In vitro and *in vivo* comparison of the DPP-IV inhibitory activity of dietary proteins from different origins after gastrointestinal digestion

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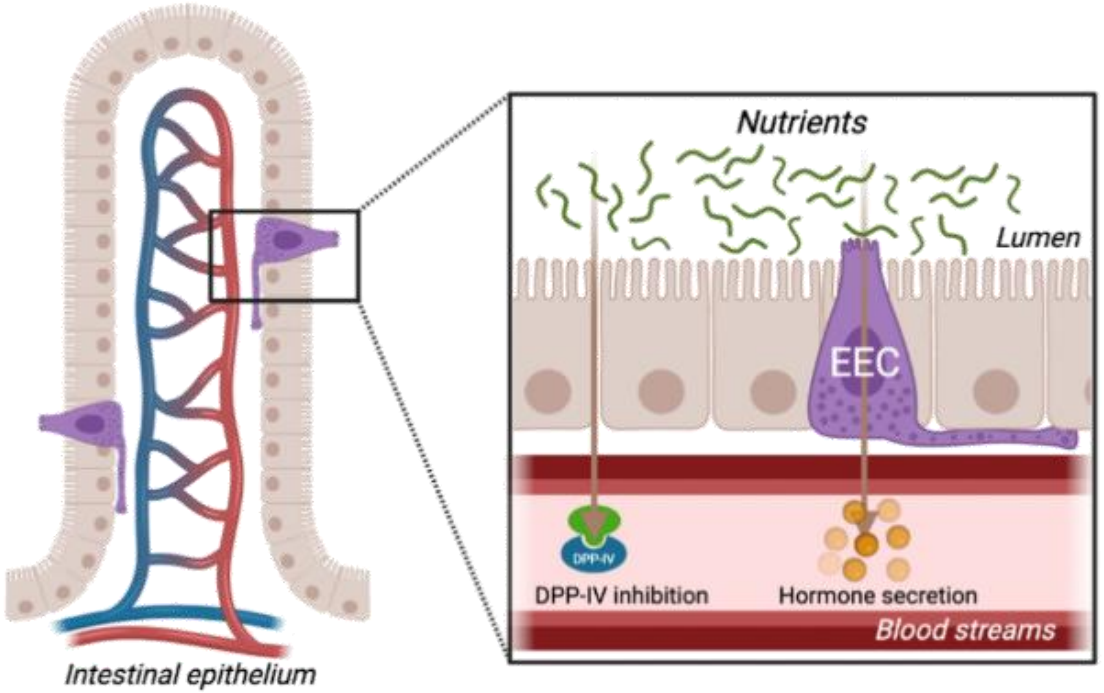
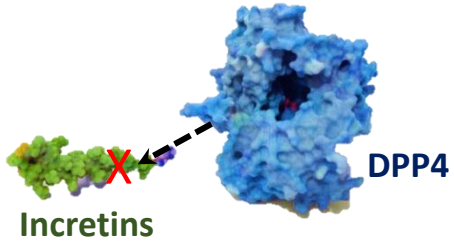
Intestinal peptide sensing is implicated in food intake regulation and glucose metabolism



Intestinal incretin hormone release **GLP-1 & GIP** → ↗ insulin release ↘ glucagon release → **↘ of blood glucose**

Dipeptidyl peptidase 4 **(DPP4)**

DPP-IV rapidly degrades incretins



→ **Food protein are natural sources of DPP-IV inhibitors**

PURPOSE

- ***In vivo* measurement of the DPP-IV activity modulation of proteins from different origins**
- **Development of an *in vitro* model of intestinal digestion and absorption to study the DPP-IV inhibitory activity of dietary proteins**

Plasma DPP-IV activity

Oral administartion

~350 mg protein
1 g.kg^{-1} BW

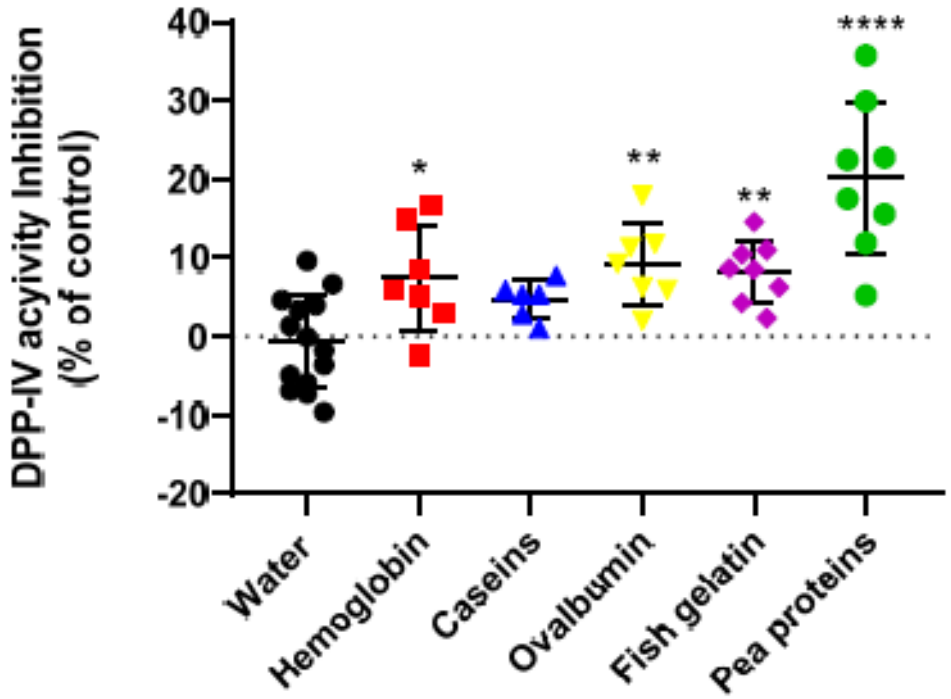
Wistar rats

30 min

plasma sampling

+ Gly-Pro-AMC substrate

DPP-IV activity assay



Plasma DPP-IV activity after 30 min protein administration
One-way ANOVA, Dunnett's multiple comparison test ($p<0,05$)

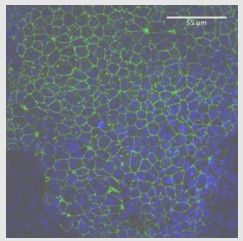
Dietary proteins inhibit the plasma DPP-IV activity
Pea proteins lead to the best enzyme inhibition

INFOGEST *in vitro* static SGID adapated to proteins

Oral phase
salivary fluid
amylase (75 U/mL)
2 min, 37°C, pH 7

Gastric phase
Oral bolus with gastic fluid
pepsin, gastric lipase
2h, 37°C, pH 3

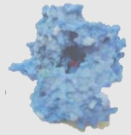
Intestinal phase
gastic chyme and intestinal fluid
pancreatin
2h, 37°C, pH 7



Absorption IB model
(Caco-2/HT29-MTX)

Brodkorb et al. Nature Protocols (2019): 991-1014.
Atallah et al. Foods (2020): 1580.
Fleury et al. IJMS (2022)

1 DPP-IV activity assay



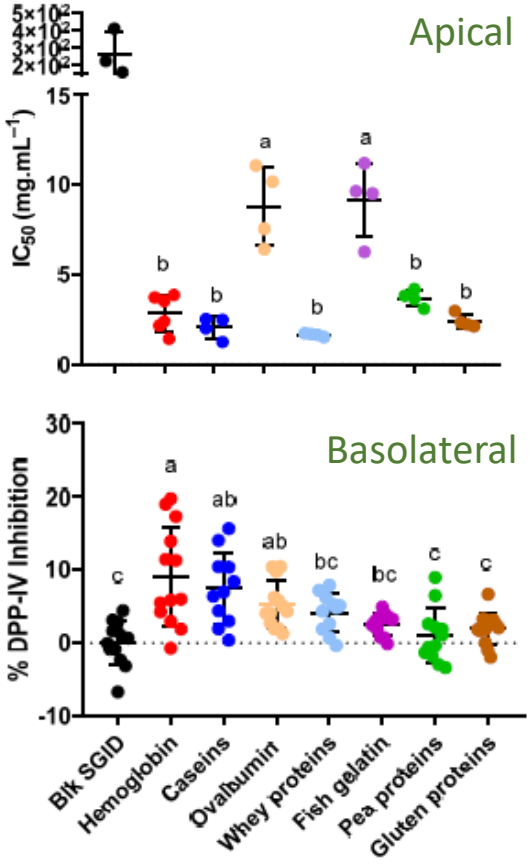
2 Apical and basolateral peptidome analysis

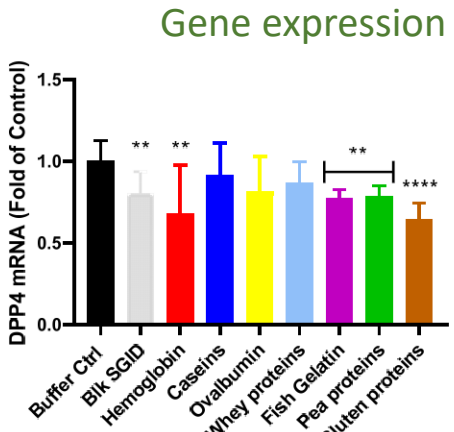
nanoLC-ESI-HR-MS/MS

3 QSAR analysis

Nongonierma et al., 2016.

1 DPP-IV activity assay





Digested proteins differently inhibit DPP-IV activity before and after IB passage.

Digested protein decrease more or less the DPP-IV gene expression

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adapated to proteins

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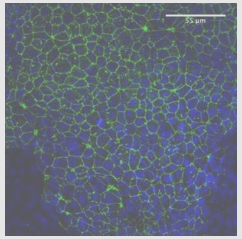

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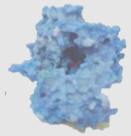

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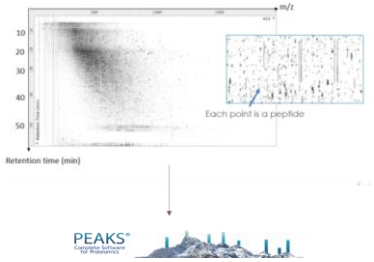
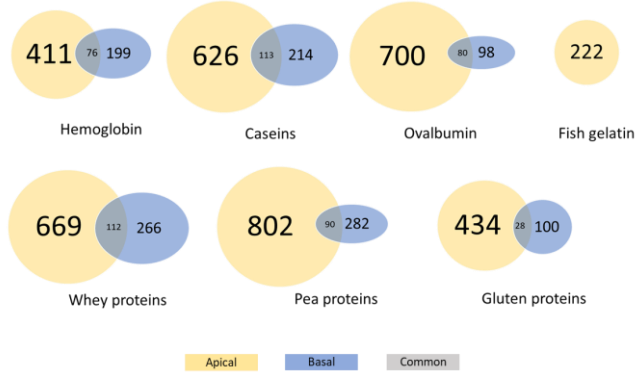
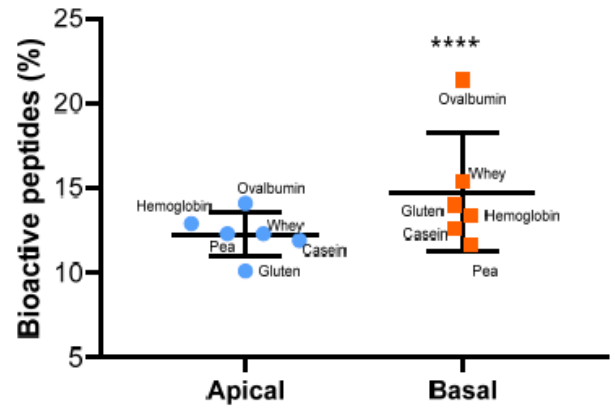




3 QSAR analysis

Nongonierma et al., 2016.

nanoLC-ESI-HR-MS/MS



Many peptides cross the IB while others are generated by IB enzyme

Basolateral peptidome contain more DPP-IV inhibitory peptides

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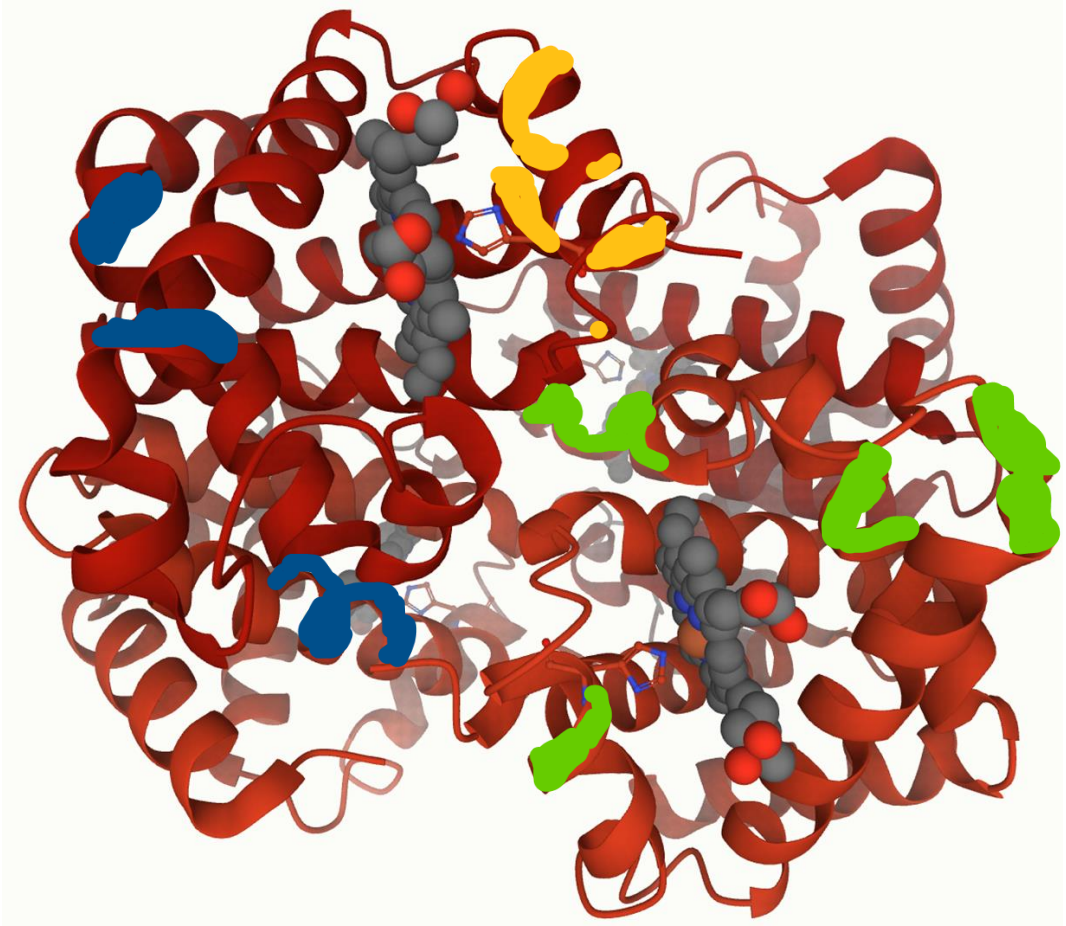
Than you for your attention!



Conclusion & perspectives

- Correlation between *in vitro* and in *vivo* is not clear
- Kinetics approach
- Peptide identification method in plasma
- Investigation in pig and human to validate the *in vitro* method

Potential applications

- Personalized diet
- Chronical disease prevention (T2D)
- Better characterization of protein and protein by-products
- Impact of industrial processing (fermentation, hydrolysis…)
- Impact of food processing (cooking…)

⇒ **Qualify the hided bioactivity and predict a part of the "health potential" of dietary proteins**

Reference: Fleury, L., Deracinois, B., Dugardin, C., Nongonierma, A. B., FitzGerald, R. J., Flahaut, C., Cudennec, B. & Ravallec, R. (2022). In Vivo and In Vitro Comparison of the DPP-IV Inhibitory Potential of Food Proteins from Different Origins after Gastrointestinal Digestion. International Journal of Molecular Sciences, 23(15), 8365.