Lipid classes and fatty acids in selected Finnish lake microalgae

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Introduction and aim

Microalgae are rich source of healthy long-chain omega-3 fatty acids, such as eicosapentaenoic acid (EPA, 20:5 (n-3)) and docosahexaenoic acid (DHA, (22:6 (n-3)). Main source for EPA and DHA in regular diet are fish and fish oil products. Fishing alone is not a sufficient way to produce enough omega-3 fatty acids for all people, and that's why new sources for omega-3 fatty acids should be examined. Aim of this study is to analyse lipid classes and fatty acids from three different microalgae species, *Gymnodinium impatiens*, *Cryptomonas sp*. and *Euglena velata*, from Finnish lakes and to assess if these microalgae could be used as raw material for omega-3 dietary supplements. The algae were selected based on the previous research of the collaborator Associate Professor Sami Taipale (University of Jyväskylä).

Materials and methods

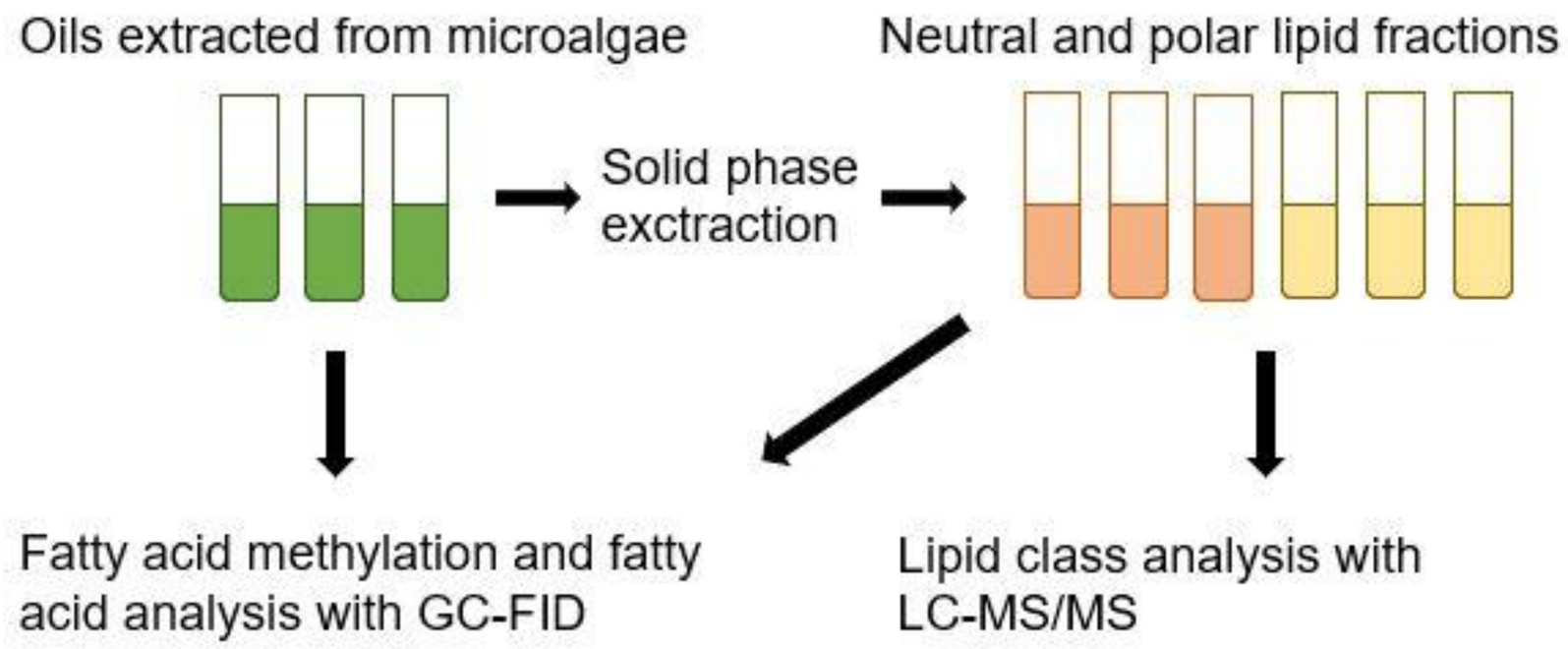

Fig. 1. Illustration of the work flow. Microalgae oils were fractioned with solid phase exctraction to neutral and polar lipids. In LC-MS/MS reversed phase liquid chromatography with C18 column was used. Total, neutral and polar lipids were methylated and analysed with gas chromatography to analyse fatty acid compositions.

Results

Table 1. PL = polar lipids, NL = neutral lipids. In total 31 different fatty acids were identified, in which five most abundant fatty acids of each sample are presented in the table. *G. impatiens* had most DHA (18.6%) and *C. sp.* had least DHA (2.2%). *C. sp.* had most EPA (21.7%) and *E. velata* had least EPA (4.8%). Polar lipids had more EPA and DHA than neutral lipids.

Fatty acids					
G. impatiens total	18:4 (n-3)	**20:5 (n-3)**	**22:6 (n-3)**	16:0	18:2 (n-6)
G. impatiens PL	18:4 (n-3)	**20:5 (n-3)**	**22:6 (n-3)**	16:0	18:2 (n-6)
G. impatiens NL	16:0	14:0	18:4 (n-3)	18:0	18:2 (n-6)
C. sp. total	18:4 (n-3)	**20:5 (n-3)**	16:0	18:3 (n-3)	18:1 (n-7)
C. sp. PL	16:0	18:4 (n-3)	**20:5 (n-3)**	18:3 (n-3)	18:1 (n-7)
C. sp. NL	16:0	18:0	14:0	18:2 (n-6)	12:0
E. velata total	16:4	18:3 (n-3)	16:0	18:2 (n-6)	**22:6 (n-3)**
E. velata PL	16:0	18:3 (n-3)	16:4	18:2 (n-6)	14:0
E. velata NL	16:0	14:0	18:0	18:2 (n-6)	20:1 (n-9)

- Neutral lipid amounts varied from 41% (*C. sp.*) to 59% (*E. velata*)
- Identified neutral lipids: triacylglycerols (TAGs) and diacylglycerols (DAGs)
- Identified polar lipids: monogalactosyl diacylglycerols (MGDGs), digalactosyl diacylglycerols (DGDGs) and phosphatidylcholines (PCs)
- Most important lipid classes were MGDGs (52.6 – 56.2% of identified lipid classes) in polar lipids and TAGs (10.4 – 25.9% of identified lipid classes) in neutral lipids

Conclusions

- *G. impatiens* would be the best option for further research and a source for omega-3 dietary supplements because its EPA + DHA amount and total lipid content were the highest
- Further research should be done with a higher sample amount, which would enable repetition of the analysis