Effect of pre-treatment on *in vitro* gastric digestion of quinoa protein

Mauricio Opazo-Navarrete, Remko Boom, Anja Janssen

Objective

The objective of the study was to evaluate the effect of heat treatment prior to *in vitro* gastric digestion of quinoa protein, isolated via dry and wet fractionation.

Methods

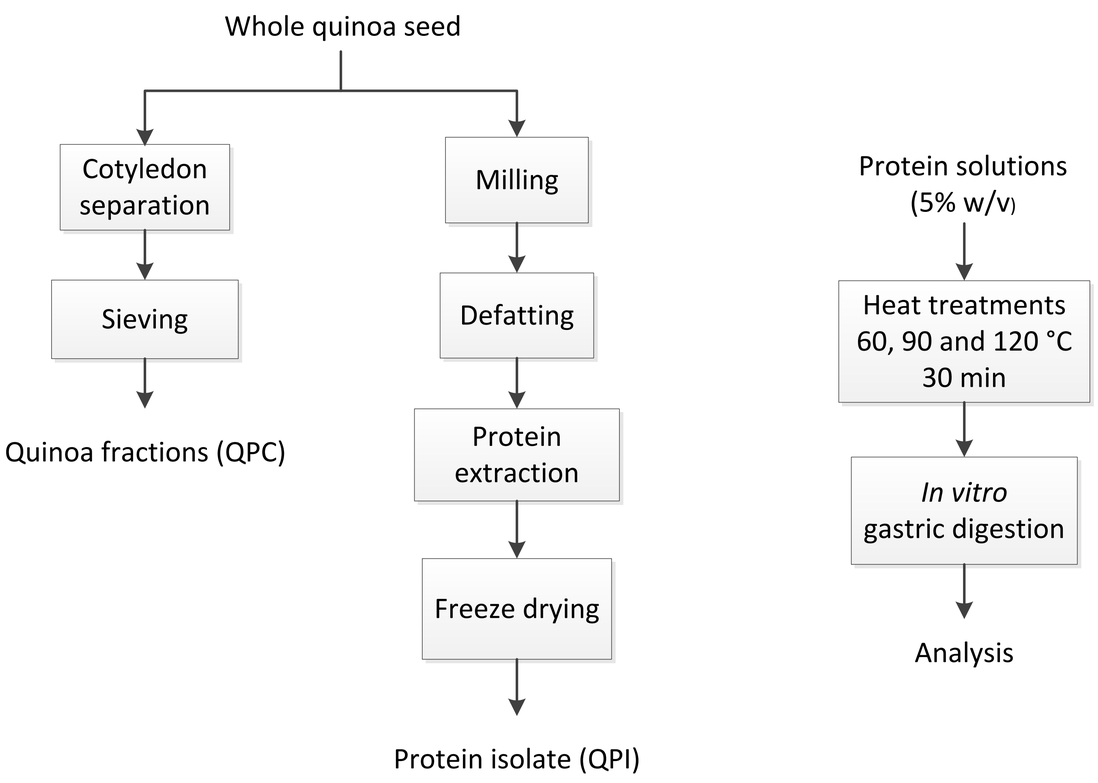

Figure 1. Dry and wet fractionation processes.

Figure 2. Gastric digestion of quinoa protein.

Results

Table 1. Experimental characterization of quinoa fractions after sieving.

Sieve (mm)	Pre-milled (sieve 1.5 mm)			Pre-milled (sieve 2.0 mm)		
	Protein content (w/dw)	Yield (%)	Protein yield (%)	Protein content (w/dw)	Yield (%)	Protein yield (%)
> 1	4.7	19.5	7.9	3.8	37.8	12.1
1 - 0.85	3.2	10.4	2.9	3.5	8.4	2.5
0.85 - 0.63	7.5	14.3	9.2	7.8	10.9	7.1
0.63 - 0.5	19.3	11.2	18.6	22.4	13.1	24.6
0.5 - 0.315	23.3	23.3	46.8	27.8	19.1	44.7
< 0.315	7.9	21.3	14.5	10	10.7	9

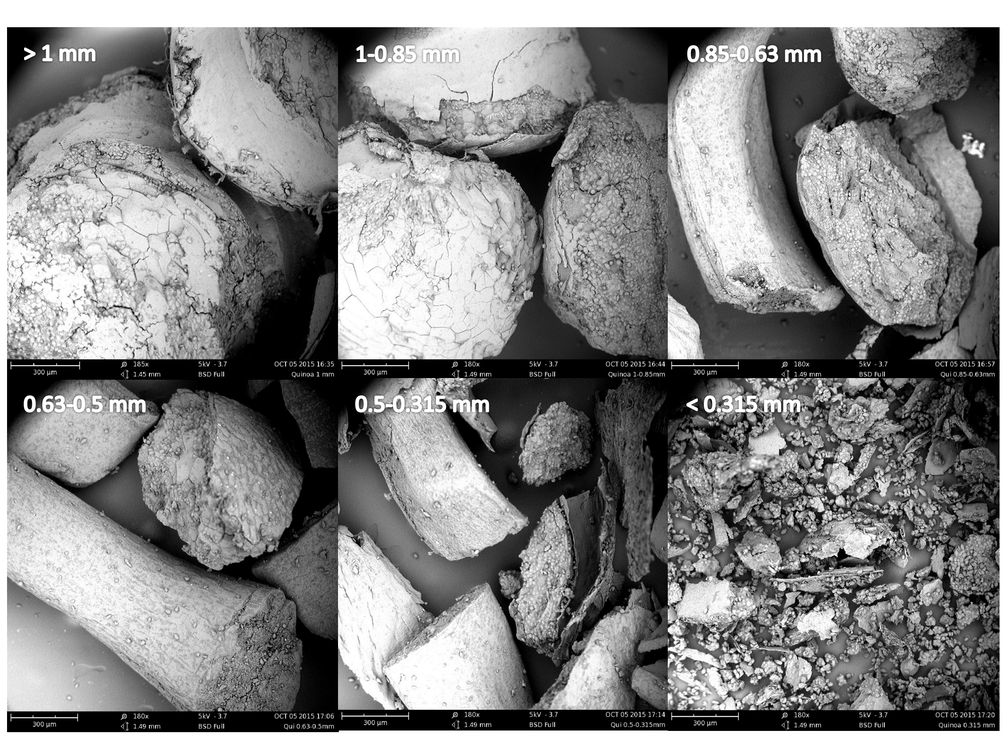

Figure 3. SEM images of quinoa fractions obtained by dry fractionation process.

Conclusions

- QPI showed slower digestibility than QPC with all pre-heating temperatures.
- QPC showed reduced digestibility above 60℃. This could be explained by the presence of starch, which after being heated above its gelatinization temperature (64.5℃) increases the viscosity and reduces the accessibility of the protein for pepsin.

- *Double exponential model*:

We assume that the protein consists of a part that is easily hydrolysed (e.g., the relatively exposed residues), one part that is hydrolysed with more difficulty, and one part that is not hydrolysed at all. This is represented in a simple double-exponential model according to:

$$DH = \alpha_1(1 - e^{-k_1 t}) + \alpha_2(1 - e^{-k_2 t})$$

In which α_1 is the fraction that is most easily digested, α_2 the fraction that is hydrolysed with more difficulty, and k_1 and k_2 are the hydrolysis rate constants.

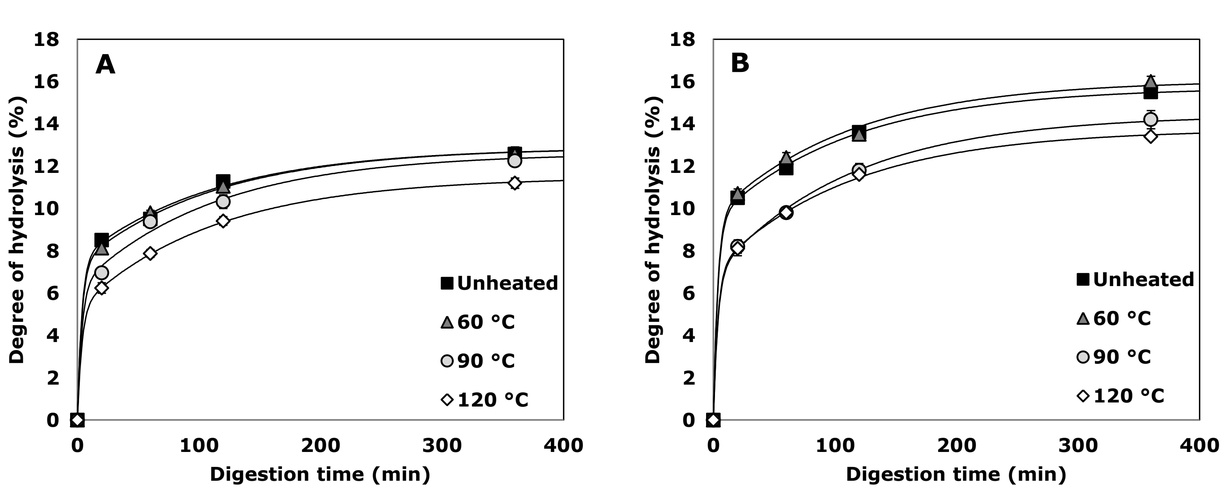

Figure 4. Degree of hydrolysis of quinoa protein obtained by A) wet fractionation (QPI) and (B) dry fractionation process (QPC).

- *Effect of starch on digestibility*:

An increase in the starch concentration results in a lower protein digestibility. When starch is removed, the quinoa proteins are more exposed and thus more accessible to pepsin digestion.

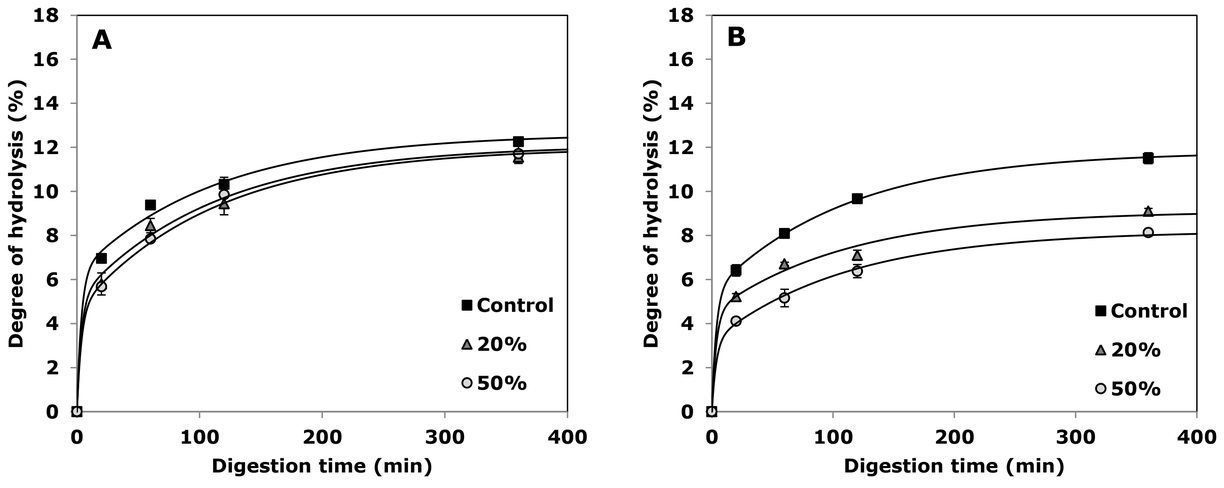

Figure 5. Degree of hydrolysis of the mixture of QPI and starch added (0, 20 and 50 % of starch) heated at (A) 90 °C and (B) 120 °C for 30 min.

Acknowledgements

This work is supported by National Commission for Scientific and Technological Research (Conicyt) of the government of Chile.

Wageningen University
P.O. Box 17, 6700 AA Wageningen
Contact: mauricio.opazonavarrete@wur.nl
T + 31 (0)317 48 34 35
www.wageningenUR.nl/fpe