INCLUDING DEFATTED ALGAE BIOMASS IN BROILER DIETS: IMPACT ON INTESTINAL MORPHOLOGY

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Introduction

Algae are an attractive nutrient source for broiler chickens, but their cultivation costs may limit their use in animal feed. To reduce costs, one can use defatted algal biomass for feed and extract lipids for other high-value applications like nutraceuticals. Yet, the impact of defatted algae biomass on broiler gut health remains largely unclear.

Aim

This study aimed to evaluate the effect of supplementing defatted *Chlorella*, *Chloromonas,* or *Nannochloropsis* biomass on broiler gut health.

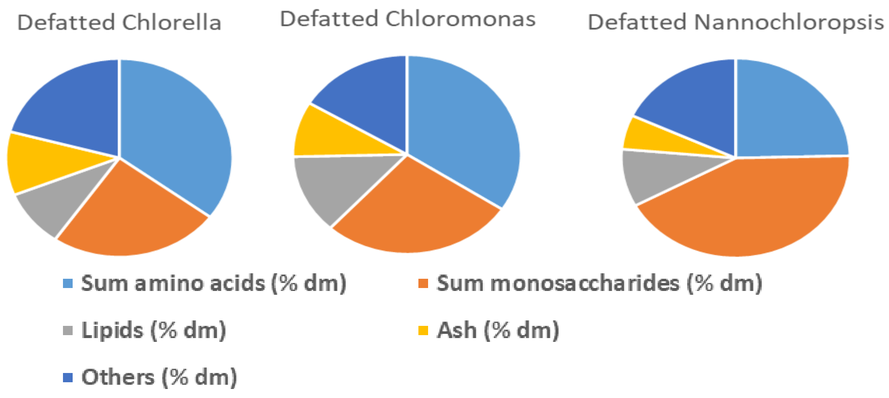
Materials & methods

- *In vitro* trial: defatted algae were digested *in vitro* and the soluble digestate was analyzed to estimate the level of water-soluble carbohydrates available for fermentation. Also, the growth potential of *Lactobacillus amylovorus* (ATCC 33620) on the soluble digestate was evaluated.
- *In vivo* trial: 105 broilers (Ross 308) were housed under standard conditions and randomly distributed over 7 treatments: *Chlorella* 1 and 2%, *Chloromonas* 1 and 2% and *Nannochloropsis* 1 and 2% and a control standard broiler feed. All treatments consisted of the same basal diet and algae were added on top.

Results

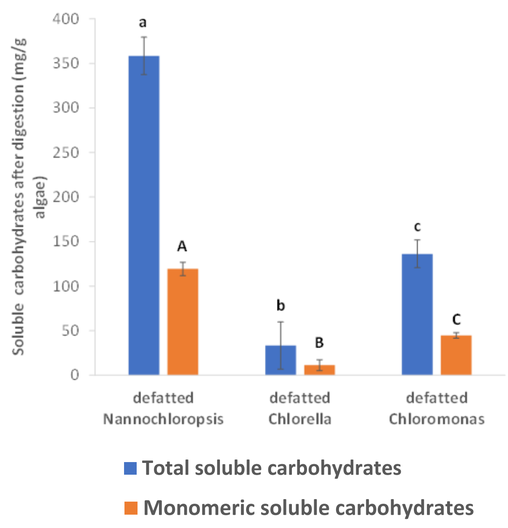
Biomass characterization

A summary of the results of the proximate analysis is shown below.



In vitro digestion of defatted algae

The highest level of indigestible and soluble carbohydrates was observed for defatted *Nannochloropsis*. The non-monomeric, indigestible carbohydrates were mainly composed of glucose in the case of defatted *Nannochloropsis* and of a mixture of many monomers for the two other algae types (not shown).

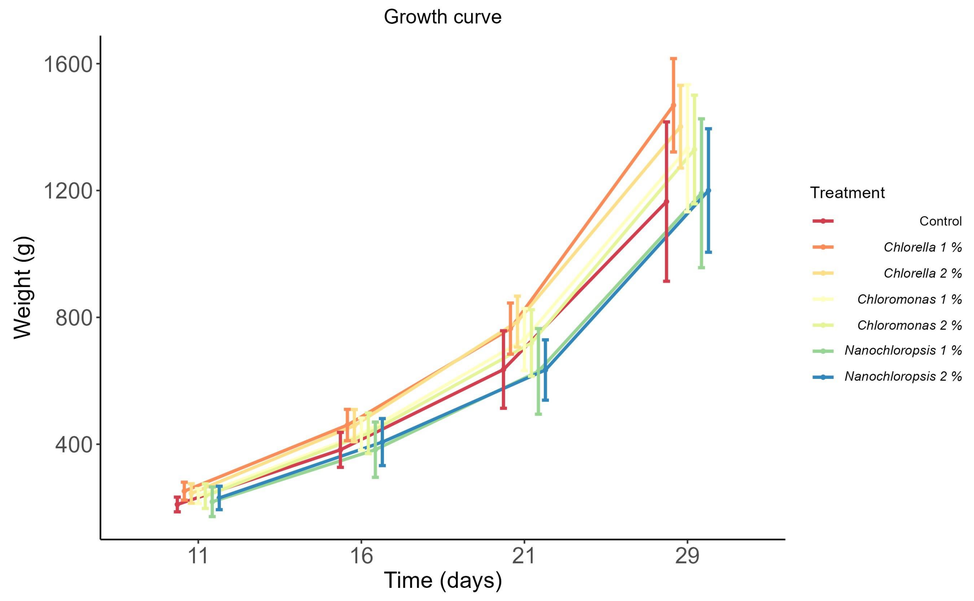


In vitro growth of *Lactobacillus amylovorus* on digested algae

In vitro growth trial data suggested that *L. amylovorus* is able to use the digested *Chloromonas* and *Chlorella* fractions as growth substrate.

Growth of broilers

The figure below shows an increased weight for the *Chlorella* and *Chloromonas* fed broilers compared to the control group, while the *Nannochlorpsis* fed broilers showed a lower growth.



	Control	*Chlorella*		*Chloromonas*		*Nannochloropsis*	
		1%	2%	1%	2%	1%	2%
Ileum length (cm)	73.3 ± 8.40	78.9 ± 8.20	81.5 ± 7.30	82.9 ± 7.00	80.8 ± 8.30	75.9 ± 9.20	82.7 ± 7.30
Jejenum length (cm)	72.1 ± 6.80	75.9 ± 5.60	78.3 ± 7.90	78.9 ± 9.00	75.7 ± 6.30	74.0 ± 6.20	77.1 ± 5.40
Villi length (µm)	1551 ± 248	1496 ± 165	1417 ± 290	1622 ± 241	1709 ± 264	1582 ± 199	1231 ± 233
Villi width (µm)	162 ± 30.3	186 ± 38.1	193 ± 36.8	186 ± 34.2	199 ± 33.7	181 ± 50.1	136 ± 24.1
Crypt depth (µm)	297 ± 77.9	301 ± 38.1	357 ± 52.9	313 ± 43.5	306 ± 51.1	310 ± 55.7	411 ± 50.6
Crypt width (µm)	44.8 ± 5.20	47.5 ± 6.30	53.1 ± 6.00	61.0 ± 6.70	62.1 ± 12.4	55.4 ± 7.60	57.6 ± 7.80
Tunica muscularis (µm)	164 ± 26.3	151 ± 18.9	156 ± 37.8	152 ± 31.8	151 ± 35.8	140 ± 19.6	137 ± 30.3

Intestinal morphology

Ileum length increased in broilers fed with algae, with the highest increase for *Nannochloropsis* 2% and *Chlorella* 2% compared to the control group. Villi height tended to increase with *Chlorella* and *Chloromonas* diets. Crypt depth seemed to increase for *Chlorella* 2% and *Nannochloropsis* 2%. The thickness of the Tunica muscularis tended to decrease for all algae-supplemented broilers.

Conclusions

- Highest level of indigestible and soluble carbohydrates occurred in defatted *Nannochloropsis*
- *L. amylovorus* can use digested *Chloromonas* and *Chlorella* fractions as a growth substrate
- Length of intestinal tract tended to increase in algae-supplemented broilers
- Villi width, and crypt width and depth seemed to increase for most algae-supplemented broilers

IDEA - Implementation and development of economic viable algae-based value chains (NWE639)

Duration: 9/2017 – 10/2021, capitalisation till 12/2023

Website: www.nweurope.eu/IDEA

Lead partner: VITO, Belgium

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