Optimization of protein intake in the elderly beyond the amino acid composition. What is the positioning of plant proteins and under what conditions?

Isabelle Savary-Auzeloux, Laurent Mosoni, Marie-Agnès Peyron, Sergio Polakof, Didier Remond, Dominique Dardevet

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Unité de Nutrition Humaine

Protein Nutrition: The Basics

- To fulfill the body's requirements for amino acids
- To cover the need for all essential amino acids
- If the minimal requirement for a single essential amino acid is not covered
  = Negative impact on the optimal use of all other amino acids

Recommended Daily Allowance (RDA) at 0.83g/kg BW/day

Healthy adult population

The recommandation is based if the dietary protein is of good quality

Food and Agriculture Organization of the United Nations

The FAO has elaborated the composition of the ideal dietary protein in term of essential amino acid composition

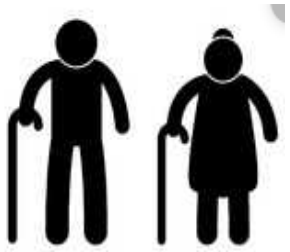
i.e the protein that will cover the requirement of all EAA when ingested at 0.83 g.kg.day in healthy human above 5yo

Amino Acid	HIS	ILEU	LEU	LYS	CYS + MET	TYR + PHE	THR	TRP	VAL
mg/g of dietary protein	16	30	61	48	23	41	25	6.6	40

Protein Nutrition: The Basics

Recommended Daily Allowance (RDA)
0.83

Healthy adult population

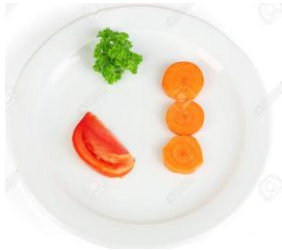


Recommended Daily Allowance (RDA)
1 to 1.2

Healthy elderly population

Protein Nutrition: The Basics

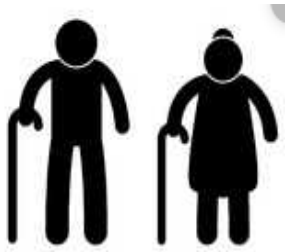
Increasing protein intake and more generally an increase in food intake in such population could be difficult to achieve



Loss of Appetite /Undernutrition

Protein palatability

Urea production and clearance

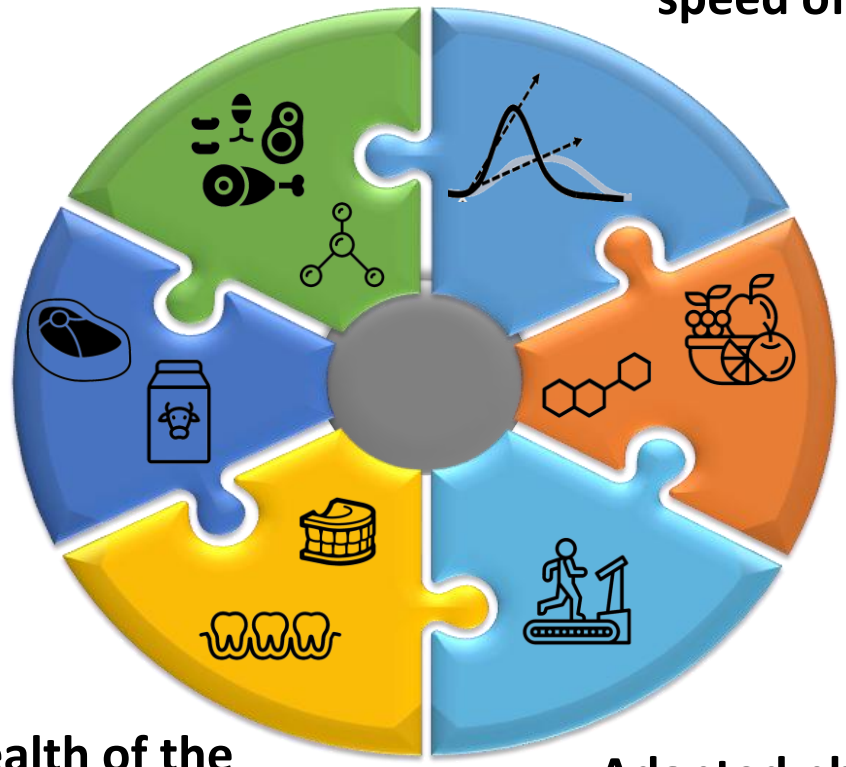


Recommended Daily Allowance (RDA)
1 to 1.2

Healthy elderly population

The quality of a dietary protein in elderly should take into account more than just its amino acid composition

in order to constrain as much as possible the increase in protein consumption
while ensuring the coverage of the need for each AA



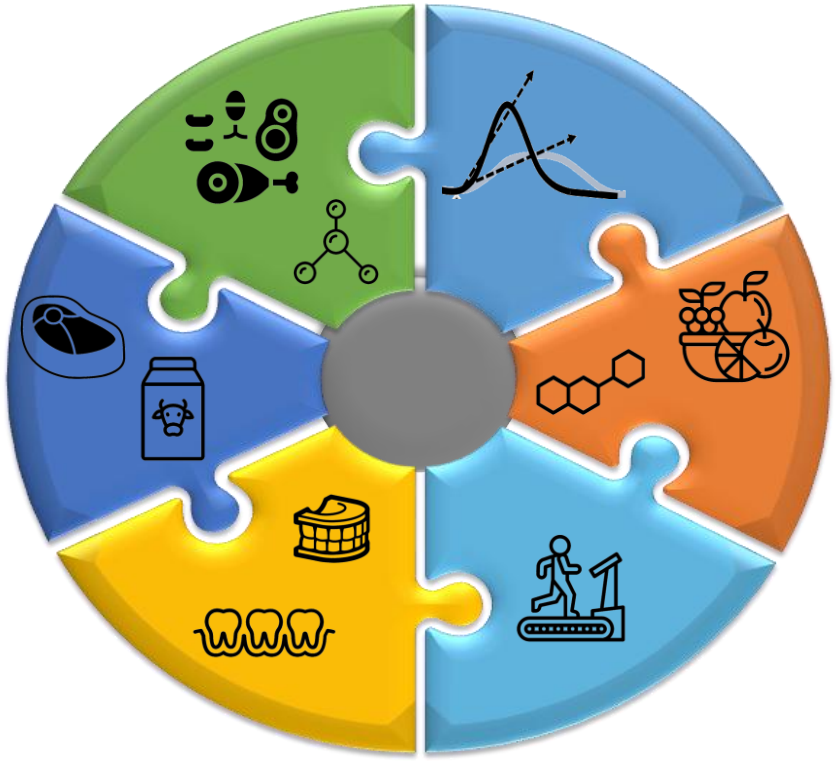
Dardevet et al. Proc Nutr Soc. 2021

Efficient at a RDA of 0.83 instead of 1.0 g.kg.d

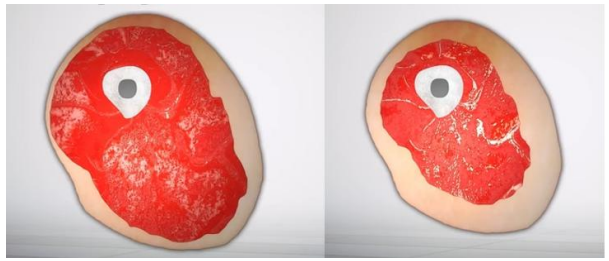
L-LEUCINE

Whey

Equilibrated proteins but also with specific amino acids



- ✓ **Efficient if 100% of the dietary proteins are whey proteins**
- ✓ **In supplementation, it remains non optimal**



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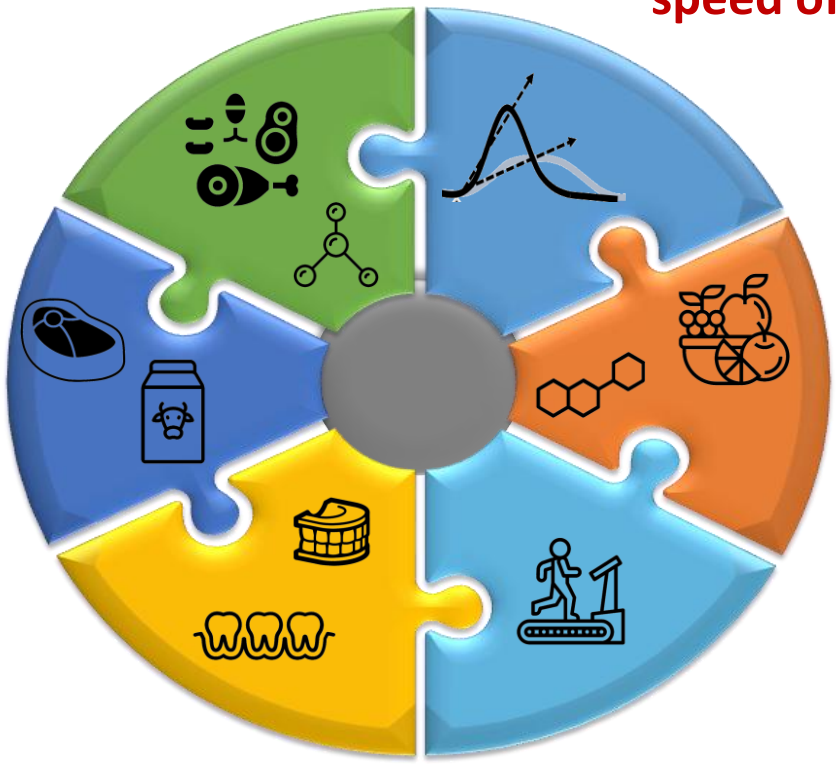
RDA is based on a dietary protein which is 100% digested

- ✓ **Favor highly digested dietary proteins in elderly**

Digestibility and digestion speed of dietary proteins



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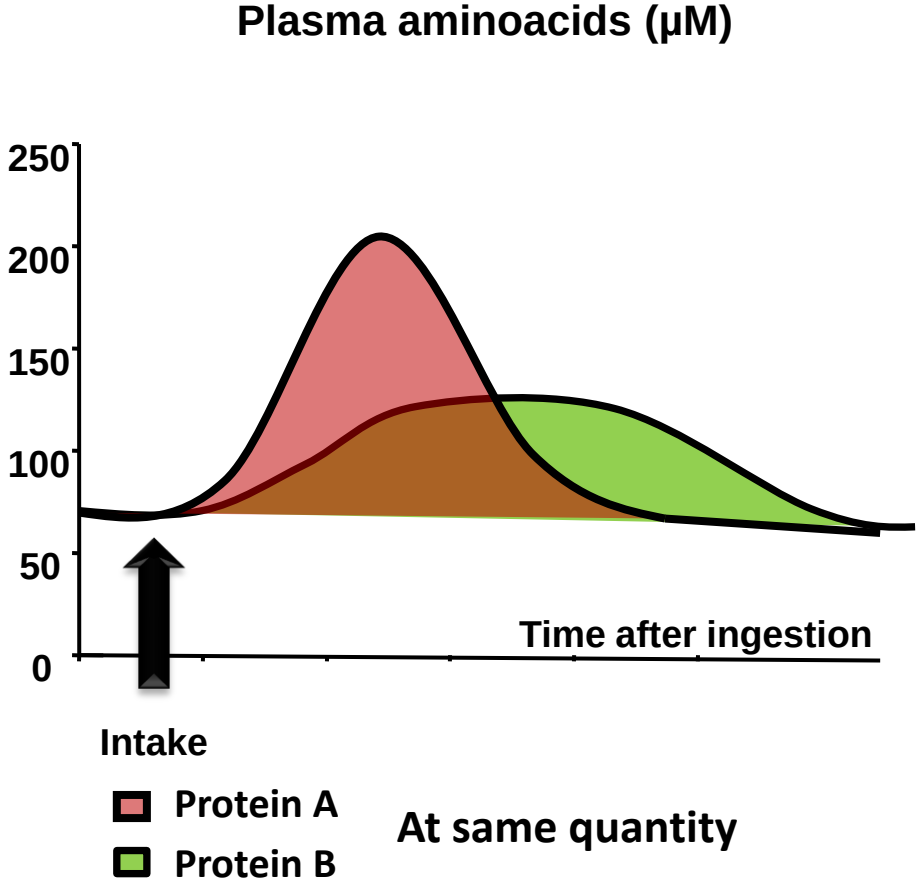
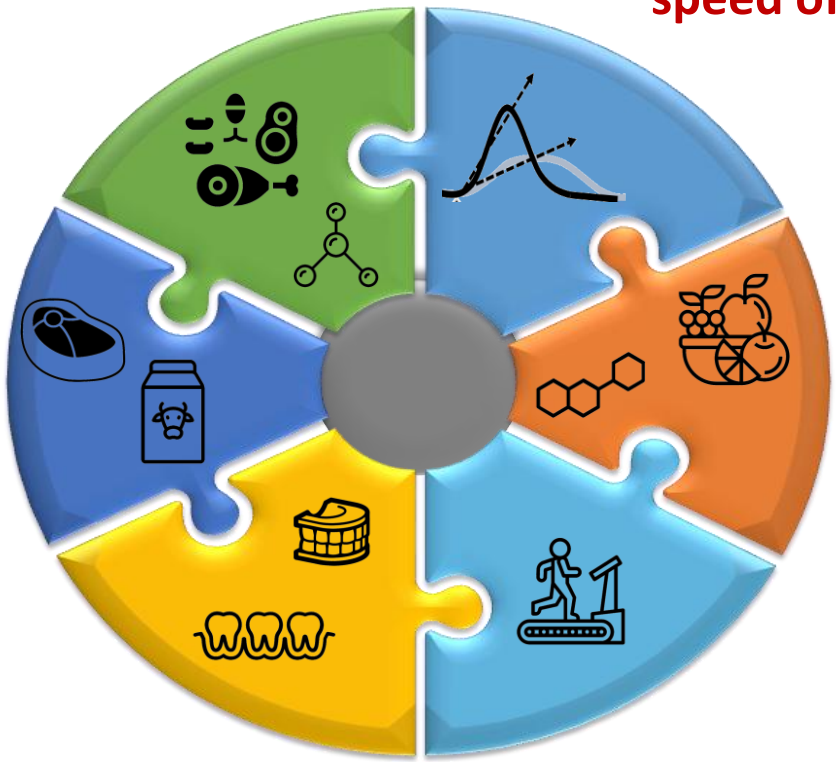


AUC after ingestion is similar

Same digestibilty so
Same bioavailability

Digestibility and digestion speed of dietary proteins



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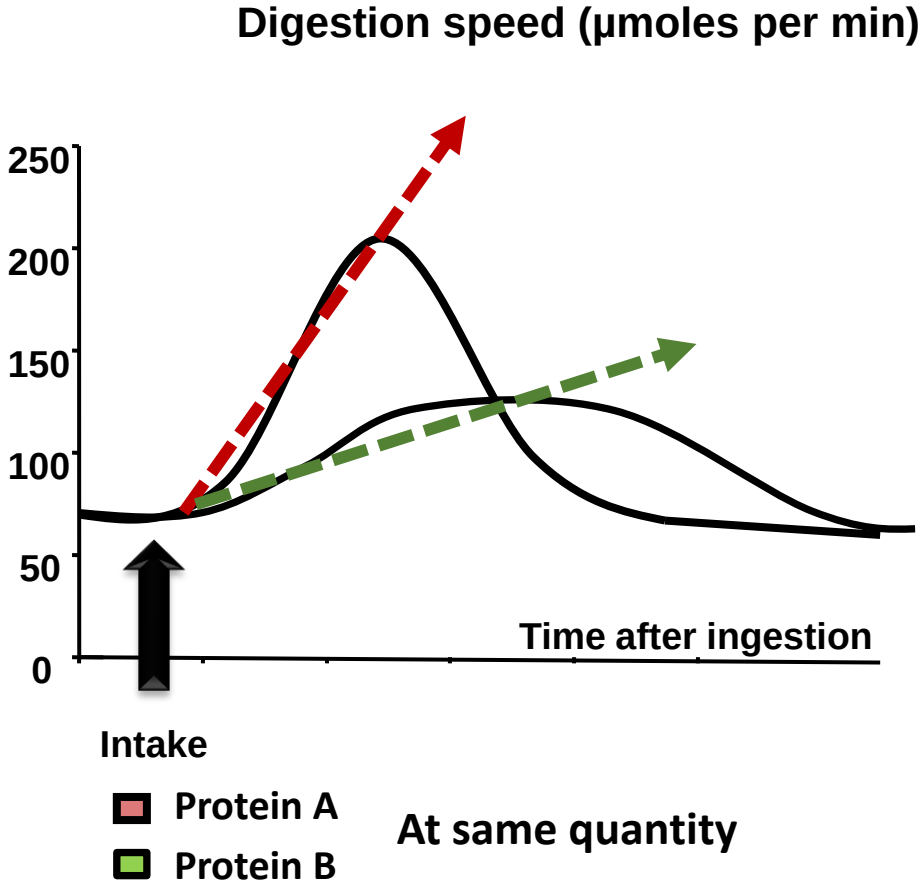
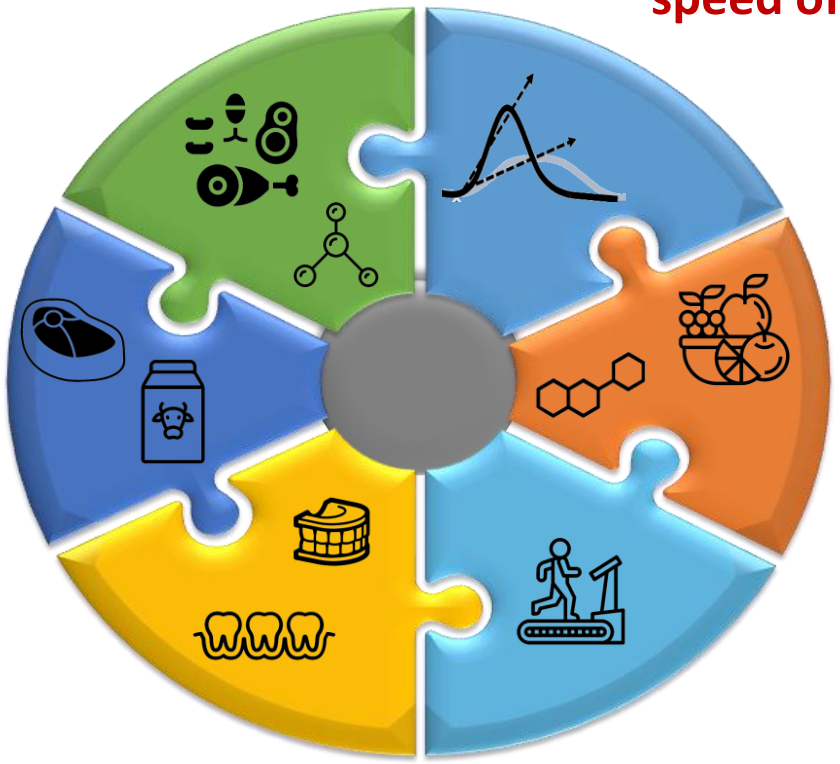


Difference in digestion speed

Digestibility and digestion speed of dietary proteins



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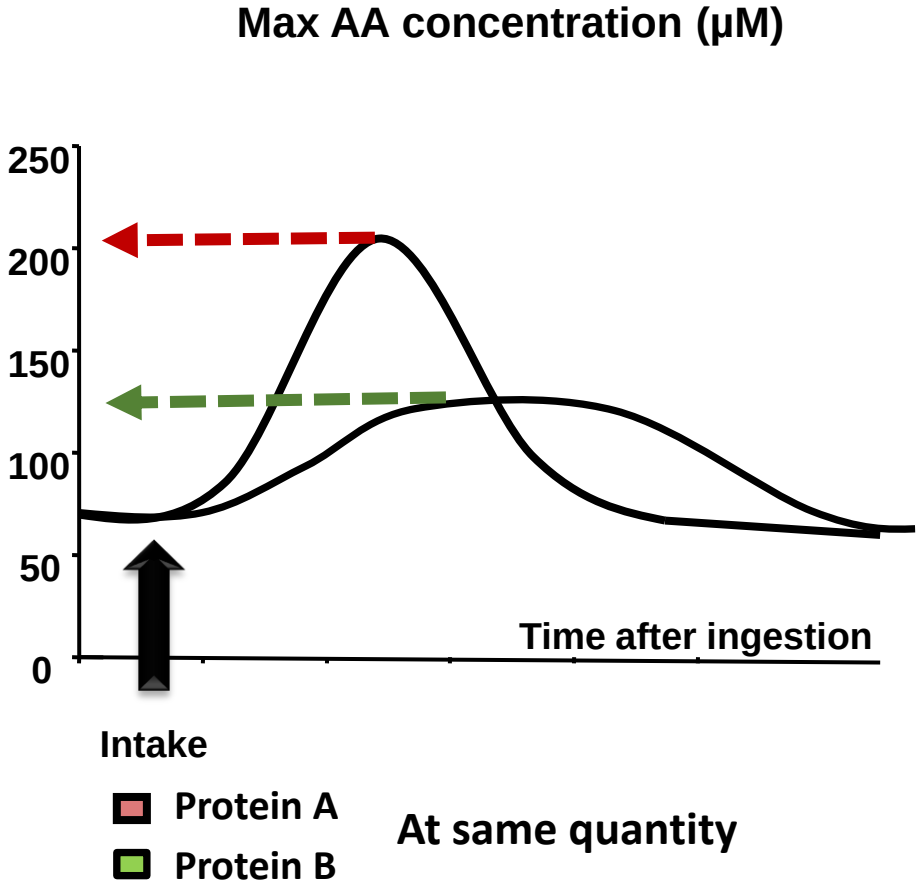
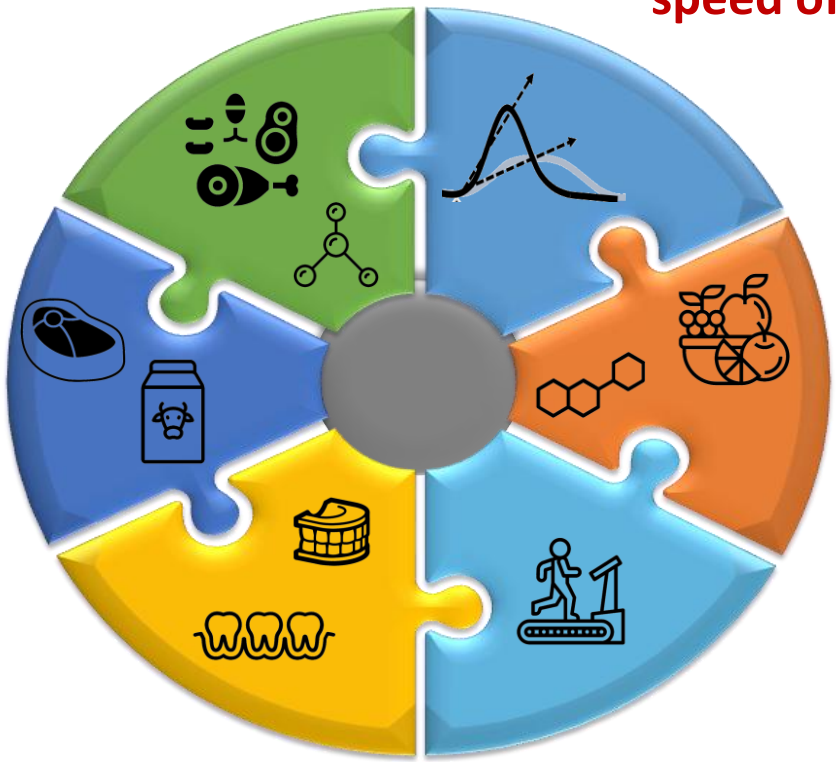


Difference in digestion speed

Difference in the maximal plasma AA concentration

Digestibility and digestion speed of dietary proteins



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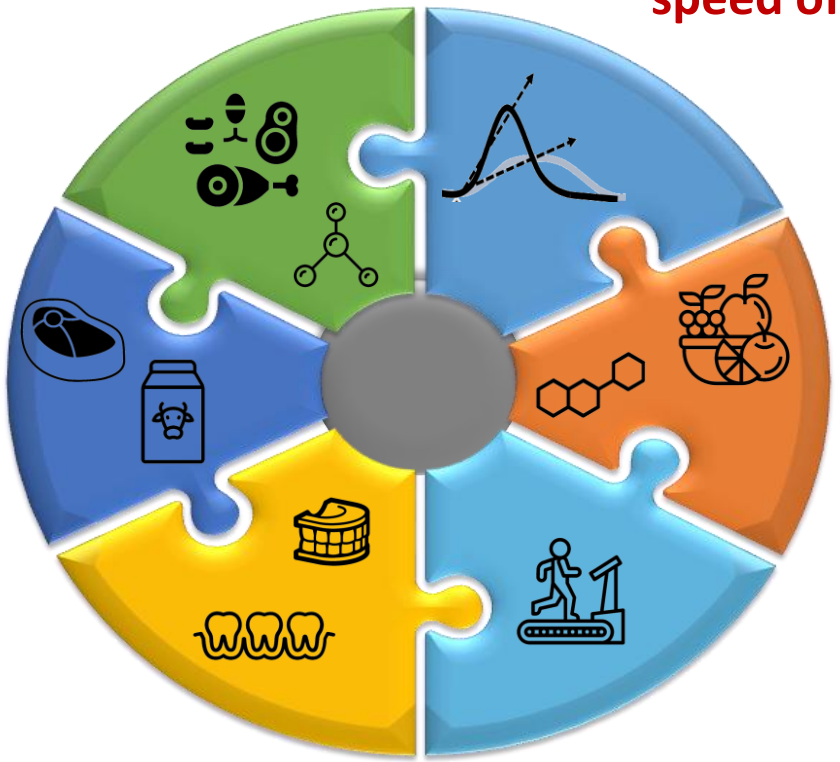
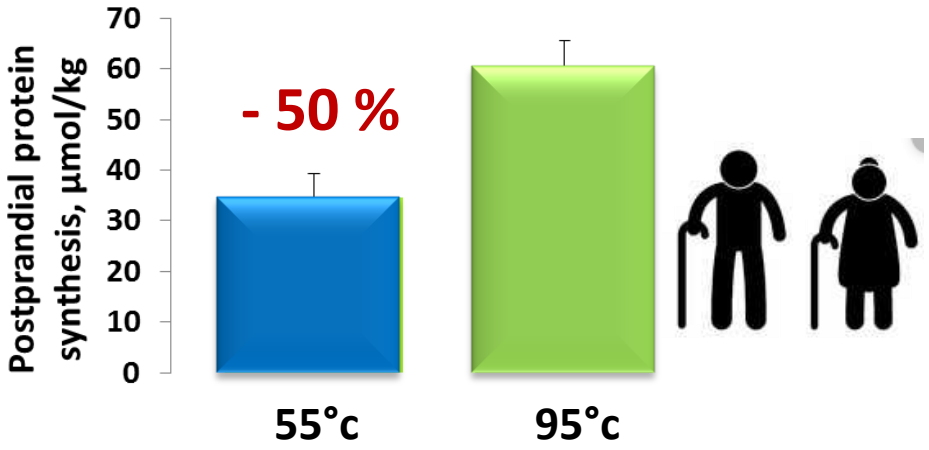
Digestibility and digestion speed of dietary proteins





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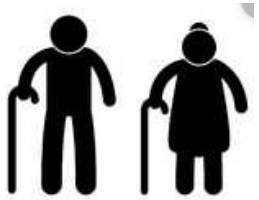
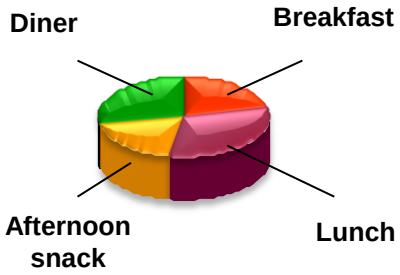
To be efficient anabolically
30+ g of dietary proteins in the meal

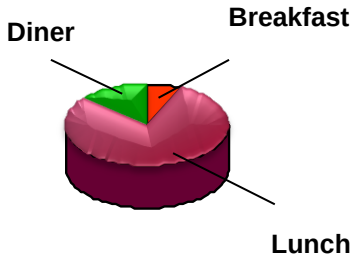
Non undernourrished elderly population



Arnal MA et al. 1999, 2000a, 2000b, 2002

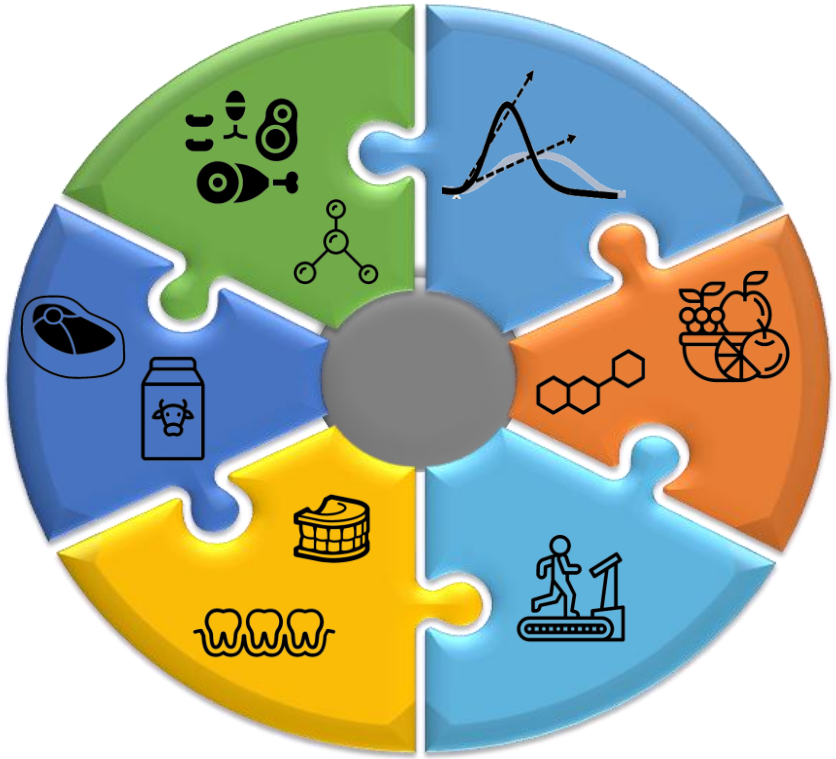
Spread intake of dietary proteins < **Bolus intake of dietary proteins**





Undernourrished elderly population

Bouillanne O et al. 2013, 2014



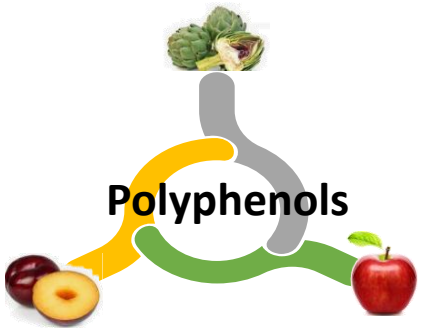
Timing and Interaction with other nutrients in the meal

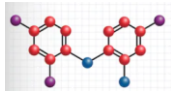
Dardevet et al. Proc Nutr Soc. 2021

Meal :

beef meat,
starch,
oil

+





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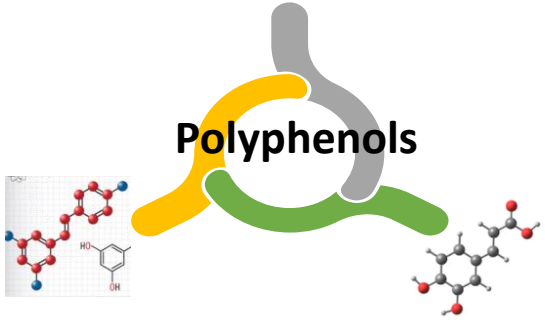

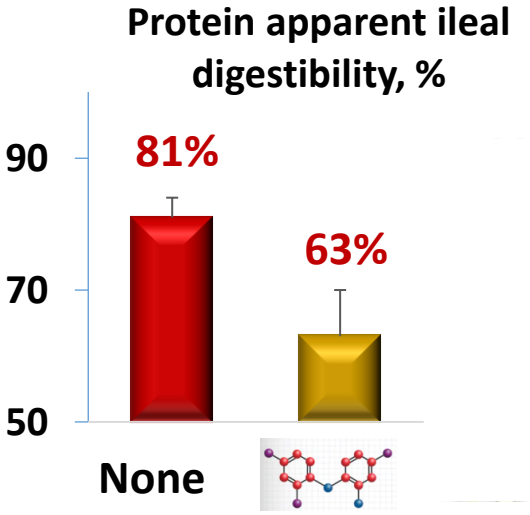

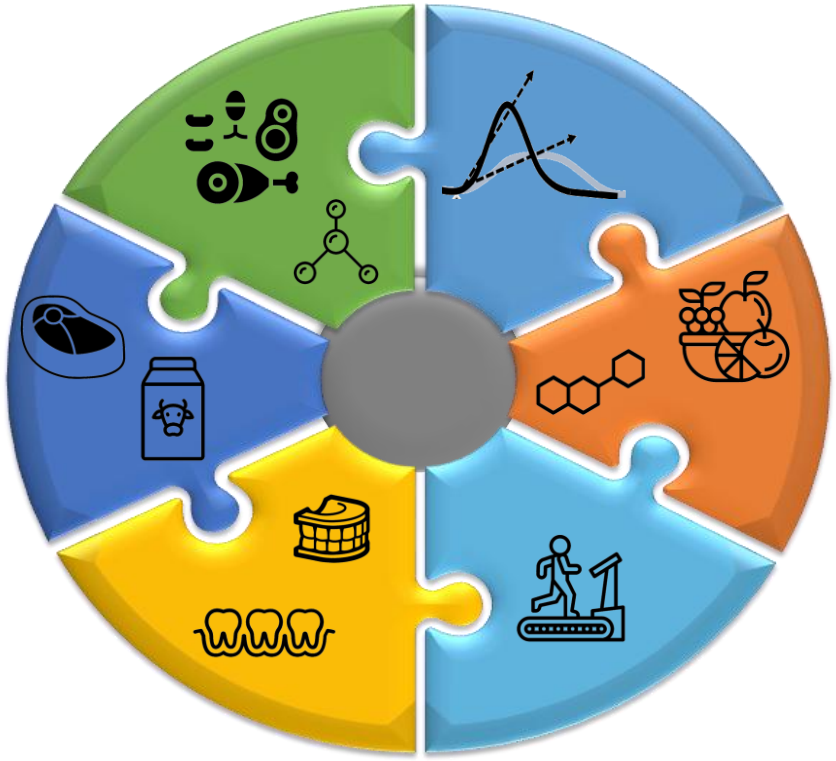

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Dardevet et al. Proc Nutr Soc. 2021

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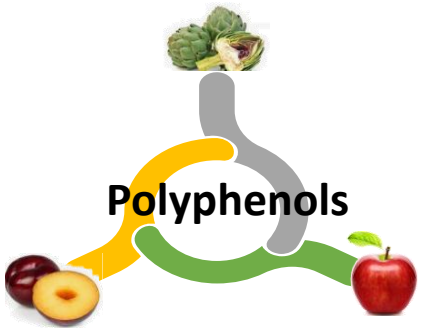

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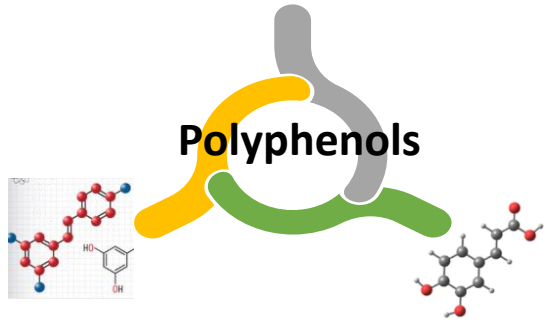
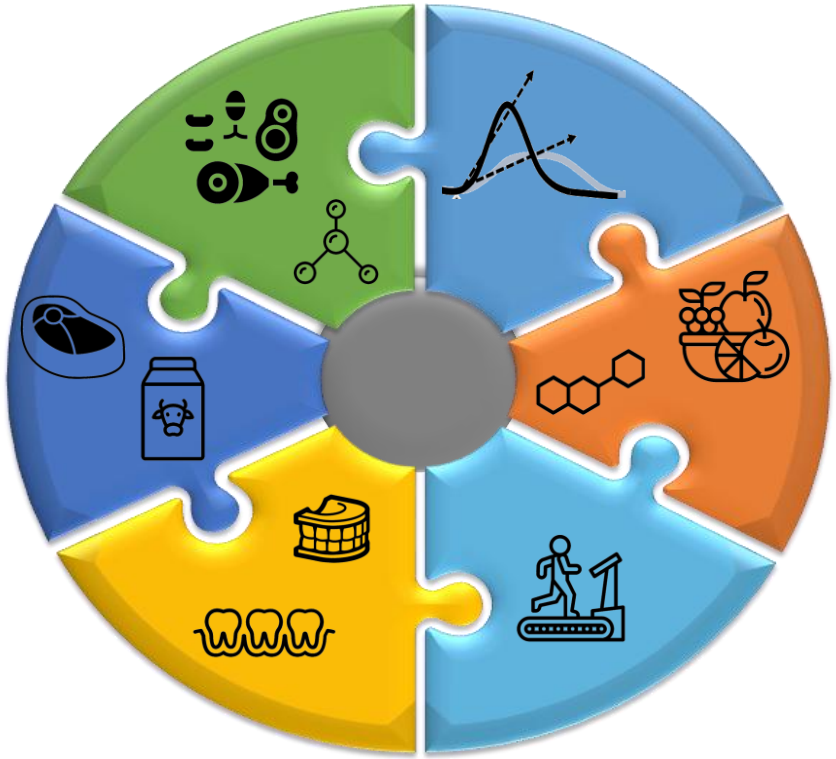
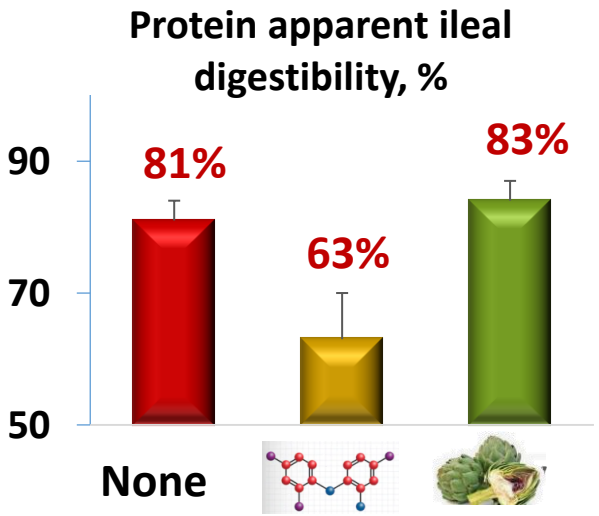
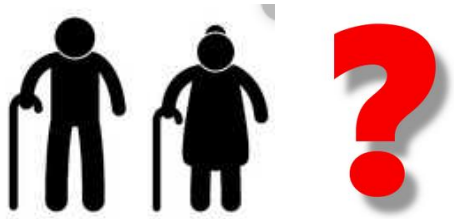




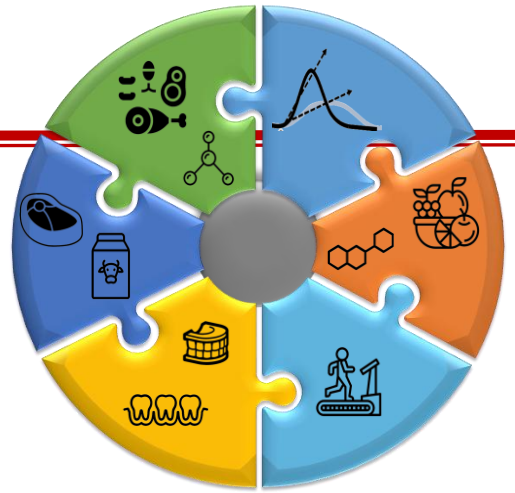
Timing and Interaction with other nutrients in the meal



Anti oxidant supplement with purified plant bioactives?



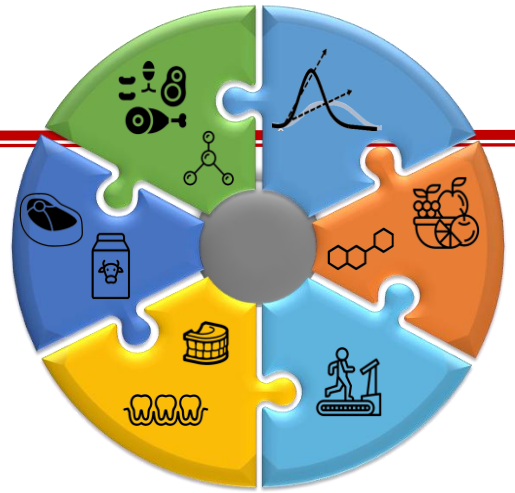
Dardevet et al. Proc Nutr Soc. 2021



Plant Proteins in Older Adults?

Equilibrated proteins but also with specific amino acids

Amino Acid	HIS	ILEU	LEU	LYS	CYS + MET	TYR + PHE	THR	TRP	VAL
mg/g of dietary protein	16	30	61	48	23	41	25	6.6	40
Animal	24	63	88	70	58	99	51	16	68



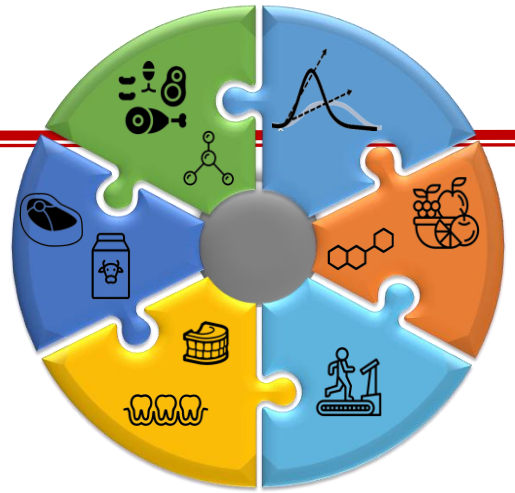
Plant Proteins in Older Adults?

Equilibrated proteins but also with specific amino acids

In general, plant proteins are not optimal in their EAA composition

Amino Acid	HIS	ILEU	LEU	LYS	CYS + MET
mg/g of dietary protein	16	30	61	48	23
Animal	24	63	88	70	58
	23	43	68	75	19
	27	37	125	27	35

	RDA	RDA
	0.83	1.00
	1.00	1.20
	1.47	1.77



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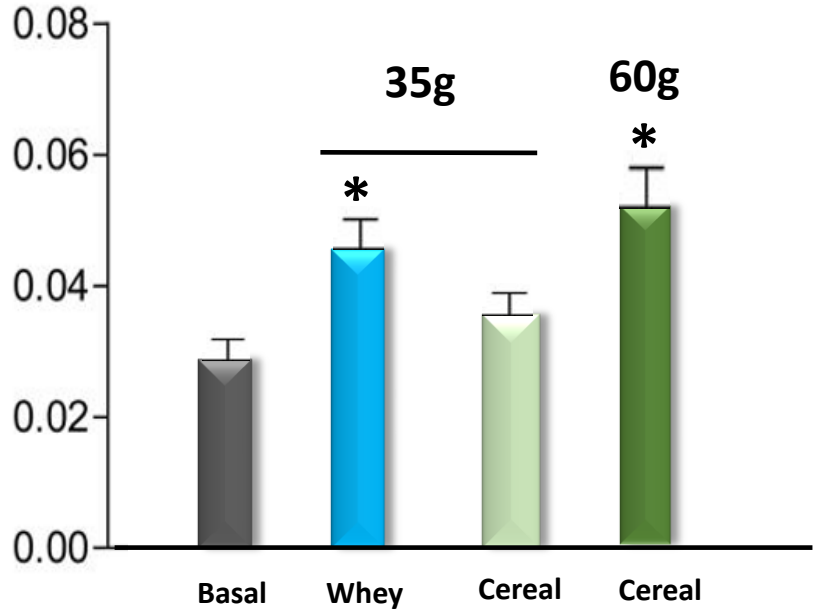
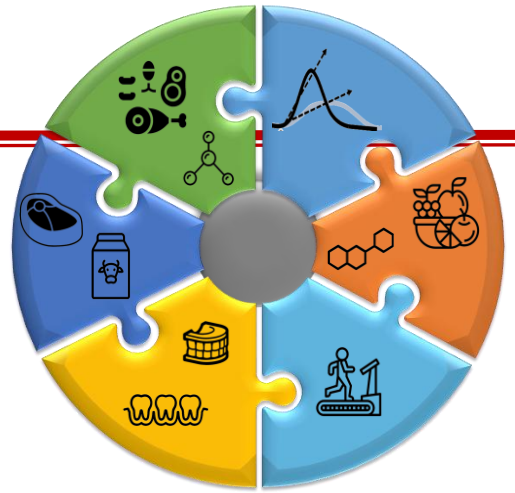
Gorissen SH J Nutr. 2016

Amino Acid	HIS	ILEU	LEU	LYS	CYS + MET
mg/g of dietary protein	16	30	61	48	23
Animal	24	63	88	70	58
	23	43	68	75	19
	27	37	125	27	35

Older Adult Anabolic effect





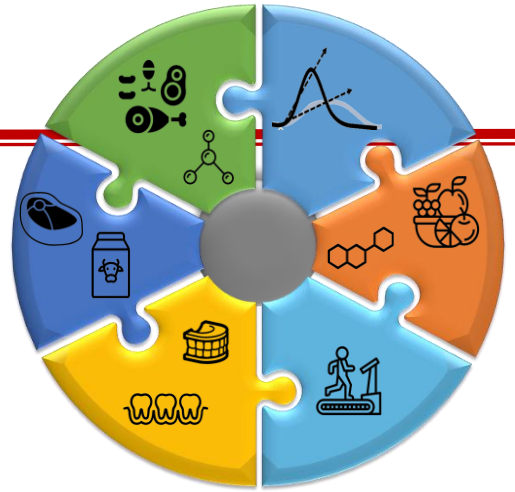
Plant Proteins in Older Adults?

Equilibrated proteins but also with specific amino acids

Solution is to combine pulse and cereal protein sources

Amino Acid	HIS	ILEU	LEU	LYS	CYS + MET
mg/g of dietary protein	16	30	61	48	23
Animal	24	63	88	70	58
50%  50% 	25	40	96	51	27,5

There are other limiting factors associated with plant protein sources

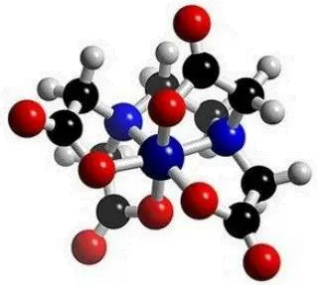


Plant Proteins in Older Adults?

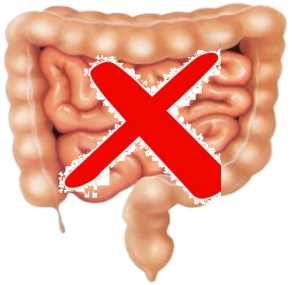
Digestibility: Lower than for animal proteins because

- Seed matrix

- Intrinsic protein properties



- Presence of anti nutritional factors (phytic acid, anti trypsin factor ....etc)

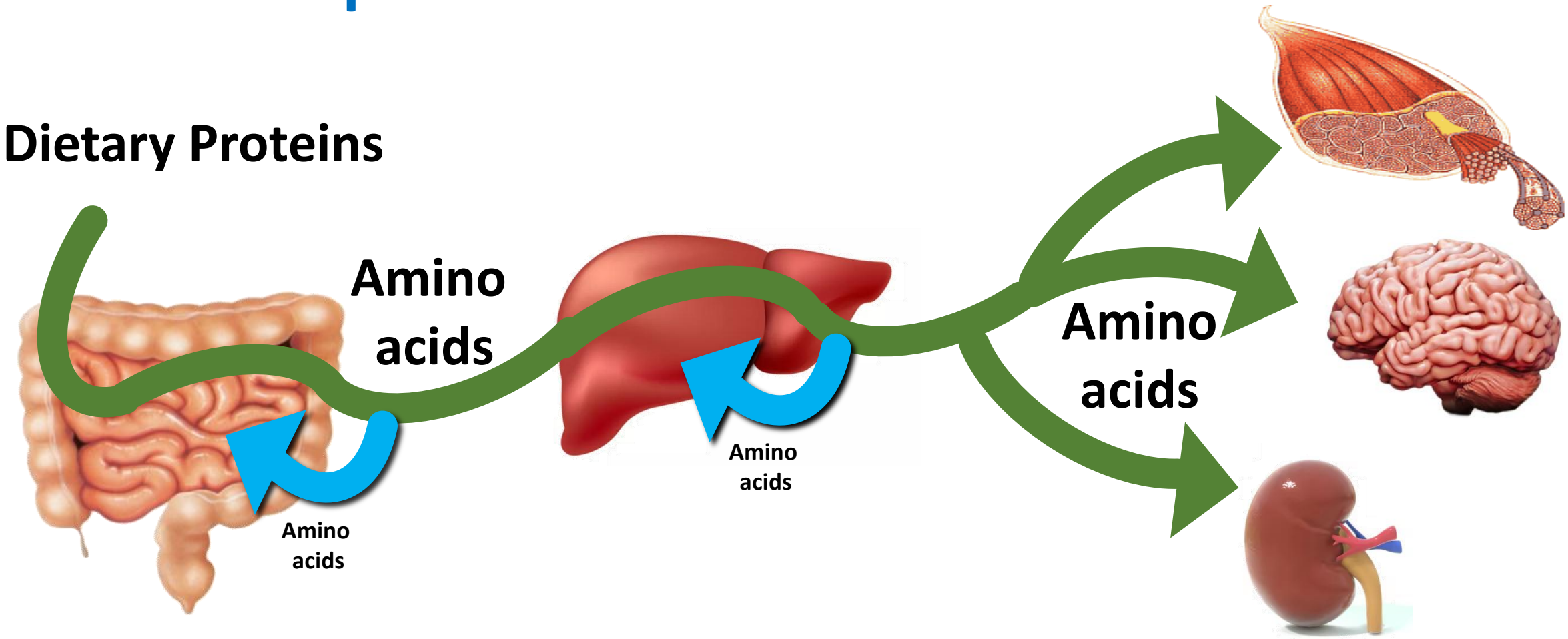


- Processes of protein fraction production

Corn or potato protein concentrate were digestible only at 50%

Plant Proteins in Older Adults?

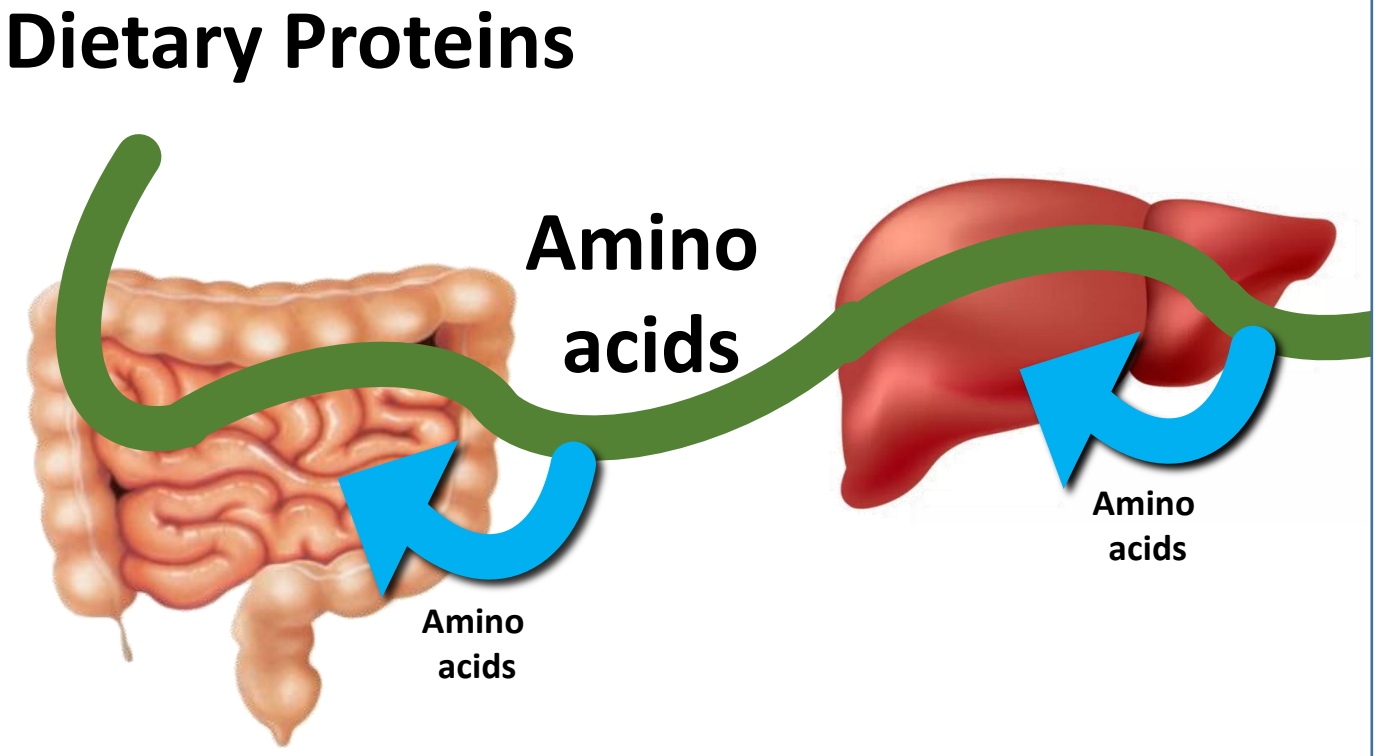
Splanchnic extraction of EAA



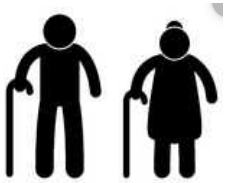
Splanchnic extraction → **Decreased peripheral AA availability**

Plant Proteins in Older Adults?

Splanchnic extraction of EAA



Splanchnic extraction of AA is higher with plant proteins than with animal proteins (Fouillet 2002, 2009; Van Vliet, 2015)



Splanchnic extraction of AA is higher in older adults than in adults (Boirie 1996, Volpi 1998)

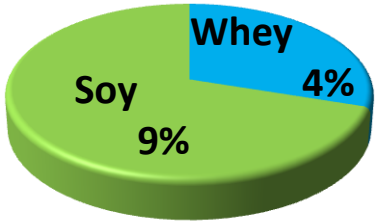
Further increase of protein intake in elderly with a plant protein diet

Diet with 100% of « green » proteins would be quantitatively too important and difficult to sustain in older adults

Mix between animal and plant proteins is the solution?

Anabolic response

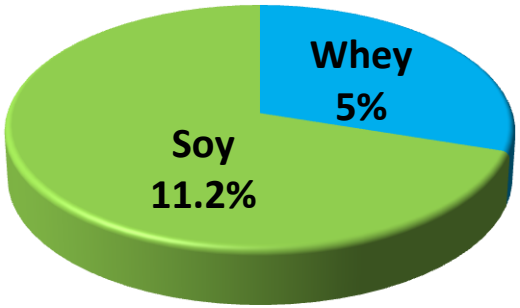
Old rats



13%

+25%

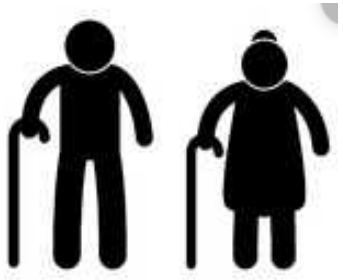
Protein intake



16.5%

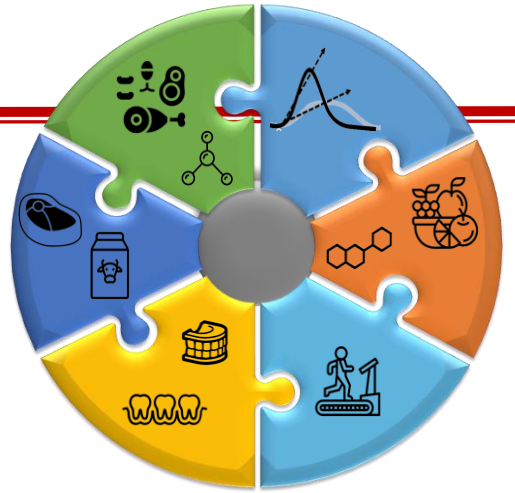
Jarzaguet et al. 2018

Message(s) to take home



In older adults,

- Protein nutrition is key and more than just their amino acid composition has to be taken into account



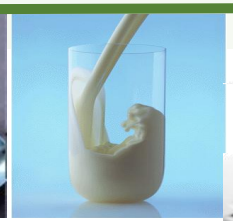
- The determinants associated with all the dimentions of protein quality have to be taken into account much more with the vegetarianization of dietary proteins

- However, « greening » significantly dietary proteins in older adults is possible but with some cautions and it should be supervised and followed

- In protein nutrition, an ally to optimize and constrain the increase of protein intake could be a program of adapted physical activity

Thank you for your attention










Optimiser l'apport protéique mais une fois consommées?

Au delà de la fraction protéique..
Métabolisation des protéines végétales données au besoin

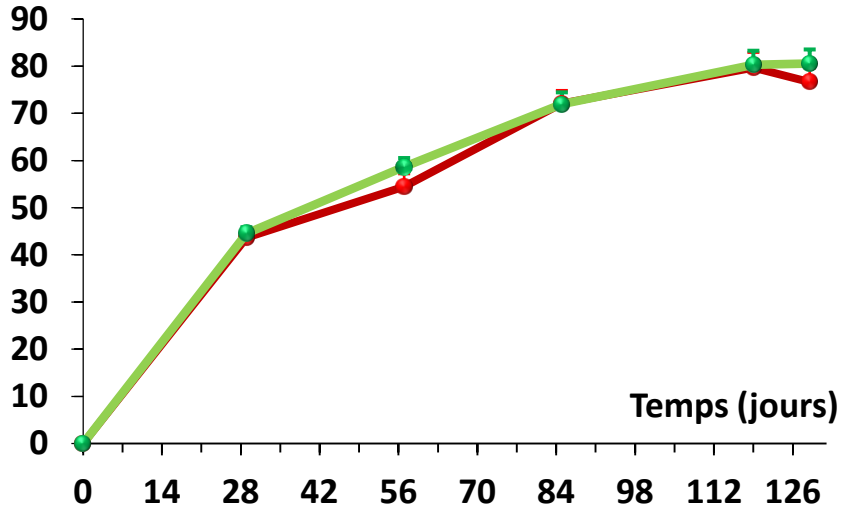
ProVegOmics

	Animal g/kg
Protéines de lait	150
Energie (kcal/kg)	4 044
	% Energie
Protéines	15%
Glucides	58%
Lipides	27%

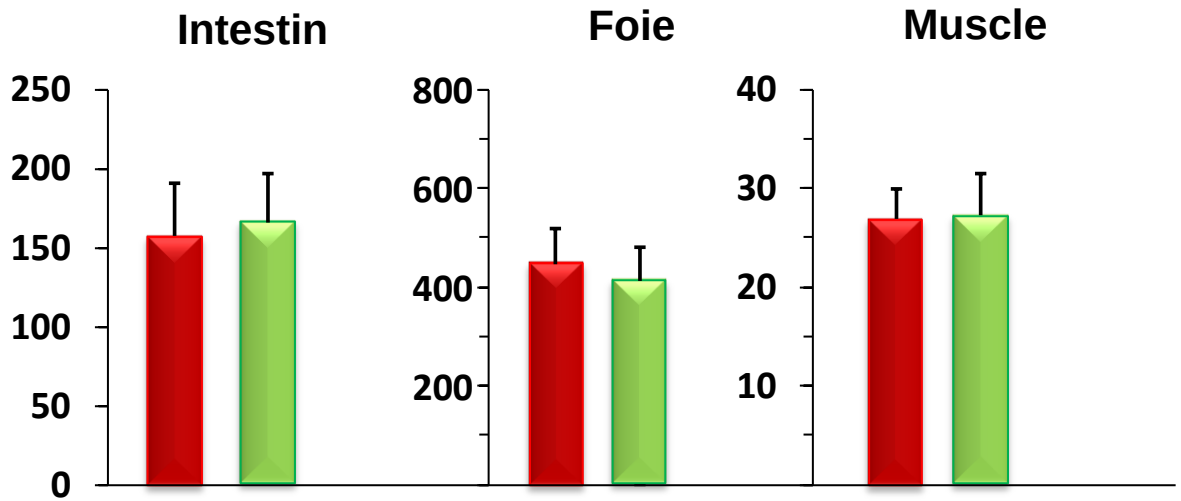
	Végétal g/kg
Protéines de pois	75
Protéines de blé	75
Energie (kcal/kg)	4 068
	% Energie
Protéines	15%
Glucides	59%
Lipides	27%

Optimiser l'apport protéique mais une fois consommées?

Masse maigre (%)

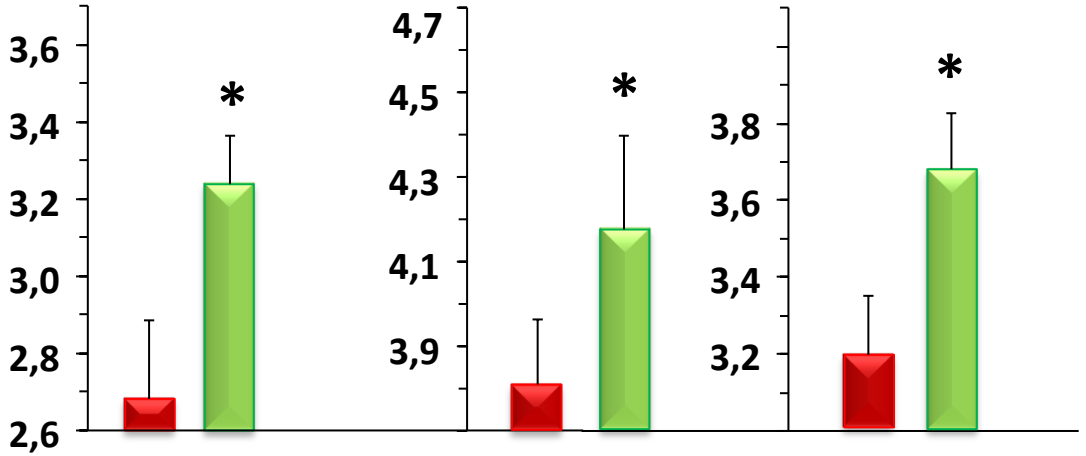


Masse protéique (mg N)

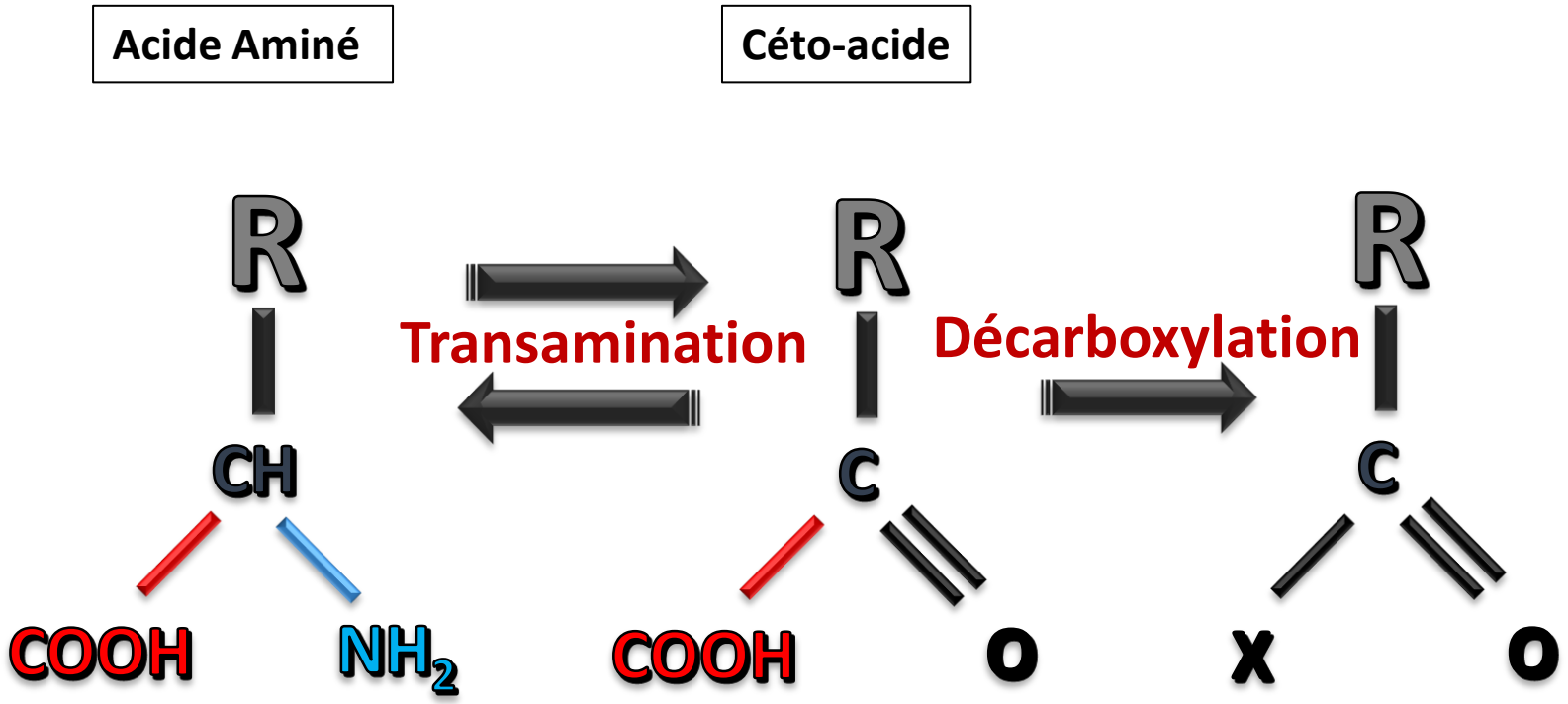


Et alors?

Transamination



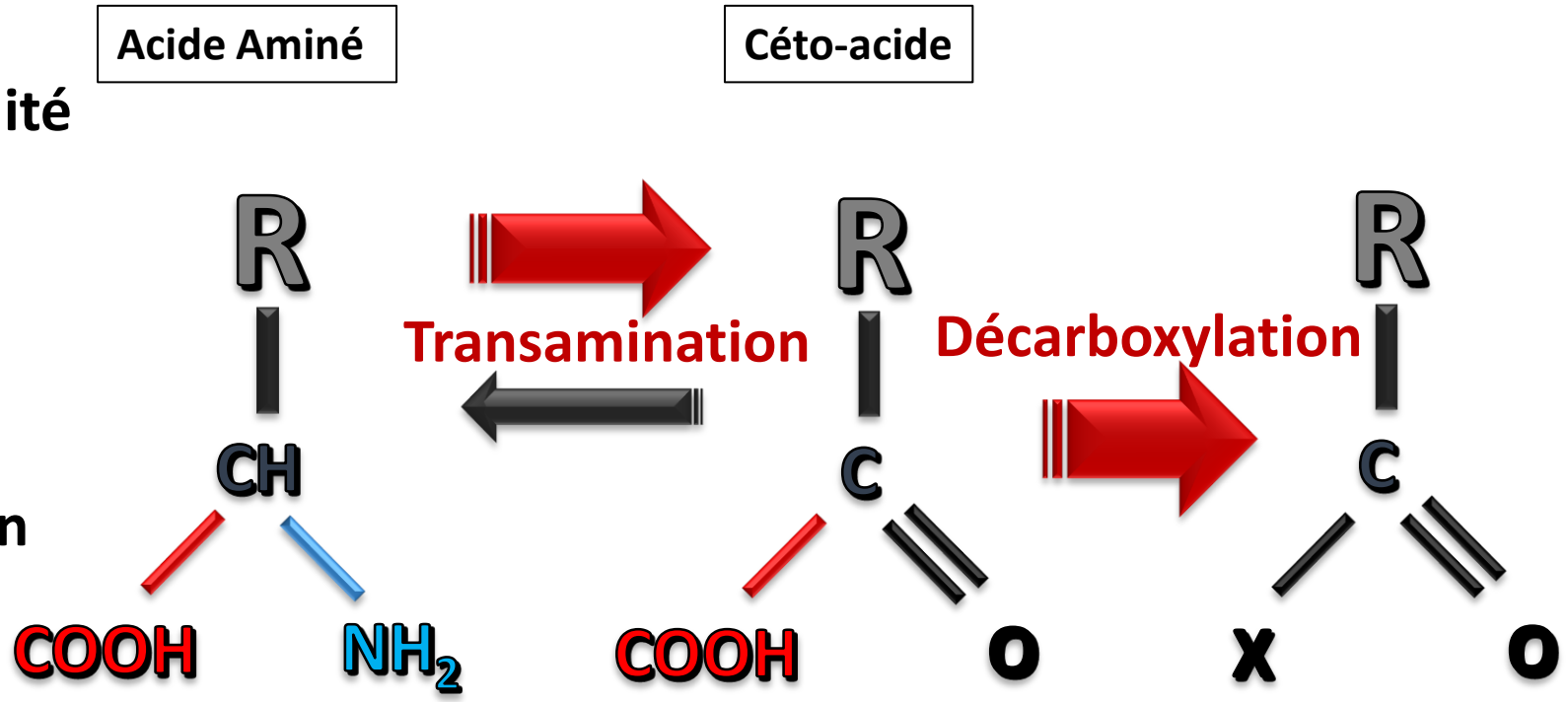
Optimiser l'apport protéique mais une fois consommées?

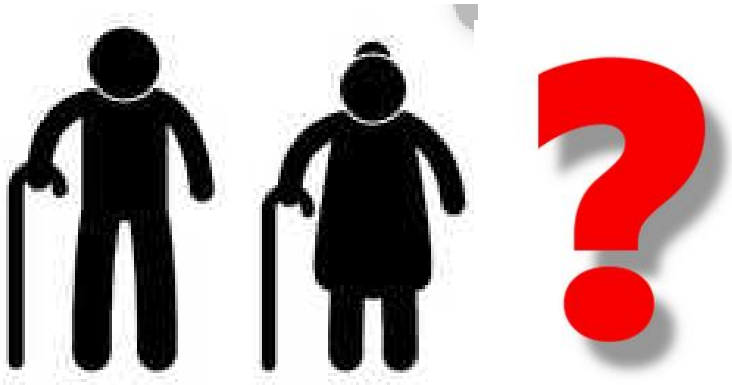


Avec un régime protéines végétales

Optimiser l'apport protéique mais une fois consommées?

- Diminution de la biodisponibilité en AA ?
- Augmentation de la dépense énergétique ?
- Augmentation de la production d'urée ?





Avec un régime «protéines végétales »