

## Supplementary Materials

Table S1. Nutrient composition of PT, FO and fish (salmon) used in the study

| Nutrient composition   | PT         | FO         | Fish (salmon) |
|------------------------|------------|------------|---------------|
| [KJ/100g]              | 1691#      |            | 741           |
| [kcal/100g]            | 405#       |            | 178           |
| Protein [g/100g]       | 47.2#      | -          | 18            |
| Carbohydrate [g/100g]  | 9.00#      | -          | <0.5          |
| Sugars [g/100g]        | 0.78#      | -          | <0.5          |
| Dietary fibre [g/100g] | 15         | *          | *             |
| Fat. Total [g/100g]    | 16.6#      | 5.2        | 13.6          |
| n-3 PUFA [mg/g]        | 57.5± 2.7  | 310.4± 3.4 | 21            |
| n-6 PUFA [mg/g]        | 4.2± 0.03  | 9.3± 0.5   | 4.1           |
| PUFA n-6: n-3 ratio    | 0.07± 0    | 0.03± 0    | 0.2           |
| EPA [mg/g]             | 53.2± 2.9  | 178.0± 2.0 | 7.5           |
| DHA [mg/g]             | 0.89± 0.07 | 122.5± 2.5 | 3.8           |
| EPA+ DHA [mg/g]        | 54.0± 2.8  | 300.5± 4.5 | 11.3          |
| Vitamin E. [mg/ kg]    | 466± 30,9  | 328.3± 4.8 | *             |
| α-T. [mg/ kg]          | 454± 30,1  | 309.4± 4.1 | *             |
| β-T. [mg/ kg]          | 9.4± 0,6   | nd         | *             |
| γ-T. [mg/ kg]          | 1.4± 0,4   | 17.5± 4.7  | *             |
| δ-T. [mg/ kg]          | 0.2± 0,0   | 1.2± 0.5   | *             |
| γ-Tocotrienol [mg/ kg] | 1.0 ± 0,1  | nd         | *             |
| <b>Carotenoids</b>     |            |            |               |
| Fucoxanthin [mg/g]     | 9.2        | *          | *             |
| β-carotene [mg/g]      | 1.84       | *          | *             |

Values are expressed as mean with SD for the microalgae *Phaeodactylum tricornutum* (PT), fish oil (FO) and fish. PT and FO was measured by our lab and fatty acids of fish, #measured by GBA group for bioanalytic (Hamburg, Germany) and fish amounts (without fatty acids) are from food composition and nutrition tables (Souci, Leipzig-Gemeinschaft, Freising, Germany). Vitamin E means a sum of all Tocopherols and γ-Tocotrienol measured and shown. Abbreviations: n-3 PUFA, omega-3 polyunsaturated fatty acids; EPA, Eicosapentaenoic acid; DHA, Docosahexaenoic acid; T., Tocopherol. \* no data measured.

Table S2. Plasma fatty acids concentrations during each of the experimental phases (in percent %)

| Fatty acids (%) | Baseline (V1) | PTpre (V2/ V6) | PTpost (V4/ V8) | FOpre (V2/ V6) | FOpost (V4/ V8)  | Fishpre (V9) | Fishpost (V11)  |
|-----------------|---------------|----------------|-----------------|----------------|------------------|--------------|-----------------|
| SFA             | 26.4± 2.7     | 27.1± 3.0      | 26.7± 2.8       | 26.5± 2.6      | 26.7± 2.6        | 28.5± 3.6    | 28.28± 3.33#    |
| UFA             | 73.6± 2.7     | 72.9± 3.0      | 73.3± 2.8       | 73.5± 2.6      | 73.3± 2.6        | 71.5± 3.6    | 71.7± 3.3#      |
| MUFA            | 23.6± 4.7     | 24.0± 4.3      | 23.7± 4.4       | 23.9± 4.9      | 23.5± 5.0        | 22.2± 3.3    | 21.0± 1.3       |
| PUFA            | 50.1± 4.1     | 48.9± 4.8      | 49.6± 4.1       | 49.6± 4.4      | 49.8± 4.6        | 49.2± 6.7    | 50.7±4.4        |
| PUFA n-3        | 8.8±4.2       | 8.0± 4.1##     | 9.3± 3.3**      | 8.1± 4.2#      | 9.4± 3.4***      | 8.8± 5.4#    | 11.3± 4.6**§    |
| PUFA n-6        | 42.4± 4.6     | 41.9± 5.2      | 40.9±4 .2       | 42.5± 4.70     | 41.0± 4.5        | 42.6± 6.0    | 41.4±3.9        |
| n-6: n-3        | 5.5± 2.1      | 5.9± 2.1       | 4.7± 1.5**      | 6.0± 2.64      | 4.65± 1.5###**   | 5.5± 2.0     | 3.9±1.3###**    |
| 18:2 n-6        | 31.4± 5.4     | 30.4± 5.6      | 30.0± 4.8       | 30.7± 4.6      | 29.8± 4.8        | 31.2± 4.8    | 29.9± 3.2       |
| 18:3 n-3        | 0.74± 0.4     | 0.49±0.2#      | 0.47± 0.2##     | 0.46± 0.2##    | 0.48± 0.2##      | 0.48± 0.2    | 0.47± 0.2       |
| 20:4 n-6        | 8.55± 1.5     | 8.82± 1.6      | 9.0± 1.6        | 9.01± 1.3      | 9.1± 1.4         | 8.62± 1.6    | 8.60± 1.1       |
| 20:5 n-3        |               |                |                 |                |                  |              | 1.4±            |
| (EPA)           | 0.54± 0.3     | 0.4± 0.2#      | 1.3± 0.4#####   | 0.4± 0.2       | 1.0± 0.3#####§§§ | 0.4± 0.2     | 0.5#####§§§     |
| 22:6 n-3        |               |                |                 |                |                  |              |                 |
| (DHA)           | 6.01± 1.9     | 5.60± 1.5      | 5.42± 1.6       | 5.69± 1.6      | 6.40± 1.4**§§    | 5.29± 1.4    | 7.0± 1.3****§§§ |
| EPA+DHA         | 6.5± 2.1      | 6.0± 1.6       | 6.7± 1.6        | 6.1± 1.6#      | 7.3± 1.6***      | 5.7± 1.4     | 8.3± 1.6#####§§ |

Values are expressed as Mean % ± SD from 22 (PT, FO), or 9 (Fish intervention) participants. Analyses were measured at different time points as indicated. Abbreviations: PT, Interventions with *Phaeodactylum tricornutum*; FO, Intervention with fish oil; Fish, Intervention with salmon; SFA, short chain fatty acids; UFA, unsaturated fatty acids; MUFA, Monounsaturated fatty acids; PUFA, Polyunsaturated fatty acids; n-3 PUFA, omega-3 polyunsaturated fatty acids; EPA, Eicosapentaenoic acid; DHA, Docosahexaenoic acid. Statistics: \* indicate differences to “pre”, # indicate differences to baseline, § indicate differences to PTpost. #/§  $p < 0.05$ , \*\*/##/§§  $p < 0.01$ , \*\*\*/###/§§§  $p < 0.001$ .

Table S3. Bacterial taxa in feces at pre- and post-intervention

| Treatment                  | PTpre<br>(V2/ V6) | PTpost<br>(V4/ V8) | FOpre<br>(V2/ V6) | FOpost<br>(V4/ V8) | Fishpre<br>(V9) | Fishpost<br>(V11) |
|----------------------------|-------------------|--------------------|-------------------|--------------------|-----------------|-------------------|
| <b>Phylum</b>              |                   |                    |                   |                    |                 |                   |
| Bacteroidetes (B)          | 19.9± 11.2        | 18.7± 11.9         | 20.4± 10          | 24.6± 11.7         | 21.7± 8.1       | 23.6± 5.9         |
| Firmicutes (F)             | 66.6± 12.9        | 65.8± 15.1         | 65.0± 13.8        | 59.4± 11.3         | 66.1± 9.5       | 65.1± 8.6         |
| F/B ratio                  | 6.2± 10.4         | 6.1± 6.8           | 4.3± 3.4          | 3.3± 2.9(*)        | 3.7± 2.2        | 3.03± 1.2         |
| Verrucomicrobiota          | 5.5± 6.3          | 7.9± 9.2           | 7.0± 10.1         | 7.2± 8.7           | 6.4± 8.8        | 4.3± 5.1          |
| <b>Class</b>               |                   |                    |                   |                    |                 |                   |
| Bacilli                    | 9.0± 8.8          | 8.1± 6.4           | 7.6± 5.4          | 5.5± 3.3           | 8.5± 5.3        | 8.4± 4.7          |
| Clostridia                 | 57.5± 11.0        | 54.8± 13.6         | 55.9± 12.2        | 52.2± 10           | 55.1± 10.5      | 55.2± 9.8         |
| Verrucomicrobiae           | 5.4± 6.5          | 8.3± 9.4           | 6.9± 10.1         | 7.2± 8.7           | 6.4± 8.8        | 4.2± 5.0          |
| <b>Order</b>               |                   |                    |                   |                    |                 |                   |
| Lachnospirales             | 23.0± 9.2         | 20.7± 6.8          | 21.9± 8.4         | 18.6± 7.6§         | 16.4± 6.8       | 21.0± 4.3*        |
| Oscillospirales            | 24.8± 6.3         | 25.2± 7.9          | 26.1± 8.3         | 24.8± 6.7          | 29.3± 9.4       | 24.7± 7.7*        |
| <b>Family</b>              |                   |                    |                   |                    |                 |                   |
| <i>Rikenellaceae</i>       | 3.8± 3.3          | 4.8± 3.8           | 4.5± 3.3          | 5.1± 2.7           | 5.5± 2.6        | 5.3± 1.3          |
| RF39_ <i>Bacilli</i>       | 2.7± 4.0          | 4.6± 6.3           | 3.2± 5.0          | 2.1± 2.5           | 5.1± 5.6        | 3.8± 3.7          |
| <i>Christensenellaceae</i> | 2.6± 2.0          | 3.4± 3.9           | 2.9± 3.2          | 2.9± 3.1           | 2.4± 1.9        | 4.2± 4.3          |
| <i>Lachnospiraceae</i>     | 23.2± 9.3         | 20.8± 6.8          | 22.1± 8.5         | 17.9± 8.5*§        | 16.5± 6.8       | 21.1± 4.3*        |
| <i>Oscillospiraceae</i>    | 7.3± 5.0          | 7.7± 4.7           | 6.4± 3.0          | 8.2± 5.6           | 6.9± 4.8        | 4.9± 3.8*§        |
| <i>Ruminococcaceae</i>     | 12.6± 6.2         | 13.9± 7.5          | 15.0± 8.3         | 11.8± 4.8          | 17.8± 9.5       | 15.9± 8.6         |
| <i>Akkermansiaceae</i>     | 5.1± 6.5          | 7.7± 9.1           | 6.9± 10.1         | 7.4± 8.7           | 6.5± 8.8        | 4.2± 5.0          |
| <b>Genus</b>               |                   |                    |                   |                    |                 |                   |
| <i>Bacteroides</i>         | 7.7± 6.0          | 8.6± 6.5           | 8.1± 5.8          | 12.0± 8.1          | 10.5± 4.6       | 11.4± 4.7         |
| <i>Agathobacter</i>        | 2.3± 2.5          | 2.7± 3.3           | 3.0± 4.0          | 2.2± 2.9§          | 1.6± 1.5        | 1.6± 1.6          |
| <i>Alistipes</i>           | 3.8± 3.5          | 4.8± 4.0           | 4.9± 3.7          | 5.3± 3.2           | 5.2± 3.1        | 5.1± 2.0          |
| <i>Bacilli</i> RF39        | 2.9± 4.3          | 4.9± 6.6           | 3.4± 5.2          | 2.2± 2.7           | 5.3± 5.8        | 4.1± 3.9          |
| <i>Roseburia</i>           | 2.7± 2.7          | 3.0± 1.9           | 4.1± 3.6          | 3.1± 3.2           | 4.7± 5.1        | 4.8± 4.4          |
| <i>Oscillospiraceae</i> _  | 3.4± 3.2          | 3.9± 3.8           | 3.3± 2.7          | 3.9± 4.8           | 3.6± 3.7        | 2.8± 3.5*§        |
| UCG-002                    |                   |                    |                   |                    |                 |                   |
| <i>Akkermansia</i>         | 5.5± 7.1          | 8.8± 9.9(*)        | 7.3± 10.6         | 7.6± 9.2           | 4.4± 5.3        | 21.6± 8**         |

Species level is not listed because no differences following intervention were found. Values are expressed as mean ± SD from 18 (PT, FO), or 9 (Fish intervention) participants. Analyses were measured before (“pre”) and after (“post”) intervention. Abbreviations: PT, Interventions with *Phaeodactylum tricornutum*; FO, Intervention with fish oil; Fish, Intervention with salmon. Statistics: \* indicate differences to “pre”, # indicate differences to baseline, § indicate differences to PTpost. (\*)  $p = 0.1$ , \*/§  $p < 0.05$ , \*\*  $p < 0.01$ ,