

# Protein digestion in broiler: what are the specificities induced by the protein source in the diet?

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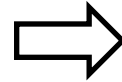
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# CONTEXT



- Protein demand ↗
- Price volatility
- Climate hazards
- Competition for resources



Diversity and variability of protein feedstuffs



**Maintain performances with unconventional and changing protein feedstuffs**

**Objectives : Better understanding of protein digestion mechanisms**



- Kinetic of protein digestion
- Peptides resistant to hydrolysis : identification, characterization
- Differences between protein sources
- Solutions (process, enzymes) to improve protein digestion

# EXPERIMENTAL DESIGN



Ross PM3  
(n = 72)



Allocation to 4 groups  
(n = 18 / group)



Soybean meal (**S**)

Rapeseed meal (**R**)

Pea (**P**)

Corn Distiller's dried grains with solubles (**C**)



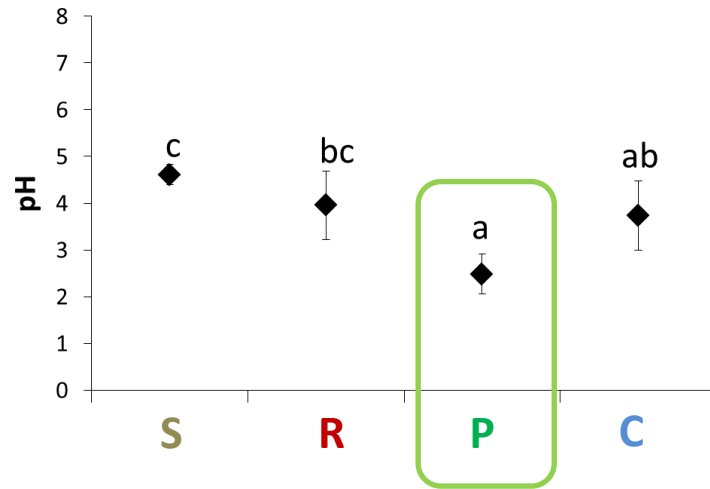
- Digesta pH measurement
- Soluble proteins analysis
  - SDS-PAGE
  - Mass spectrometry



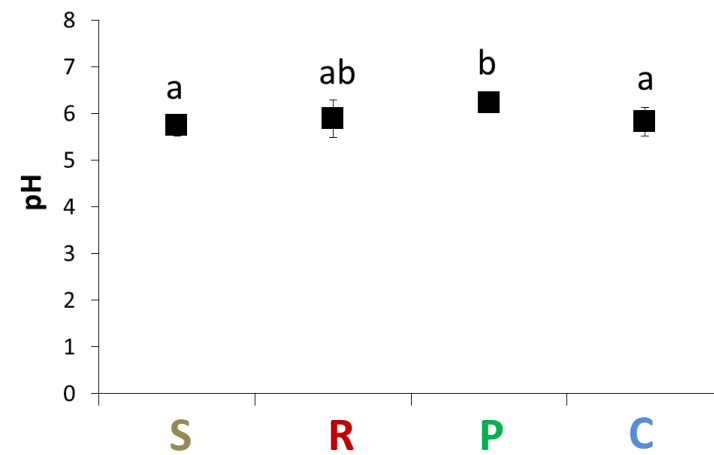
Digestive content collection  
(Gizzard, Duodenum, Jejunum, Ileum)

## pH of digesta

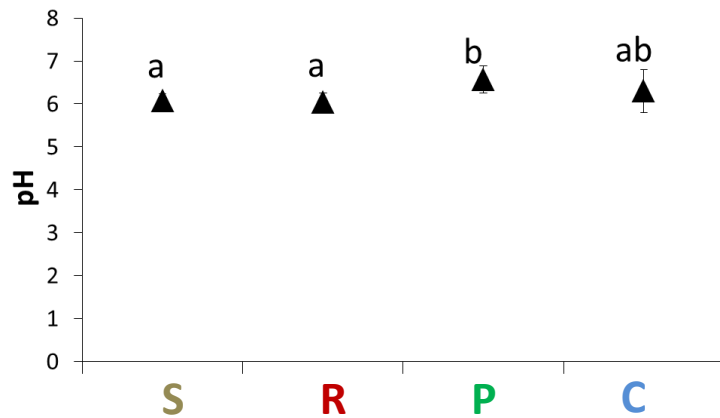
Gizzard



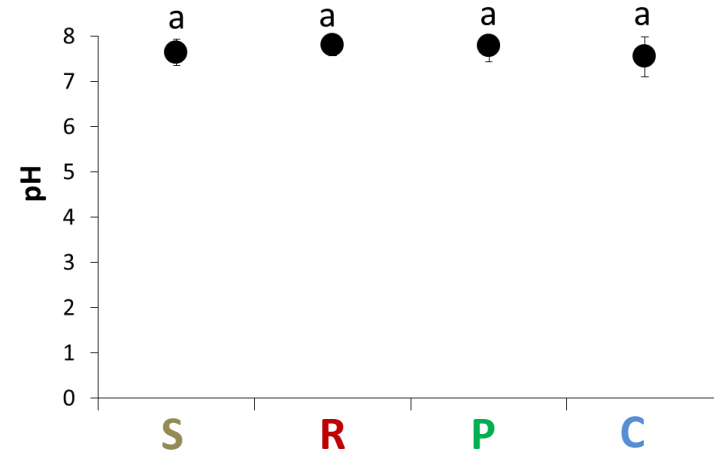
Duodenum



Jejunum

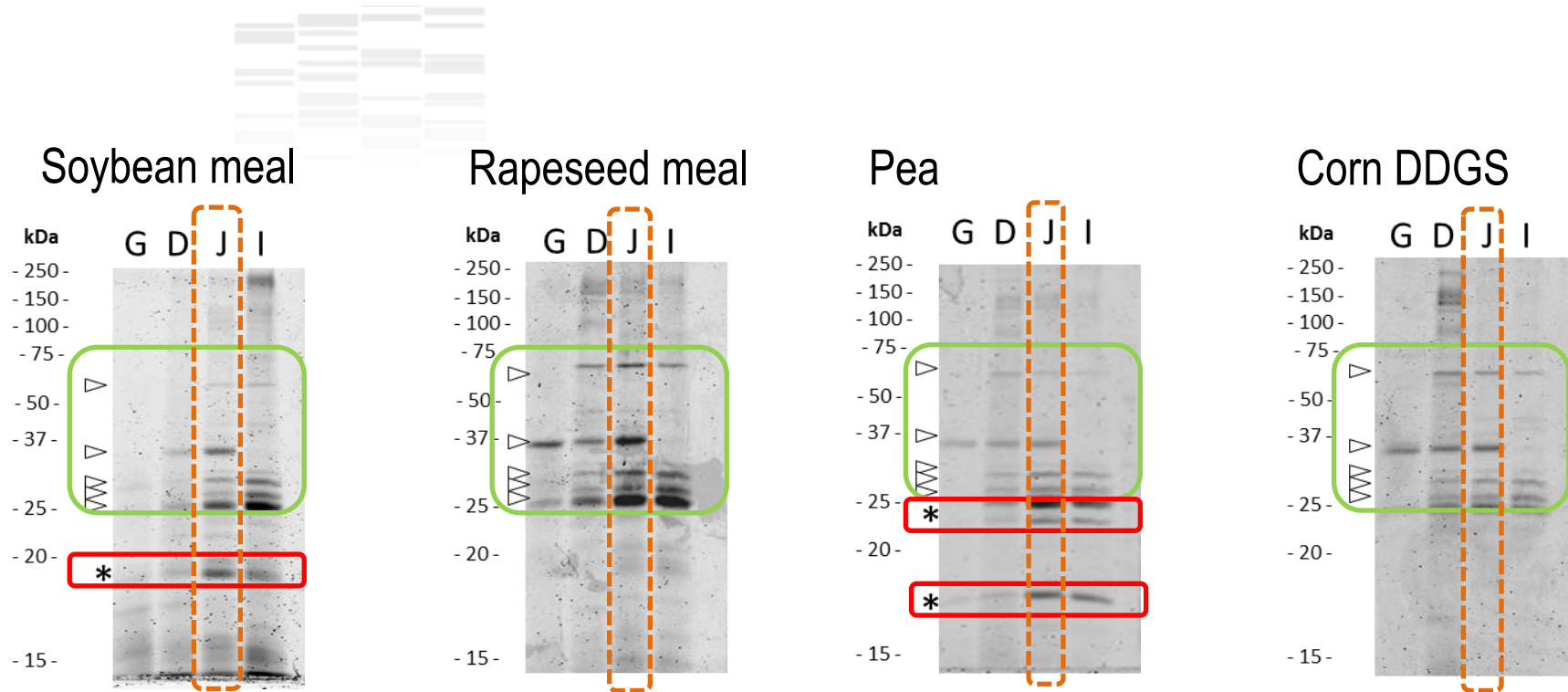


Ileum



# Identification of proteins

## Results



– 5 **common** bands : 25, 26, 27, 36 et 55 kDa



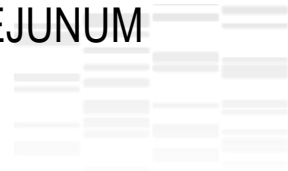
– 3 **diet-specific** bands: 18 kDa (S) and 16 et 24 kDa (P)

– Bands in jejunum were analyzed by LC-MS/MS

# Characterization of proteins

## Results

Bands of JEJUNUM



17 plant proteins

59 proteins

42 *Gallus gallus* proteins



11 (S) + 2 (R) + 4 (P) + 0 (C)

18 common to all diets

15 diet-specific

9 in 2 or 3 diets

- High variability

- Limits :

- data available in databanks
- soluble proteins only

- But interesting proteins:

- Kunitz inhibitor (S)
- Bowman-Birk inhibitor (P)

Classified according to predicted function

- ✓ Protein digestion and regulation
- ✓ Carbohydrate metabolism
- ✓ Lipid metabolism
- ✓ Amino acid metabolism
- ✓ Intestinal homeostasis

# Integration of knowledge



**Carbohydrates**

**DIET**  
**Proteins**

**Nucleic acids**

**Fats**

**HOMEOSTASIS**

	Carbohydrates	Proteins	Nucleic acids	Fats	HOMEOSTASIS
Proventriculus Gizzard		Pepsin A precursor			
Pancreas Duodenum Jejunum	Maltase-glucoamylase Maltase glucoamylase-like X4 Amylase alpha 2A  S (1)	Chymotrypsinogen 2-like Chymotrypsin-like elastase 2A Trypsinogen Proproteinase E-like Chymotrypsin C Carboxypeptidases A1, A2, A5, B Aminopeptidase N Xaa-Pro dipeptidase  S (4) + P (2)	Cytidine deaminase  URIDINE	Not detected  S (2)	Angiotensin-related protein 1-like Hydroxyacylglutathione hydrolase  S (5) + P (1)
Ileum	OSSES	AMINO-ACIDS			

# CONCLUSION



## Objectives :

- Better understand the mechanisms involved in protein digestion
- Identify differences related to protein source in the diet

## Contribution of the study

- Gizzard pH
- Endogenous / plant proteins
- Common / diet-specific proteins

## Technical limits

- Soluble proteins only
- Data available in databanks
- Qualitative approach only

## To go further...

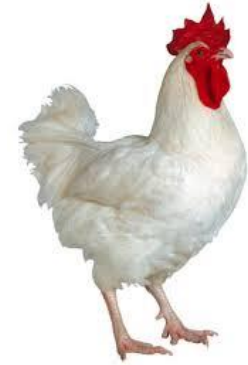
- Kinetic of protein digestion
- Quantitative approach
- Link with digestibility / performances

Recoules et al. 2015 (Submitted)





- The experimental unit INRA – PEAT
- DSM



THANK YOU FOR YOUR ATTENTION