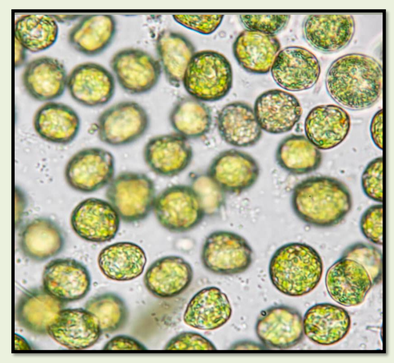
Chlorella vulgaris as health-promotor for chickens: how will cell disruption of its cell walls influence digestibility in broilers?

Sofie Van Nerom[1,2], Filip Van Immerseel[2], Johan Robbens[1], Evelyne Delezie[1]

[1] Flanders Research Institute for Agriculture, Fisheries and Food, Scheldeweg 68, 9090 Melle, Belgium

[2] Faculty of Veterinary Medicine, Ghent University, Salisburylaan 133, 9820 Merelbeke, Belgium



Aim of the study

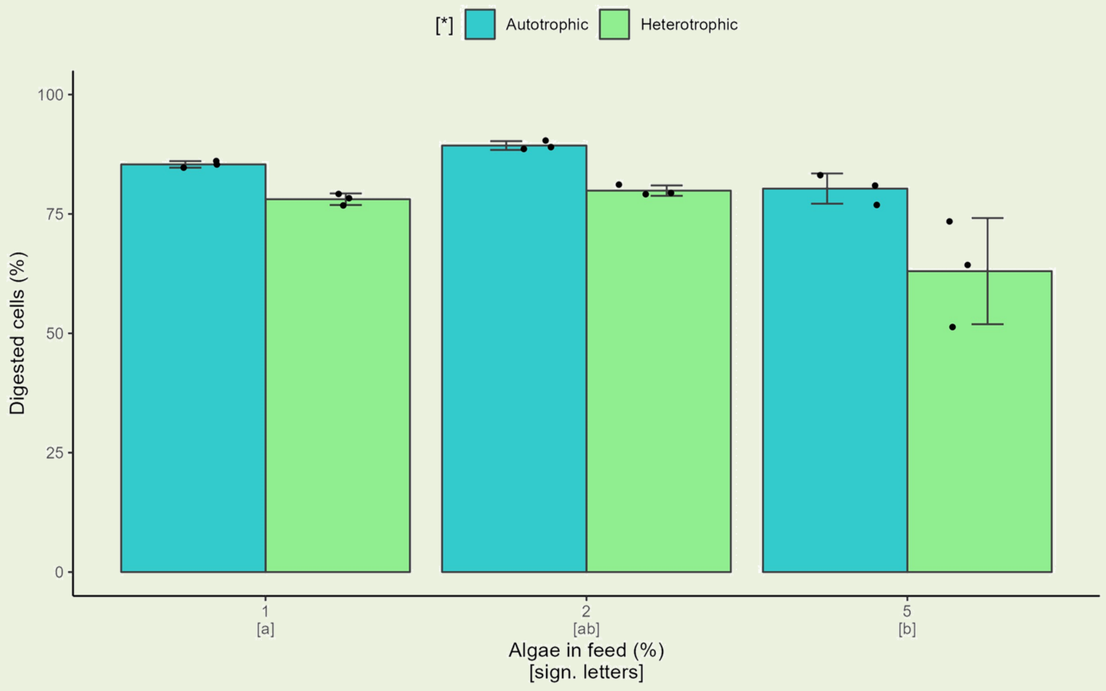
Assess whether cell wall disruption of *Chlorella vulgaris* is feasible and required to increase the availability and digestibility of its nutrients in chicken feed.

Methodology

Cell disruption techniques
- Pulse Electric Field (PEF, 360 kJ)
- Freezing (1 week, - 20 °C, powder)
- Freezing (1 week, - 20 °C, 10 % water solution)

Digestibility trials
- Broilers in digestibility units for 11 days, feed intake and feces production are registered
- Determination of crude fat, protein, ash, fiber, intact *Chlorella* cells and metabolisable energy in feed and feces to determine digestibility coefficients

Results



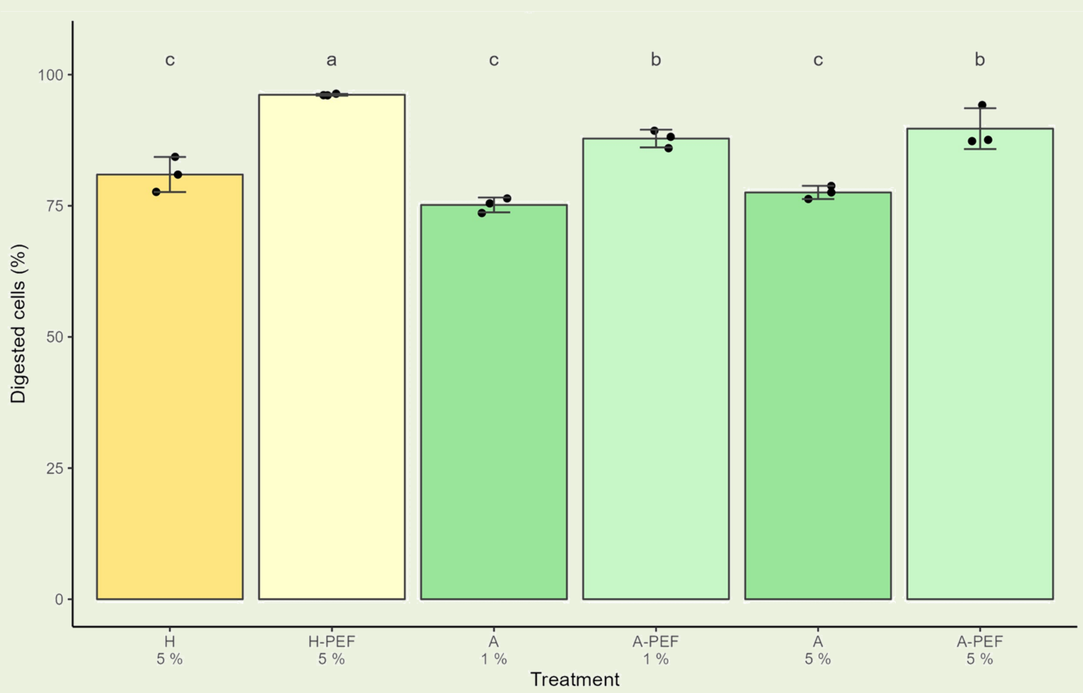


Figure 2: Digestibility of *Chlorella vulgaris* cells of the different feed treatments in broiler trial 1 (top) and 2 (bottom). A: Autotrophic, H: Heterotrophic, PEF: Pulse Electric Field. Different letters show statistically significant differences between inclusion levels (x-axis). [*] shows significant differences between algae type (n = 3, α = 0,05) (top). Different letters show statistically significant differences between treatments (n = 3, α = 0,05) (bottom).

Introduction

- *Chlorella vulgaris* produces high-value compounds, useful for different applications, with new genomic techniques, production of those substances can be increased, after extraction, residual biomass can be repurposed (for example in poultry feed)
- *Chlorella* might have health-promoting effects on chickens and their products (eggs and meat)
- *Chlorella* has a very rigid cell wall: cell wall disruption techniques can be used to increase the digestibility of autotrophic and heterotrophic *Chlorella* for broilers and laying hens
- Since autotrophic and heterotrophic *Chlorella* have other growth conditions, the composition can differ which might lead to different beneficial characteristics

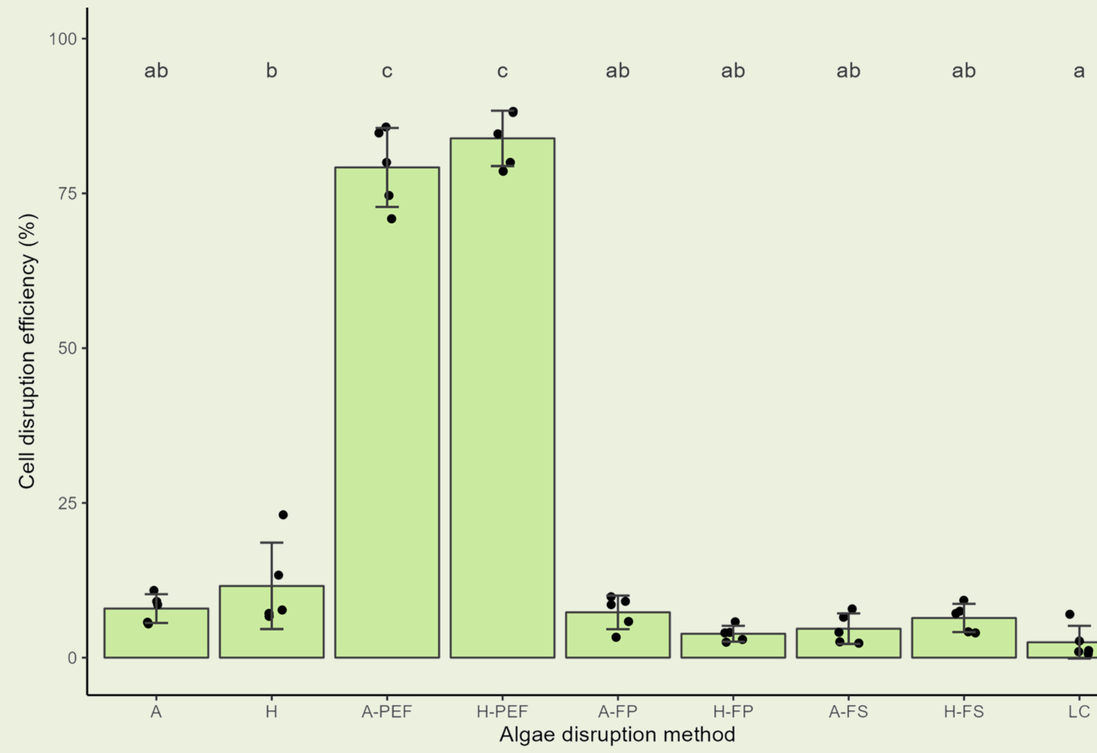


Figure 1: Cell disruption efficiency of different treatments on autotrophic and heterotrophic *Chlorella vulgaris*, evaluated with SYTOX Green staining. Efficiency is the number of green stained cells (perforated cell wall), divided by the total number of cells (red + green cells). Different letters show statistically significant differences between treatments. A: Autotrophic, H: Heterotrophic, PEF: Pulse Electric Field, FP: Frozen - Powder, FS: Frozen - Solution, LC: Living Culture.

Cell disruption (Figure 1)

Results show a significant increase of the cell disruption after PEF processing. Freezing, both as a powder and a solution does not show an increase in cell disruption efficiency compared to the living culture (control).

Digestibility *Chlorella* cells (Figure 2)

Results show significantly higher digestibility of PEF-processed algae cells compared to non-processed algae (7 to 15 % increase). Moreover, the 5 % *Chlorella* feeds show significantly lower cell digestibility compared to the 1 % feeds, the difference between the 5 % *Chlorella* feeds and the 2 % *Chlorella* feeds are not significant, considering the factor 'inclusion level'.

Conclusion

PEF is the most efficient cell disruption technique, with a disruption efficiency around 80 %. PEF-treated algae show better digestibility of their cells than the non-treated algae,

Corresponding author: sofie.vannerom@ilvo.vlaanderen.be

Acknowledgement: This project is funded by the European Union under the project GeneBEcon – Grant Agreement No. 101061015