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Quality attributes of pork and processed products from fat breeds -Examples of local french breeds

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➤ Quality attributes of pork and processed products
from fat breeds - Examples of local french breeds

Bénédicte LEBRET

INRAE PEGASE, 35590 Saint-Gilles, France

➤ Introduction

INRAE – Pig production in Europe



INRAE

Quality of pork and processed products from local fat breeds

University of Guelph – Meat Science & Muscle Biology Club / 30th March 2023 / Bénédicte Lebret

➤ INRAE, French National Research Institute for Agriculture, Food and Environment



INRAE throughout France



Physiology, Environment and Genetics for the Animal and Livestock Systems


18
research centres


14
scientific divisions


11,500
full-time staff


260
research, experimental and support units



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➤ INRAE, French National Research Institute for Agriculture, Food and Environment

An integrated approach

To meet major challenges for agriculture, food, and the environment

Changes in agricultural practices & reduction of inputs

Biodiversity & risk management

Sustainable production of healthy food

Bioeconomy & bioresources



➔ <https://www.inrae.fr/en>

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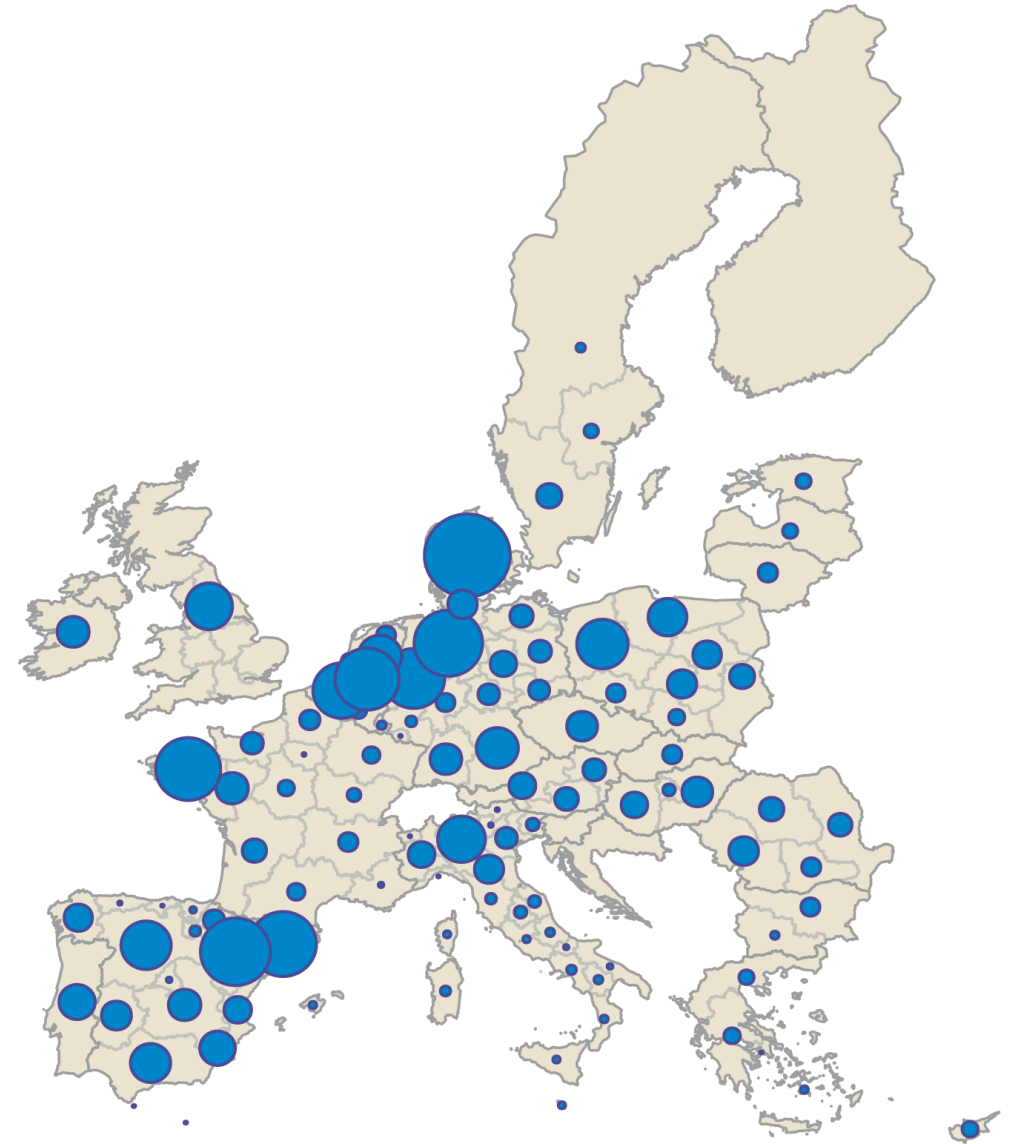
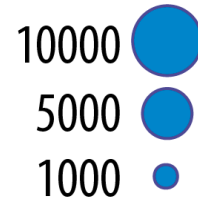
➤ Pig production in Europe

Total Pig production in France

- ≈ 14200 pig farms and 24 millions pigs produced /year
- 3rd pig producer in Europe (1st: Spain, 2nd: Germany; 4th: Denmark)

Pig herds

1000 têtes :



IFIP, 2021

➤ The quality of pork and pork products



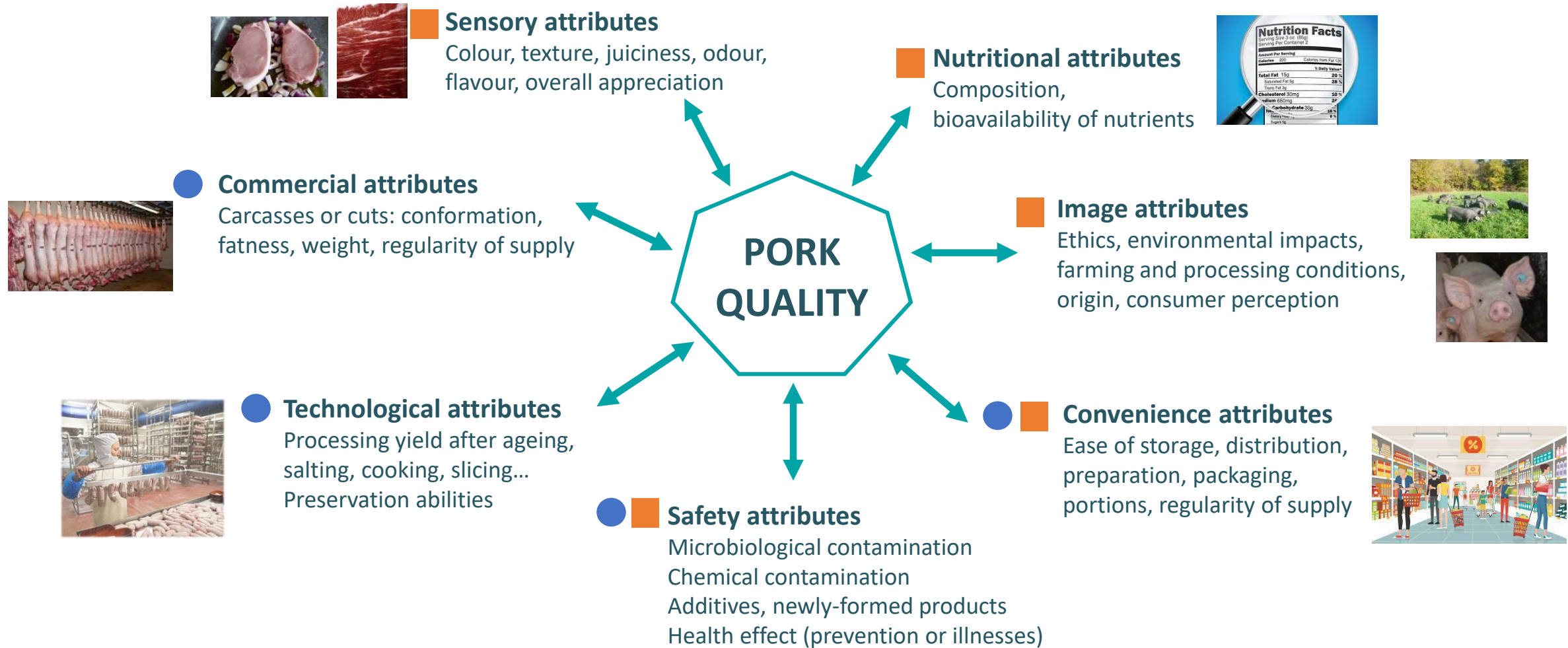
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➤ The quality attributes of animal-source foods: pork

Collective scientific assessment (INRAE)



● Producers, processing actors ■ Consumers ↔ Contribute to

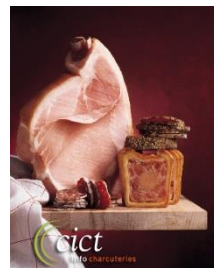
Prache et al., 2022



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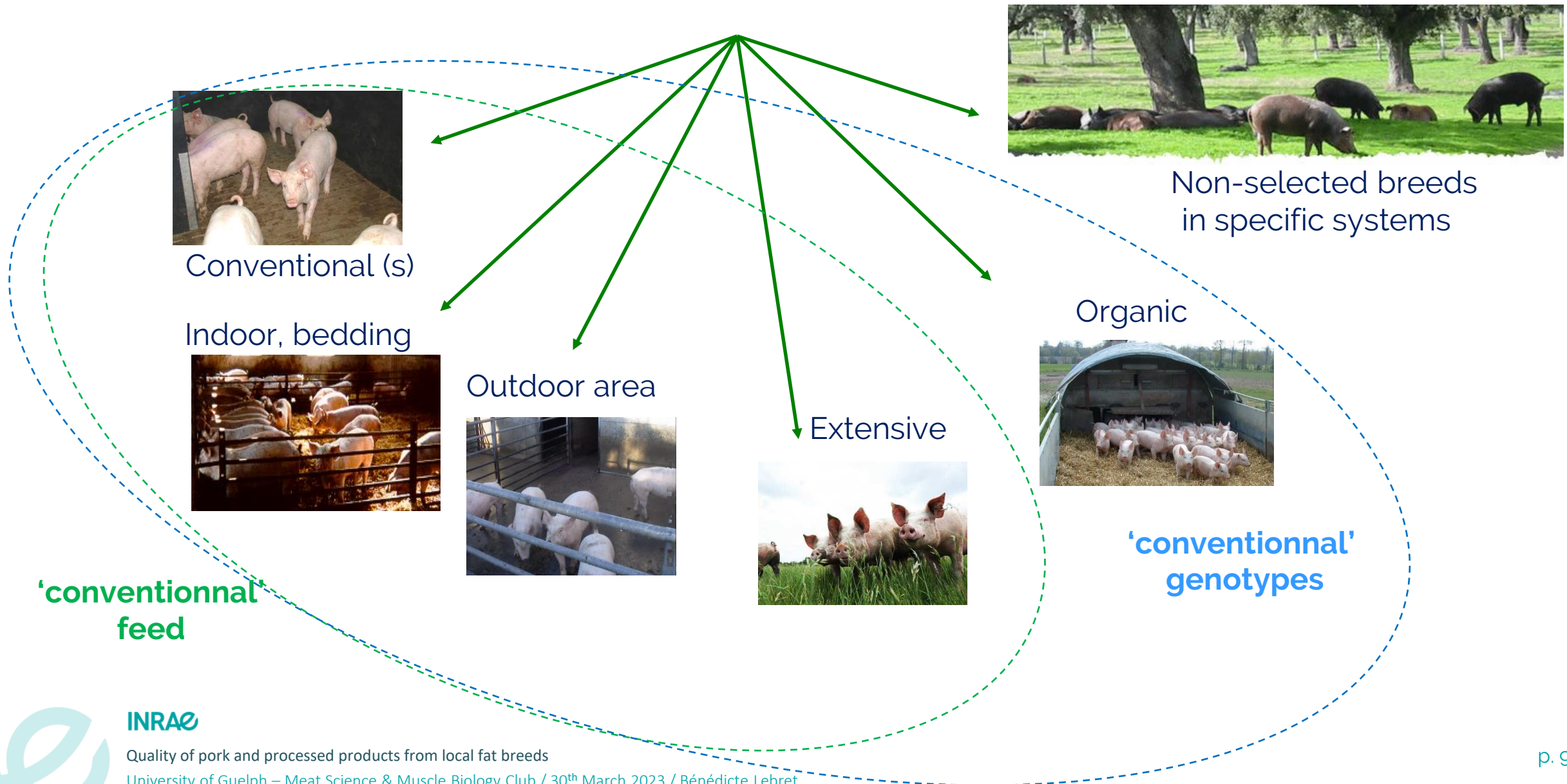
➤ Pork: a great diversity of processed products!

- **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**...
 - **Dry cured ham** in Mediterranean regions (high diversity: technique, ripening time...)
 - Brine salting and smoking in continental regions of Europe
- Diversity of products -> **various quality expectations of raw material** according to process



*Lebret & Candek-Potokar,
2022 a, b*

➤ Pork -> a diversity of pig production systems



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



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

Pigs characteristics
Genetics, sex, age

Rearing conditions
feeding, housing,
production system



Production

Transport, pre-slaughter stress



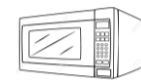
Processing

Cooking, salting...



Retail

Storage & marketing conditions



Home preparation



Consumption

- **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*



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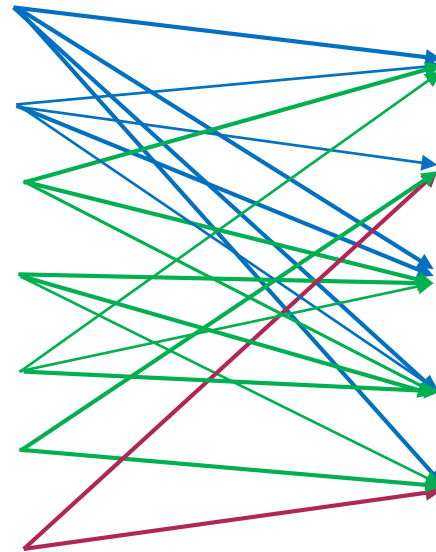
➤ Example: Quality of dry-cured ham

1 – Rearing factors and properties of raw material

Factors of variation



- Pig genotype
- Sexual type
- Age weight at slaughter
- Feeding
- Rearing conditions
- Pre-slaughter handling
- Slaughtering and carcass refrigeration conditions



Important criteria for dry-cured ham processing

- Weight of ham
- Visual / appearance defects
- Thickness of subcutaneous fat
- Fatty acid composition
- Meat ultimate pH



Lebret and Candek-Potokar, 2022 b



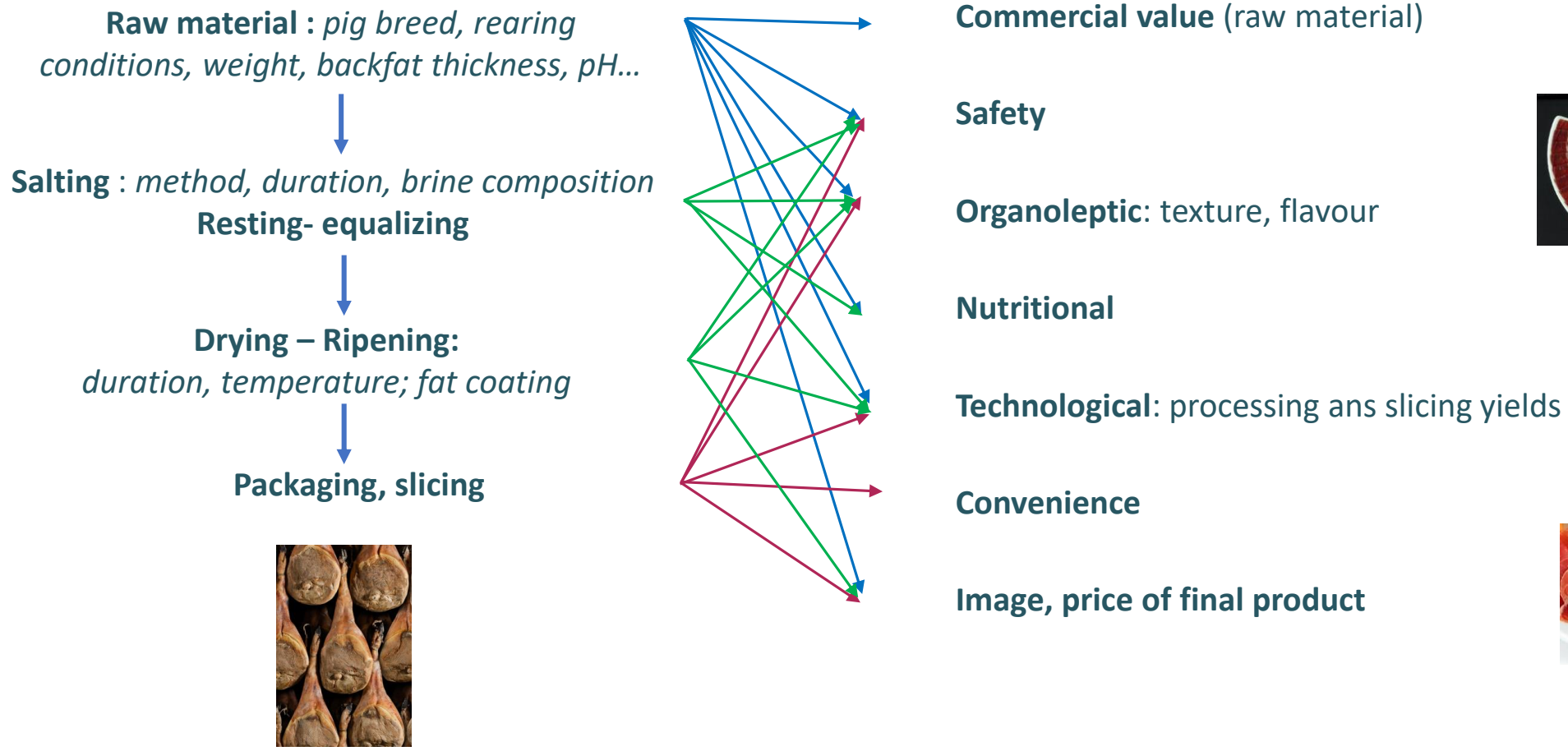
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➤ Example: Quality of dry-cured ham

2 – Main processing steps and effects on quality attributes



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Lebet and Candek-Potokar, 2022 b

➤ Quality certifications of products related to production systems

European quality schemes on geographical indications

- **Aim:** protect names of specific products, promote their unique characteristics linked to **geographical origin** and **traditional know-hows**



Protected Designation of Origin: PDO

Every part of the **production**, processing and preparation process takes place in a specific region

-> **specifications on genetics** (often non-selected breeds), **husbandry, feed, slaughter weight/age, processing**... Ex. Parma, San Daniele (I), Extremadura (SP), Barrancos (P), Noir de Bigorre, Corsican (Fr) dry-cured hams



Protected geographical indication: PGI

At **least one of the stages** of production, processing or preparation takes place in the region -> specifications **less binding for pig production** and geographical region. Ex: Bayonne ham

➤ Some figures about French and European local pig breeds



➤ The French local, non selected pig breeds
6 local breeds and 1 local population recognized by the Ministry of
Agriculture






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Quality of pork and processed products from local fat breeds

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➤ French local breeds: main figures as of January 2022

	Basque	Bayeux	Blanc de l'Ouest	Cul Noir Limousin	Gascon	Nustrale*
Number of farms	23	32	41	24	64	128
Number of breeding sows	556	139	177	230	1591	1232
Number of breeding males	65	43	49	34	169	180
Pork products	Dry-cured ham  Dry sausage Fresh meat	Fresh meat	Fresh meat, fresh and dry sausage	Fresh meat, sausage	Dry-cured ham Fresh meat, sausage, pate 	Dry-cured ham and loin, coppa  Dry sausage

* Number of present breeder animals

Pigs from local pig breeds ≈ 0.1 % of total pig production in France

➤ Local pig breeds: main characteristics - 1

- **Not selected for efficiency of lean production:** not selected for reproductive and productive performances (growth rate, feed efficiency) or against fatness
- Well **adapted to their environment:** use of **local natural resources**
- Source of **traditional meat products:** high sensorial quality and part of **cultural heritage**

Lebret, 2008; Candek-Potokar et al., 2019

TREASURE European Project 2015-2019:
Productive performance and meat quality
of European local pig breeds

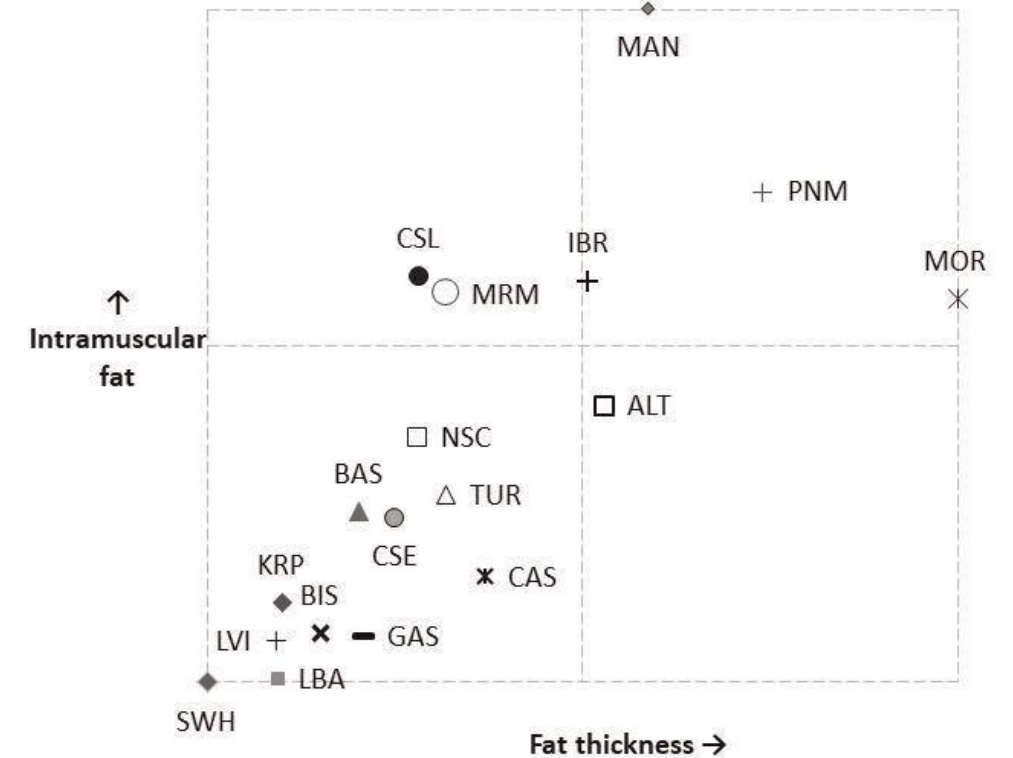
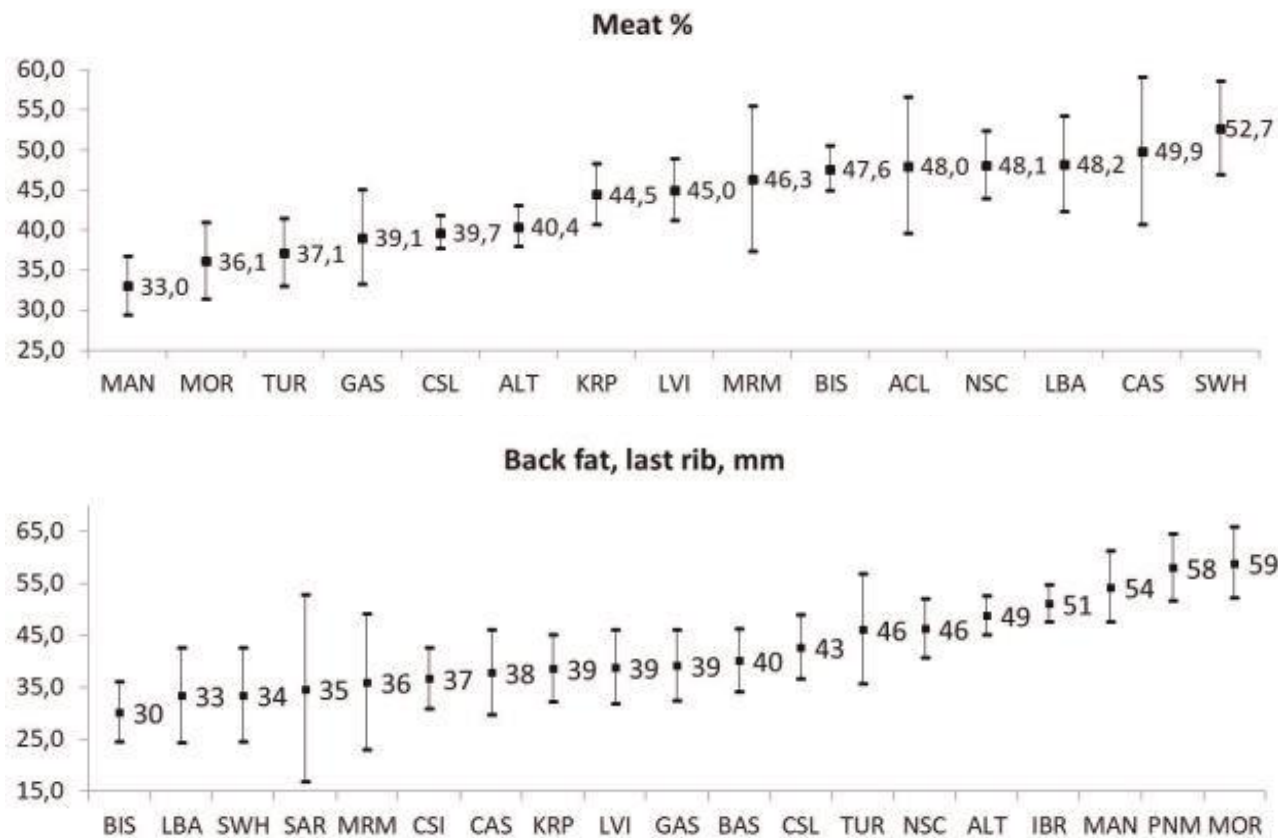


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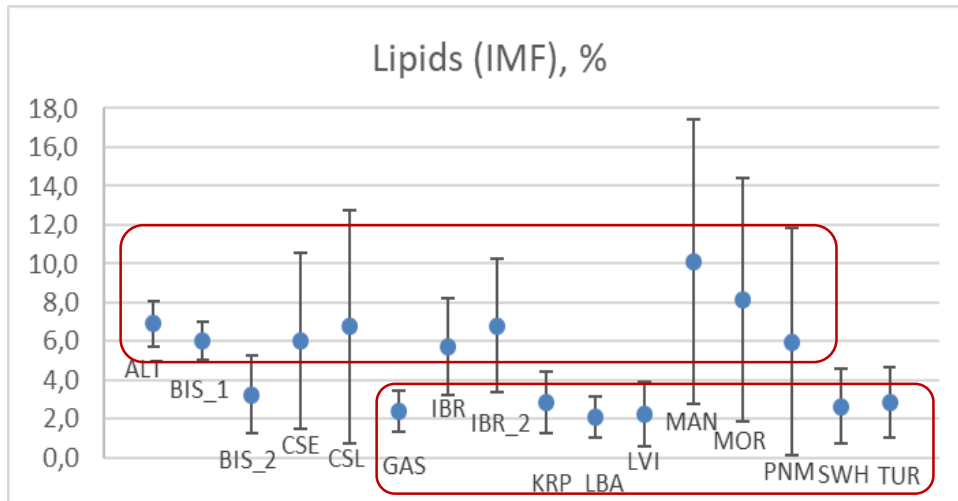
➤ Local pig breeds: main characteristics - 2



- Low lean percentage, high carcass **fatness**
- **Variability** among and within breeds

- For similar carcass fatness: **high breed variability** for **IMF** content

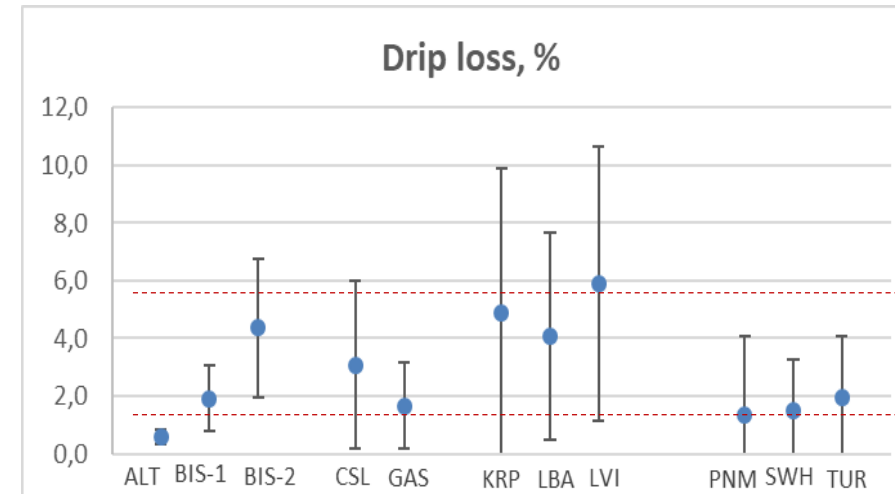
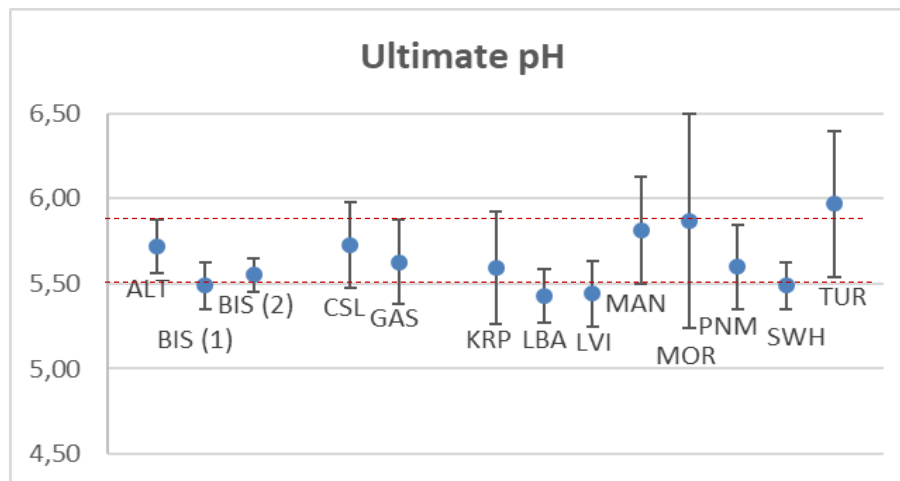
➤ Local pig breeds - 3: loin meat quality (standardized methods)



IMF content: major trait related to eating quality

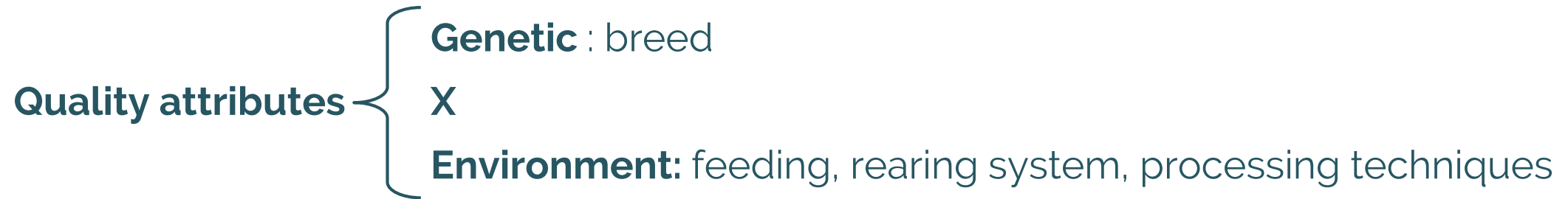
- **Variability among breeds** : 2.1-2.6% (e.g. Gascon), ≥ 6% in 8 breeds : higher than conventional breeds
- Variability **within breeds**
- Role of **management practices** in IMF content and variability: **G X E interactions**

(Pugliese & Sirtori 2012)



- **Technological quality**: high variability among & within breeds
- Most local breeds with **satisfactory values**, higher than selected breeds

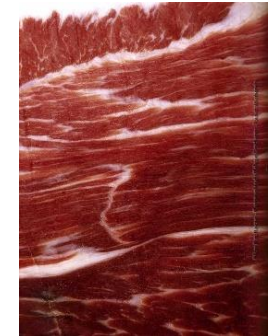
➤ Quality of pork and processed products from fat breeds in specific production systems



Lebret, 2008

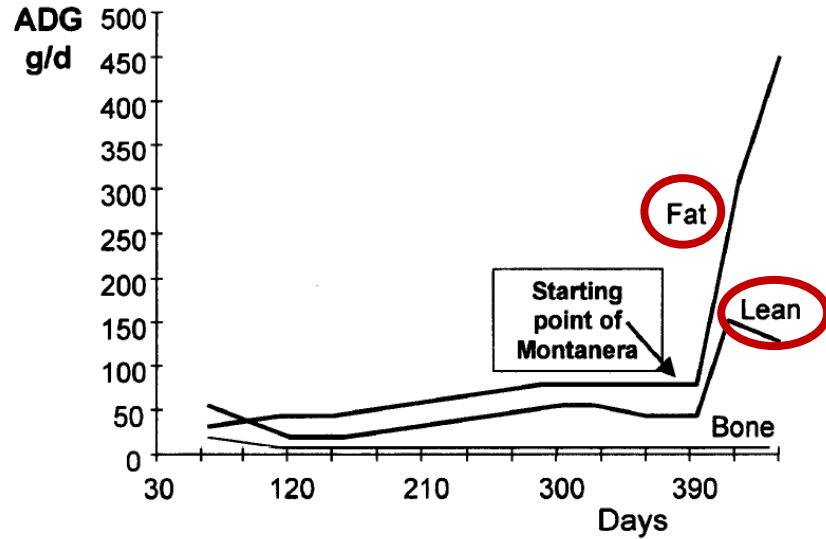


Iberian pigs (pedronieto.com)



Basque pigs and dry-cured hams

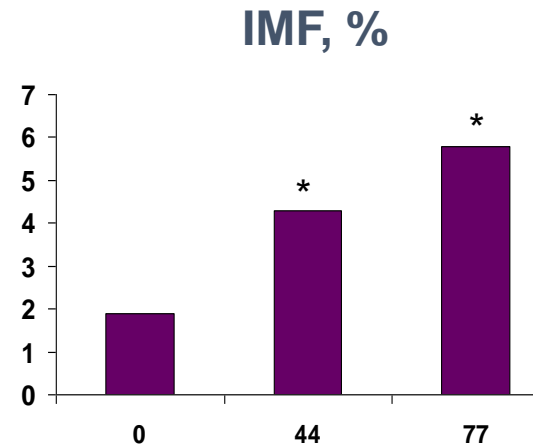
➤ Local, fat breeds in specific production systems: G X E



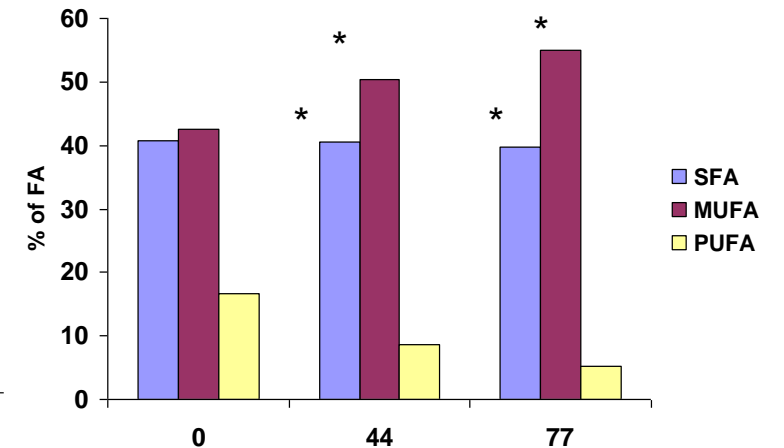
Iberian pigs

extensive finishing, only local feed resources on rangelands: grass, acorns
 -> compensatory growth, **high fat deposition**

(Lopez-Bote, 1998)



Fatty acid composition



Finishing duration, d

Nustrale (Corsican, Fr) pigs, extensive finishing on chestnuts

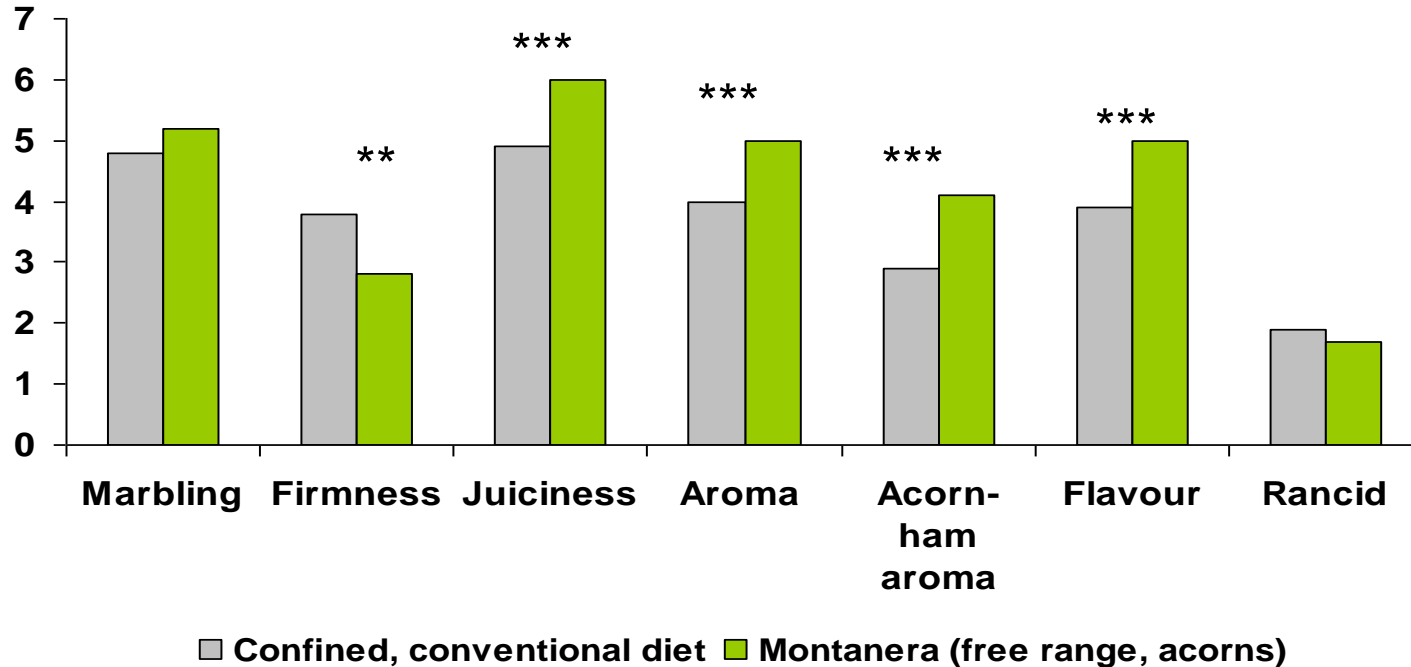
-> pigs **express their high potential** for IMF deposition

-> changes in **the FA profile of** muscles

(Secondi et al., 1992)

➤ Local, fat breeds in specific production systems: G X E

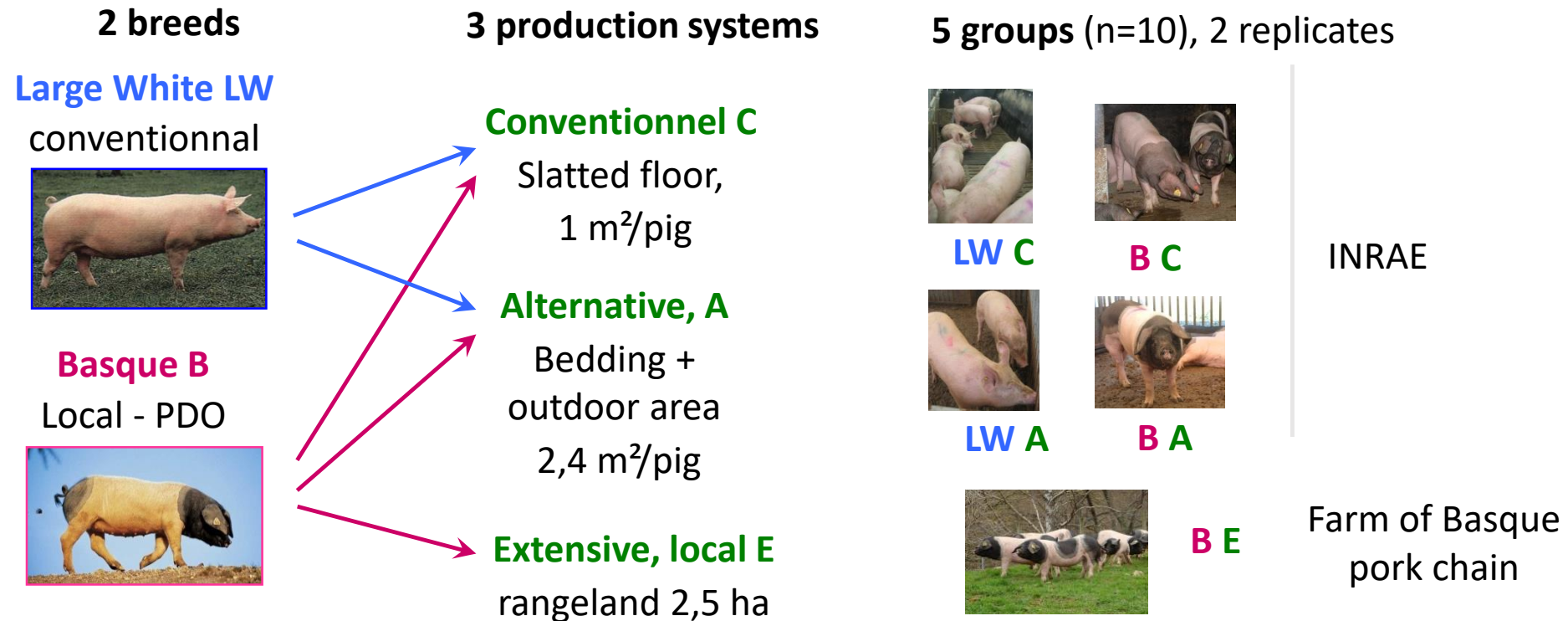
Influence of rearing system on the sensory quality of Iberian hams



(Cava et al., 2000)

➤ The **production system** plays a **key role** in the determination of the **high eating quality** of pork products from local breeds

➤ Effects of breed and production systems on animal performance, carcass traits, and quality of meat and dry-cured ham (1)



*Lebret et al.,
2013, 2015*



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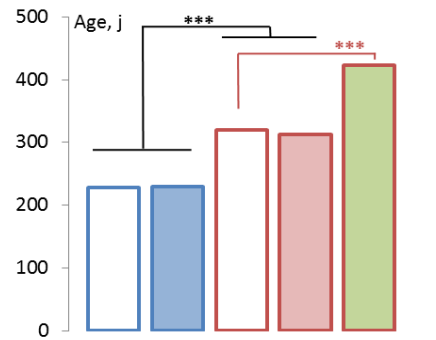
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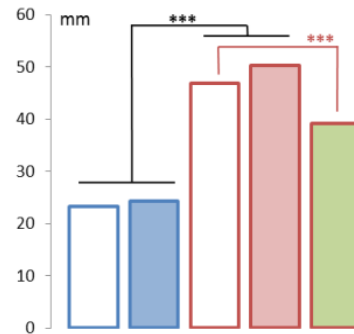
➤ Effects of breed and production systems on animal performance, carcass traits and meat quality (2)



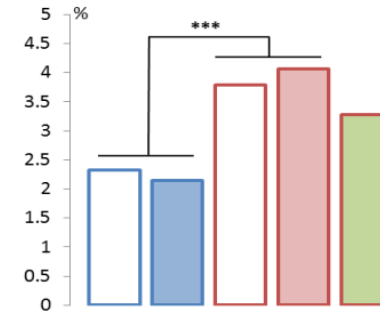
Age at slaughter 145 kg



Backfat thickness

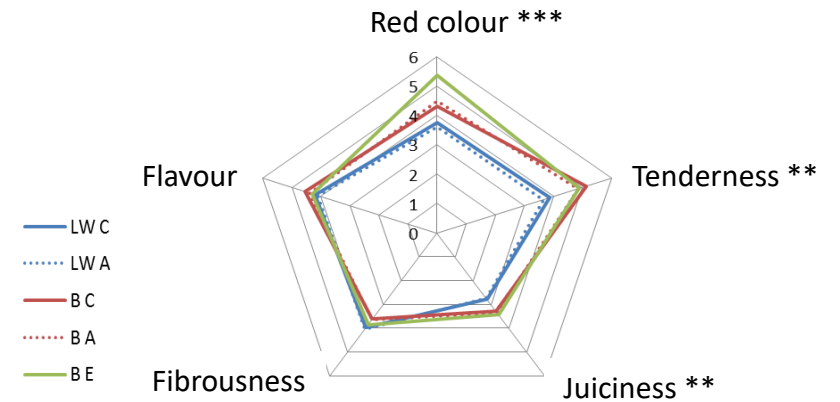


IMF content, loin

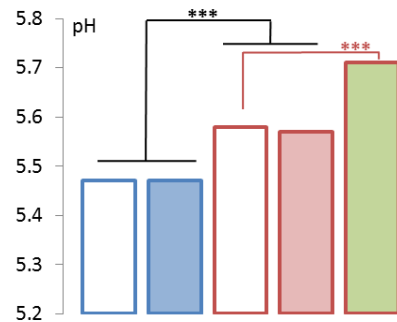


Lebret et al., 2013, 2015

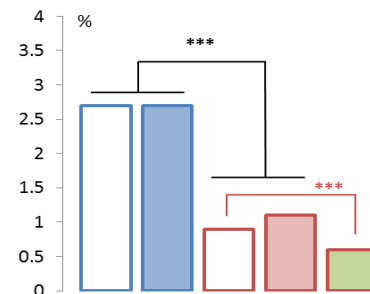
Sensory analysis



Ultimate pH



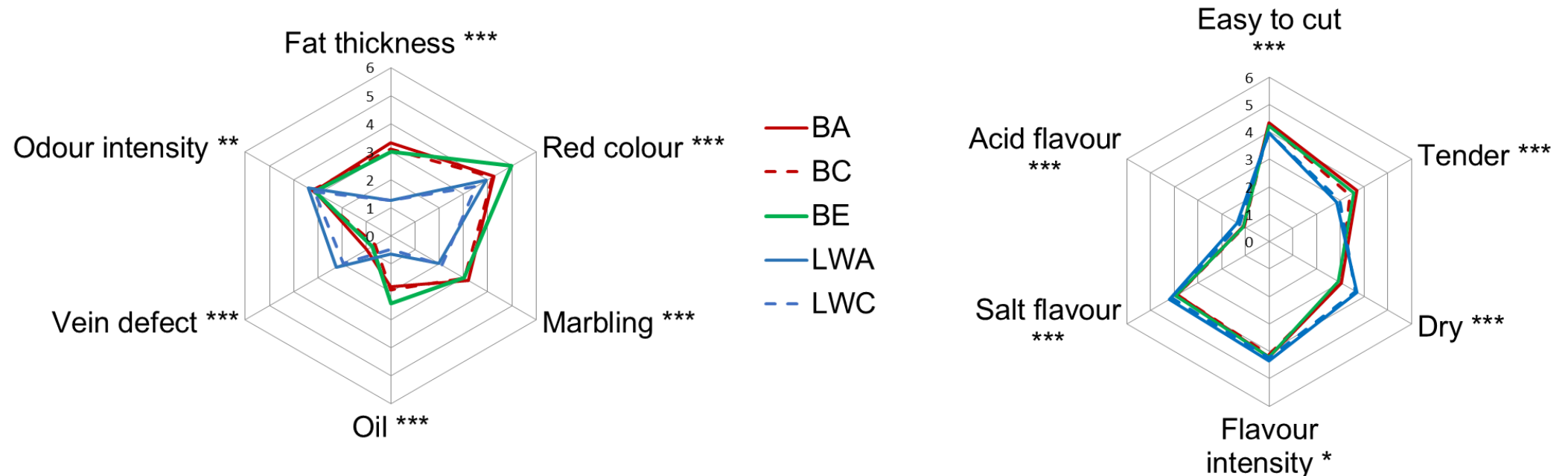
Drip loss



Longissimus muscle (loin)

➤ Effects of breed and production systems on the sensory quality of dry-cured ham (3)

Dry-cured ham, 18 months ripening



➤ Marked effects of **breed** and **production system within breed**, especially for the BE pigs

(Lebret et al., 2013, 2015)

➤ Consumers' study on traditional pork products from local breeds : expectations and hedonic evaluation

❖ Products : dry-cured hams

- **Noir de Bigorre-PDO, 24 months ripening** – local pig breed in extensive system : **NB24 (Traditional pork product)**
- **Noir de Bigorre-PDO, 36 months ripening** – local pig breed in extensive system : **NB36 (Innovation in Traditional pork product)**
- **Iberian ham, 50% Iberian pig : IB (Competing product, premium quality)**

❖ Consumers

- n=124, regular purchasers of high-quality dry-cured hams



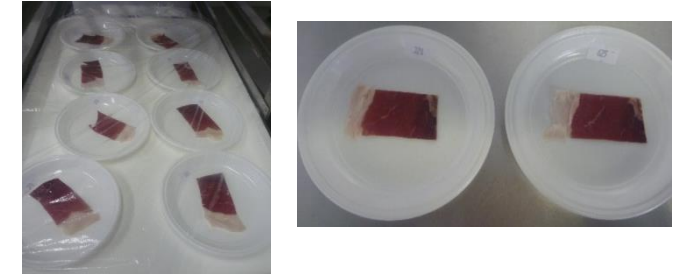
(Lebret et al 2018, Vitale et al 2020)

➤ Consumers' study on traditional pork products from local breeds : expectations and hedonic evaluation

❖ **Sensory tests: 3 phases** (expectation disconfirmation theory)

	Consisting on...
1. Blind liking	= blind sensory test : hedonic evaluation, no information
2. Expected liking	= expectation based only on product description (no sensory test)
3. Informed liking	= informed sensory test : hedonic evaluation with information on products

Preparation of products

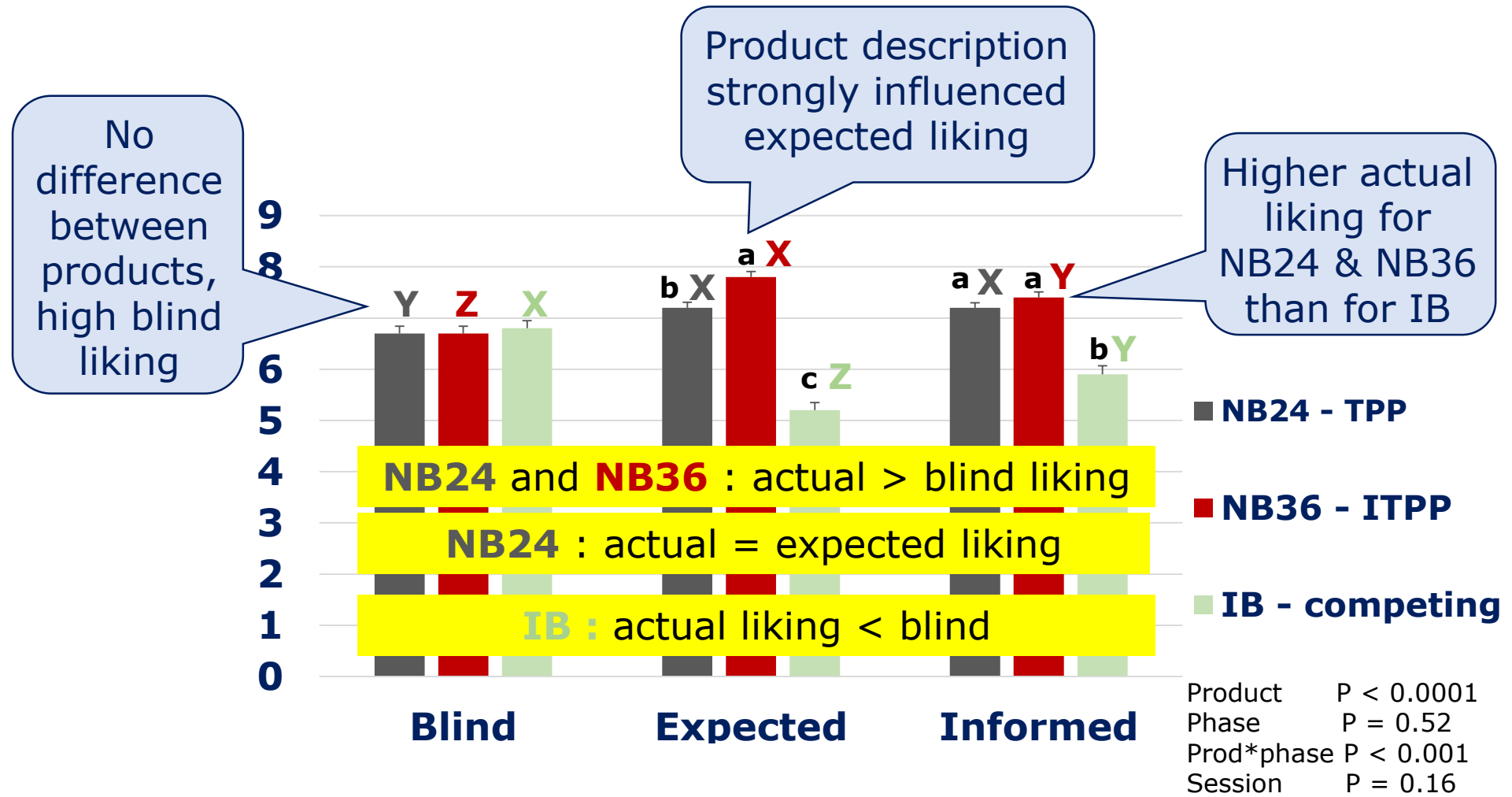


Consumer tests



❖ **At each phase and for each product: score on discrete scale from 0 (dislike) to 9 (like extremely)**

➤ Consumers' study on traditional pork products from local breeds



a, b, c : within phase = differences between products

X, Y, Z : within product = differences between test phase

➤ Consumers' study on traditional pork products from local breeds : expectations and hedonic evaluation

❖ Conclusions

- **High but similar blind acceptability** of the three products
 - **High consumer expectations for NB24** (traditional) and even more for **NB36** (innovation in traditional product)
 - **Fulfilment of hedonic expectations** for the NB 24
 - **Providing information modifies the hedonic perception of products:** higher for PDO-NB hams but impaired that of IB ham:
- **interaction between sensory and image attributes**



(Lebret et al 2018, Vitale et al 2020)

➤ Conclusions and Perspectives

- **Quality** of pork and pork products from local fat breeds: **complex!**
 - Various quality attributes, various priorities of chain actors, and various products
- **Fat pig breeds** generally exhibit **high sensory and technological attributes** – with some **variability** (e.g. IMF) among and within breeds
- The **pig production system** : feeding, housing conditions... can **differentiate further quality** attributes especially **sensory and image: G X E interactions**
- Quality of the **raw material** is essential for the quality of the processed products
- Quality is **built** and can be improved – but also impaired at all steps of production and processing
- Increasing role of **image attributes** e.g. animal welfare (castration?), biodiversity, environmental impacts, origin, retailing organization (short chains)
- Quality of pork and pork products should be considered at a broader level: **farm to fork approach**, and evaluating the **synergies or antagonisms between quality attributes** by multicriteria analyses



Thank you for your attention!



Quality of pork and processed products from local fat breeds

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