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

To cite this version:
Isabelle Savary-Auzeloux, Laurent Mosoni, Marie-Agnès Peyron, Sergio Polakof, Didier Remond, et al.. Optimization of protein intake in the elderly beyond the amino acid composition. What is the positioning of plant proteins and under what conditions?. International Conference on Frailty and Sarcopenia Research, Apr 2022, Boston, United States. hal-03623468

HAL Id: hal-03623468
https://hal.inrae.fr/hal-03623468
Submitted on 29 Mar 2022

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

Dominique Dardevet, Isabelle Savary-Auzeloux, Laurent Mosoni, Marie-Agnès Peyron, Sergio Polakof, Didier Rémond.
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 recommendation is based if the dietary protein is of good quality
The FAO has elaborated the composition of the ideal dietary protein in terms 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 humans above 5yo.

<table>
<thead>
<tr>
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Protein Nutrition: The Basics

Recommended Daily Allowance (RDA)
Healthy adult population

0.83

Healthy elderly population

1 to 1.2
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.
Efficient at a RDA of 0.83 instead of 1.0 g.kg.d

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

Equilibrated proteins but also with specific amino acids

Dardevet et al. Proc Nutr Soc. 2021
RDA is based on a dietary protein which is 100% digested

✓ Favor highly digested dietary proteins in elderly

Dardevet et al. Proc Nutr Soc. 2021
Plasma amino acids (µM)

Intake
- Protein A
- Protein B

At same quantity

AUC after ingestion is similar

Same digestibility so
Same bioavailability

Dardevet et al. Proc Nutr Soc. 2021
Digestibility and digestion speed of dietary proteins

Difference in digestion speed

Intake
- Protein A
- Protein B

At same quantity

Digestion speed (µmoles per min)

Time after ingestion

Protein A
Protein B

Dardevet et al. Proc Nutr Soc. 2021
Digestibility and digestion speed of dietary proteins

Max AA concentration (µM)

Time after ingestion

Intake
- Protein A
- Protein B

At same quantity

Difference in digestion speed

Difference in the maximal plasma AA concentration

Dardevet et al. Proc Nutr Soc. 2021
Digestibility and digestion speed of dietary proteins

Plasma AA concentration, μM

Cooking temperature
- 55°C
- 95°C

Time, min

Postprandial protein synthesis, μmol/kg

- 50%
To be efficient anabolically
30+ g of dietary proteins in the meal

Non undernourished elderly population

Non undernourished elderly population

Spread intake of
dietary proteins

Bolus intake of
dietary proteins

Diner
Breakfast
Afternoon snack
Lunch

Diner
Breakfast
Lunch

Timing and
Interaction with
other nutrients
in the meal

Undernourished elderly population

Undernourished elderly population

Bouillanne O et al. 2013, 2014
Meal: beef meat, starch, oil

Polyphenols + or

Timing and Interaction with other nutrients in the meal

Protein apparent ileal digestibility, %

81% 63%

None

Dardevet et al. Proc Nutr Soc. 2021
Meal: beef meat, starch, oil

Timing and Interaction with other nutrients in the meal

Polyphenols

Meal:

beef meat, starch, oil

or

Polyphenols

Protein apparent ileal digestibility, %

81% ± 0.5

83% ± 0.5

None

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

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### Plant Proteins in Older Adults?

Equilibrated proteins but also with specific amino acids

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

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RDA

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Equilibrated proteins but also with specific amino acids

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

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Older Adult Anabolic effect

![Bar graph showing anabolic effect with Basal, Whey, and Cereal proteins with and without asterisk (*) indicating significant differences.](image-url)
Plant Proteins in Older Adults?

Equilibrated proteins but also with specific amino acids

Solution is to combine pulse and cereal protein sources

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<td>96</td>
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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

Dietary Proteins → Amino acids → Amino acids → Amino acids

Splanchnic extraction → Decreased peripheral AA availability
Plant Proteins in Older Adults?

Splanchnic extraction of EAA

Dietary Proteins

Amino acids

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?

Old rats

Anabolic response

Whey 13%

Soy 13%

Whey 4%

Soy 9%

+25%

Protein intake

13%

16.5%

Jarzaguet et al. 2018
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 dimensions 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

<table>
<thead>
<tr>
<th></th>
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<th>Végétal</th>
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<tbody>
<tr>
<td>Protéines de lait</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>Energie (kcal/kg)</td>
<td>4 044</td>
<td>4 068</td>
</tr>
<tr>
<td>% Energie</td>
<td>15%</td>
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ProVegOmics
Optimiser l’apport protéique mais une fois consommées?

Masse maigre (%)

Masse protéique (mg N)

Intestin

Foie

Muscle

Transamination

Et alors?
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 ».