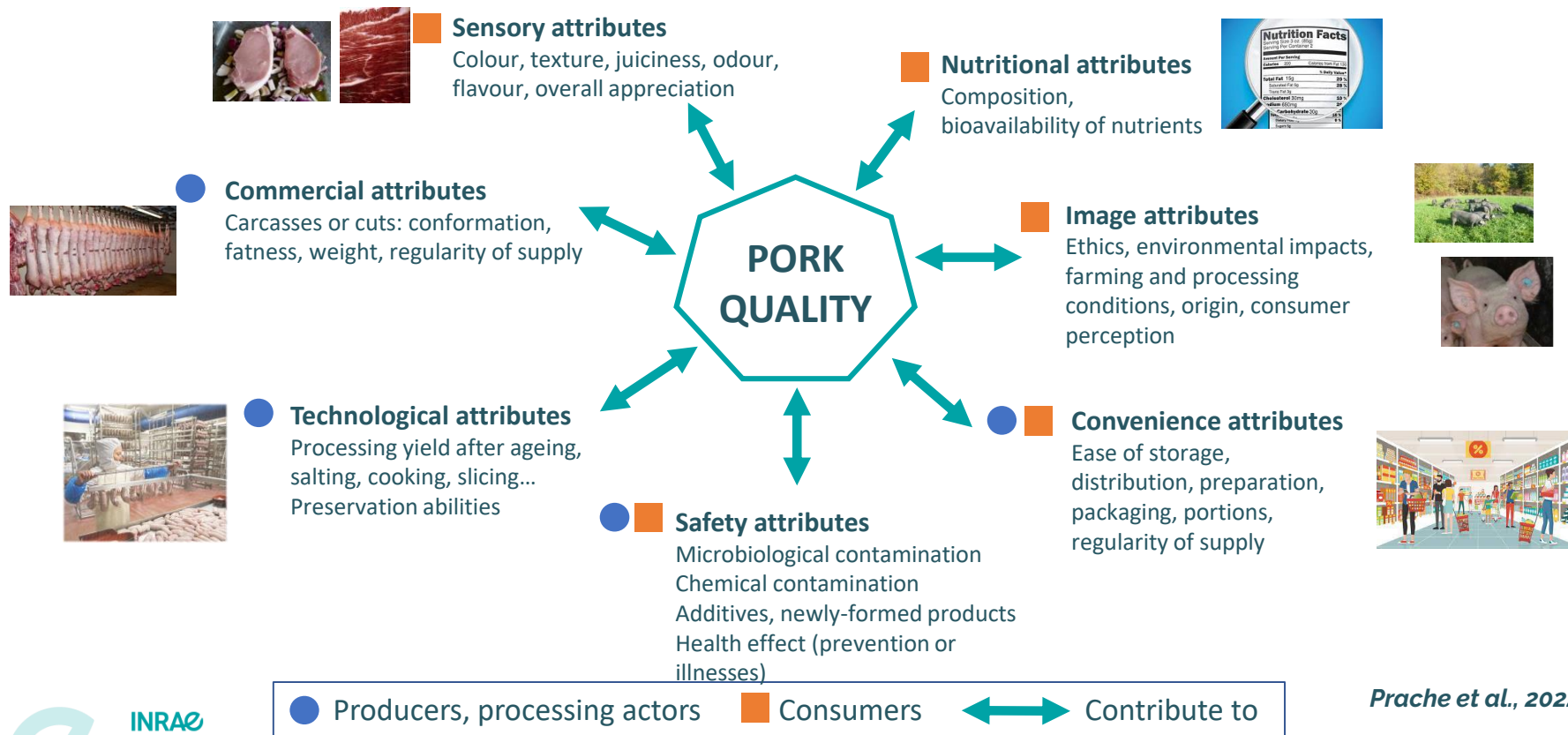
UMR **PEGASE**  


## ➤ Pork quality : what does it mean?



# ➤ The quality attributes of animal-source foods: pork

Collective scientific assessment (INRAE)



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

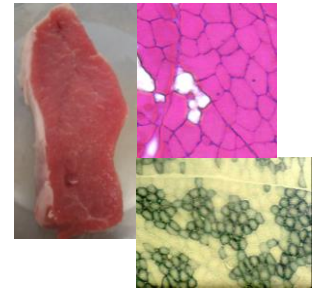
**Carcass composition**

**Meat and product quality**

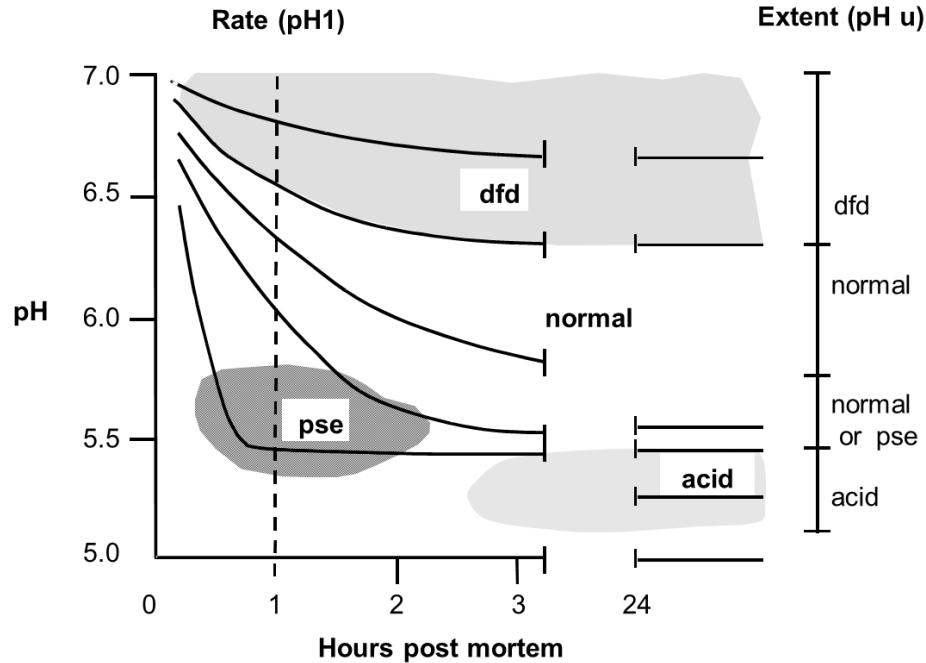


## ➤ Pork : a great diversity of products - but common major quality indicators

- ✓ **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



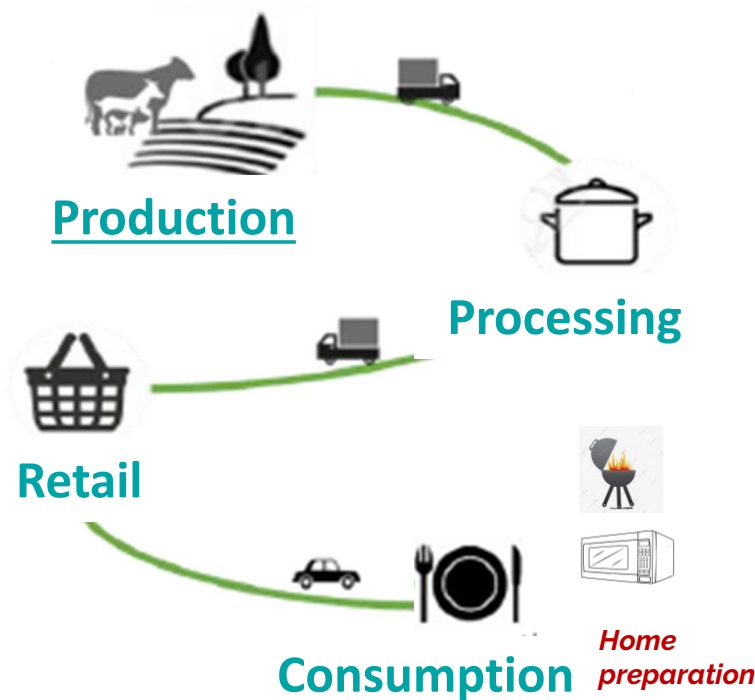
Monin (2004)



# ➤ 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*



INRAE

- 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?

INRAE

Pork quality: a complex concept

Webinar Pig Progress – 6 July 2023 / Bénédicte Lebret

## ➤ 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**

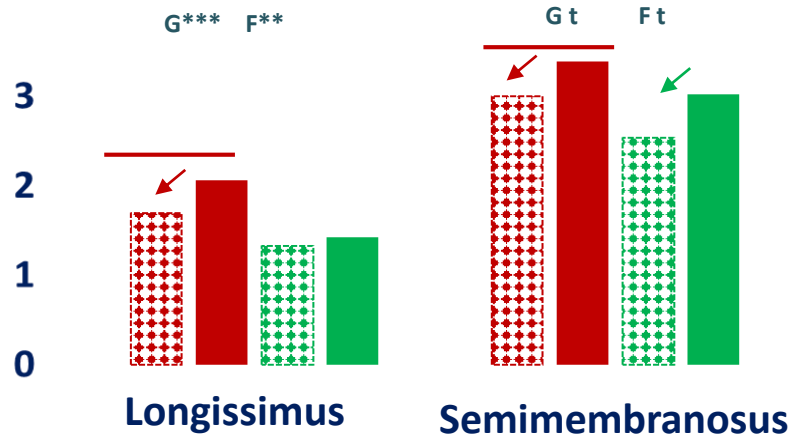


**Colour: greater effect in ham muscles**  
**D : less light and redder meat esp for DR pigs**



## ➤ IMF content and fatty acid profile

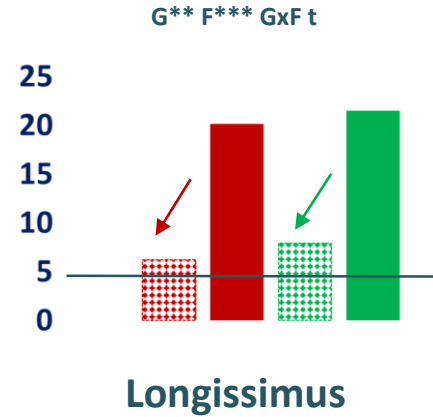
### Intramuscular fat : IMF, %



↗ 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

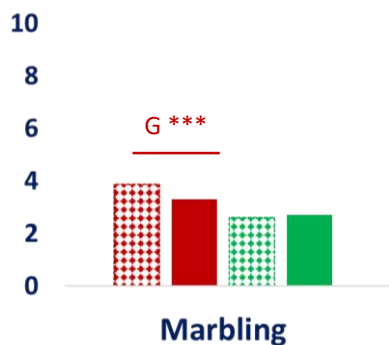
12 panelists

Loin meat, 8 days ageing

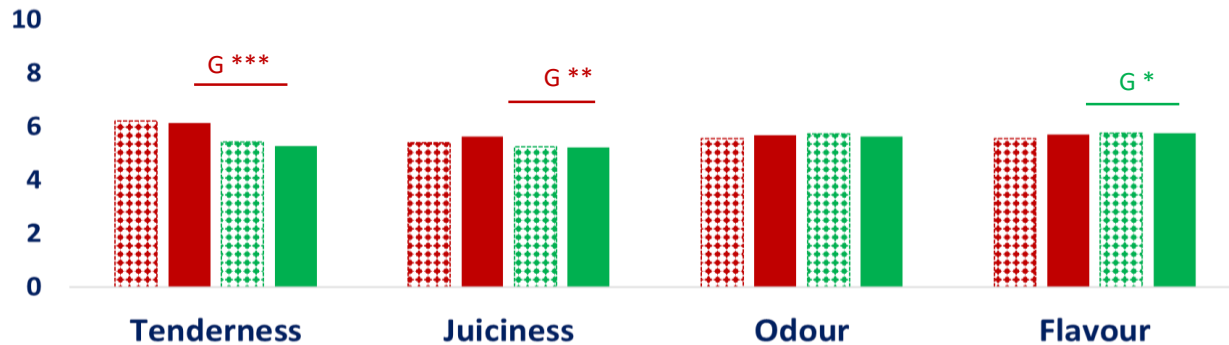
Scale: 0 (low) to 10 (high)



### 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



INRAE

Pork quality: a complex concept

Webinar Pig Progress – 6 July 2023 / Bénédicte Lebreton



## ➤ 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)

	<b>DR</b>	<b>DC</b>	<b>PR</b>	<b>PC</b>	
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***
<b>Added value (output – feed)/kg CC, €</b>	<b>1.22</b>	<b>1.17</b> <sup>+5 ct</sup>	<b>1.32</b>	<b>1.31</b>	G***, Ft
<b>Added value (output – feed)/pig, €</b>	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!

[benedicte.lebret@inrae.fr](mailto:benedicte.lebret@inrae.fr)



**INRAE**



**INRAE**



WEBINAR  
Meat Quality

Thank you  
for joining us!

**ALL ABOUT FEED**

The logo for Topigs Norsvin, consisting of a stylized pink and grey pig head icon followed by the text "Topigs Norsvin" in black.

**Topigs Norsvin**