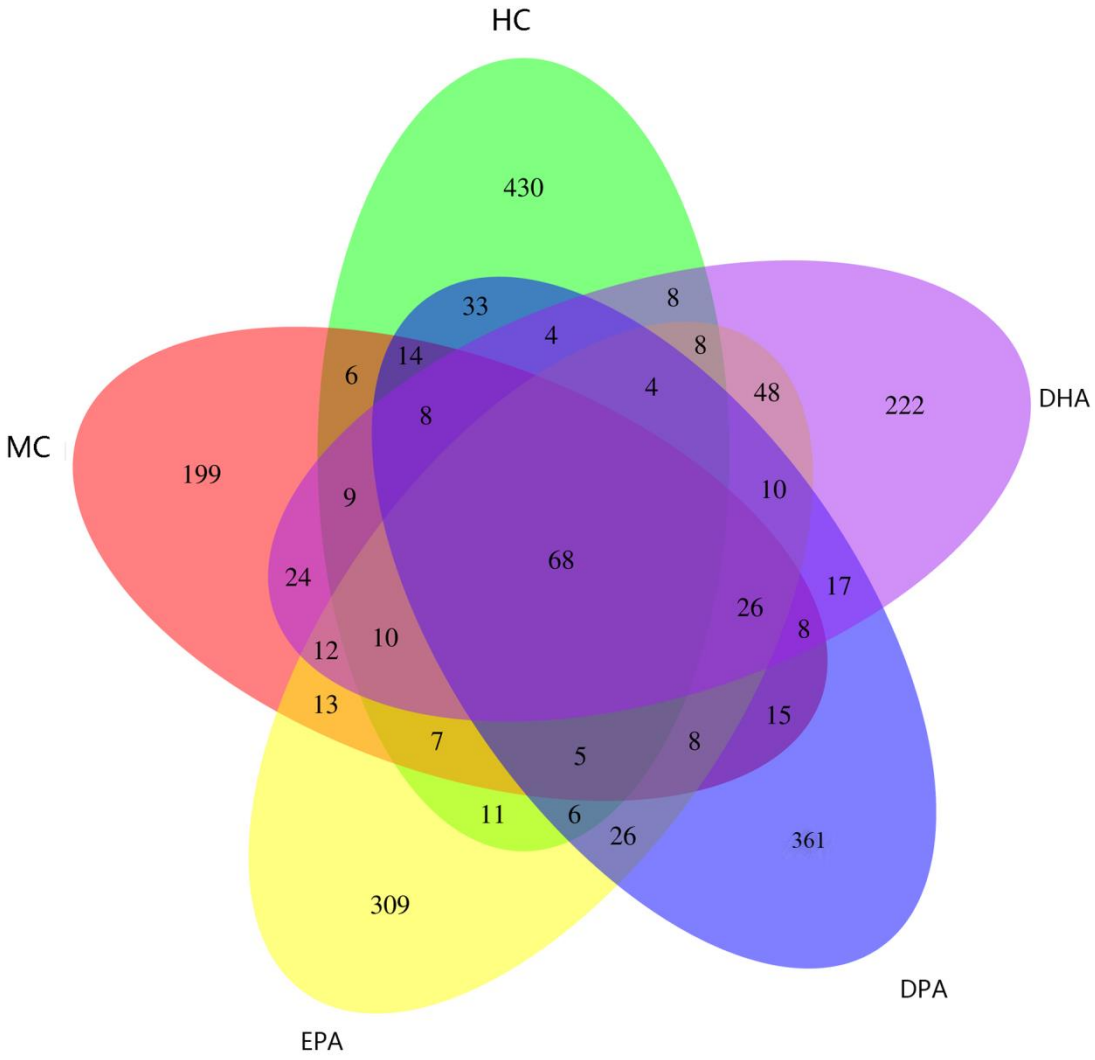


**Figure S1.** The Venn diagram of the gut microbiota in the different groups. Note: EPA, DPA, DHA, MC, HC represented EPA group, DPA group, DHA group, model control group, health control group respectively.

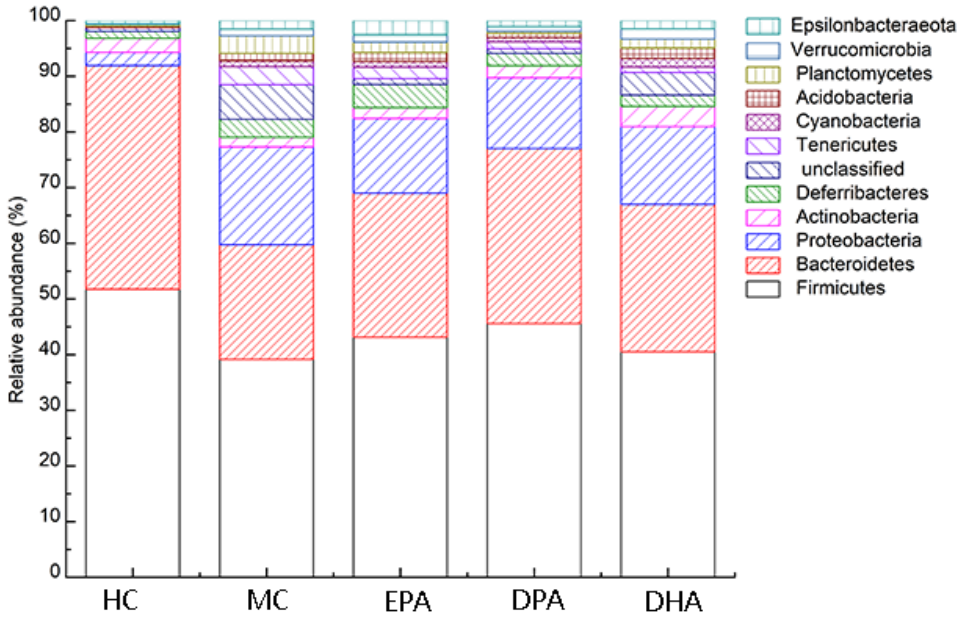


**Figure S2.** The abundance changes of the gut microbiota in the different groups at phyla level. Note: EPA, DPA, DHA, MC, HC represented EPA group, DPA group, DHA group, model control group, health control group respectively.

Table S1 The VIP value of the genera after OPLS-DA in Figure 5 and Figure 6

| Figure 5 | | Figure 6 | |
|---|---|---|---|
| Genera | VIP value | Genera | VIP value |
| *Allobaculum* | 1.76 | *Parabacteroides* | 1.64 |
| *Butyricicoccus* | 1.62 | *Lactobacillus* | 1.52 |
| *Akkermansia* | 1.52 | *Escherichia-Shigella* | 1.51 |
| *Escherichia-Shigella* | 1.39 | *Lachnospiraceae* | 1.34 |
| *Bifidobacterium* | 1.34 | *Butyricicoccus* | 1.31 |
| *Ruminiclostridium_9* | 1.33 | *Bifidobacterium* | 1.26 |
| *Alistipes* | 1.13 | *Ruminiclostridium_9* | 1.25 |
| *Lactobacillus* | 1.13 | *Desulfovibrio* | 1.11 |
| *Bacteroides* | 1.12 | *Akkermansia* | 1.11 |
| *Intestinimonas* | 1.12 | *Alistipes* | 1.11 |
| *Anaerotignum* | 1.1 | *Bacteroides* | 1.11 |
| *Blautia* | 1.09 | *Allobaculum* | 1.06 |
| *Parabacteroides* | 1.06 | *Mucispirillum* | 1.05 |
| *Lactococcus* | 1.04 | *Peptococcaceae* | 0.97 |
| *Mucispirillum* | 1.01 | *Faecalibacterium* | 0.94 |
| *Acetatifactor* | 0.95 | *Burkholderia-Caballeronia-Paraburkholderia* | 0.94 |
| *Lachnospiraceae* | 0.89 | *Intestinimonas* | 0.91 |
| *Oscillibacter* | 0.88 | *Acetatifactor* | 0.91 |
| *Ruminiclostridium_5* | 0.85 | *Anaerotignum* | 0.89 |

| | | | |
|---|---|---|---|
| *Peptococcaceae* | 0.8 | *Eubacterium* | 0.8 |
| *Desulfovibrio* | 0.8 | *Ruminiclostridium_5* | 0.75 |
| *Kineothrix* | 0.66 | *Kineothrix* | 0.73 |
| *Roseburia* | 0.47 | *Lactococcus* | 0.7 |
| *Burkholderia-Caballeronia-Parabu rkholderia* | 0.44 | *Firmicutes_unclassified* | 0.58 |
| *Faecalibacterium* | 0.43 | *Prevotella* | 0.54 |
| *Prevotella* | 0.36 | *Roseburia* | 0.53 |
| *Eubacterium* | 0.27 | *Lachnoclostridium* | 0.47 |
| *Lachnoclostridium* | 0.15 | *Oscillibacter* | 0.47 |
| *Enterococcus* | 0.12 | *Enterococcus* | 0.33 |
| *Firmicutes_unclassified* | 0.04 | *Blautia* | 0.32 |

Table S2 The VIP value of the genera after OPLS-DA in Figure 7 and Figure 8

| Figure 7 | | Figure 8 | |
|---|---|---|---|
| genera | VIP value | genera | VIP value |
| *Allobaculum* | 2.15 | *Akkermansia* | 3.34 |
| *Akkermansia* | 1.84 | *Blautia* | 2.24 |
| *Escherichia-Shigella* | 1.66 | *Butyricicoccus* | 2.08 |
| *Butyricicoccus* | 1.45 | *Lactobacillus* | 1.37 |
| *Lactobacillus* | 1.45 | *Alistipes* | 1 |
| *Bifidobacterium* | 1.41 | *Acetatifactor* | 0.97 |
| *Desulfovibrio* | 1.37 | *Bifidobacterium* | 0.97 |
| *Lactococcus* | 1.32 | *Allobaculum* | 0.9 |
| *Alistipes* | 1.16 | *Bacteroides* | 0.82 |
| *Prevotella* | 1.11 | *Ruminiclostridium_5* | 0.75 |
| *Bacteroides* | 1.03 | *Roseburia* | 0.74 |
| *Oscillibacter* | 0.9 | *Firmicutes_unclassified* | 0.61 |
| *Ruminiclostridium_9* | 0.83 | *Peptococcaceae* | 0.56 |
| *Burkholderia-Caballeronia-Parabu rkholderia* | 0.83 | *Parabacteroides* | 0.54 |
| *Enterococcus* | 0.78 | *Mucispirillum* | 0.52 |
| *Peptococcaceae* | 0.76 | *Anaerotignum* | 0.5 |
| *Acetatifactor* | 0.72 | *Prevotella* | 0.42 |
| *Kineothrix* | 0.56 | *Lactococcus* | 0.34 |
| *Intestinimonas* | 0.5 | *Lachnospiraceae* | 0.32 |
| *Blautia* | 0.48 | *Enterococcus* | 0.25 |
| *Ruminiclostridium_5* | 0.48 | *Ruminiclostridium_9* | 0.21 |
| *Anaerotignum* | 0.43 | *Intestinimonas* | 0.2 |
| *Lachnoclostridium* | 0.42 | *Kineothrix* | 0.2 |
| *Roseburia* | 0.37 | *Burkholderia-Caballeronia-P araburkholderia* | 0.15 |
| *Firmicutes_unclassified* | 0.32 | *Eubacterium* | 0.11 |

| | | | |
|---|---|---|---|
| *Parabacteroides* | 0.31 | *Lachnoclostridium* | 0.06 |
| *Lachnospiraceae* | 0.31 | *Escherichia-Shigella* | 0.05 |
| *Faecalibacterium* | 0.23 | *Desulfovibrio* | 0.05 |
| *Mucispirillum* | 0.21 | *Faecalibacterium* | 0.04 |
| *Eubacterium* | 0.13 | *Oscillibacter* | 0.01 |

Table S3 The VIP value of the metabolites after OPLS-DA in Figure 10 and Figure 11

| Figure 10 | | Figure 11 | |
|---|---|---|---|
| Metabolites | VIP value | Metabolites | VIP value |
| butyrate | 2.5 | cedrol | 2.06 |
| 4-ethylphenol | 2.07 | N-carbamylglutamate | 1.64 |
| 6,10-dimethylundeca-5,9-dien-2-ol | 1.74 | hexadecane | 1.38 |
| N-carbamylglutamate | 1.17 | histamine | 1.37 |
| histamine | 1.03 | butyrate | 1.24 |
| 3,4-dehydrobrevicomin | 0.88 | 2-pentylfuran | 1.24 |
| ethyl palmitate | 0.84 | (E)-2-octenal | 1.02 |
| 7,9-Di-tert-butyl-1-oxaspiro | 0.83 | ethyl palmitate | 1.02 |
| 1,3,3-Trimethyl-1-phenylindane | 0.76 | 2,4-Di-tert-butylphenol | 1.01 |
| (E)-2-octenal | 0.73 | Ethyl tetradecanoate | 0.99 |
| cedrol | 0.72 | Tetradecane | 0.9 |
| 2,4-Di-tert-butylphenol | 0.64 | 1,3,3-Trimethyl-1-phenylindane | 0.86 |
| Phenol | 0.64 | 7,9-Di-tert-butyl-1-oxaspiro | 0.81 |
| Pyrazine, 2-ethenyl-6-methyl- | 0.61 | 2,6-Di-tert-butyl-p-benzoquinone | 0.69 |
| Tetradecane | 0.56 | Dimethyltrisulfide | 0.67 |
| 2-pentylfuran | 0.44 | Hexadecanoic | 0.55 |
| 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)- | 0.39 | 3,4-dehydrobrevicomin | 0.54 |
| Hexadecanoic | 0.37 | 4-ethylphenol | 0.39 |
| Ethyl tetradecanoate | 0.36 | Pyrazine, 2-ethenyl-6-methyl- | 0.3 |
| 2,6-Di-tert-butyl-p-benzoquinone | 0.26 | Phenol | 0.27 |
| Hexadecane | 0.12 | 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)- | 0.18 |
| Dimethyltrisulfide | 0.07 | 6,10-dimethylundeca-5,9-dien-2-ol | 0.03 |

Table S4 The VIP value of the metabolites after OPLS-DA in Figure 12 and Figure 13

| Figure 12 | | Figure 13 | |
|---|---|---|---|
| Metabolites | VIP value | Metabolites | VIP value |
| histamine | 2.78 | 4-ethylphenol | 2.04 |
| butyrate | 2.08 | butyrate | 1.95 |
| 4-ethylphenol | 1.19 | 2-pentylfuran | 1.58 |

| | | | |
|---|---|---|---|
| 3,4-dehydrobrevicomin | 1.14 | histamine | 1.46 |
| N-carbamylglutamate | 1.01 | hexadecane | 1.24 |
| 6,10-dimethylundeca-5,9-dien-2-ol | 0.95 | 6,10-dimethylundeca-5,9-dien-2-ol | 1.18 |
| cedrol | 0.91 | N-carbamylglutamate | 1.12 |
| Hexadecane | 0.83 | 7,9-Di-tert-butyl-1-oxaspiro | 1.11 |
| 2,4-Di-tert-butylphenol | 0.77 | 3,4-dehydrobrevicomin | 0.8 |
| ethyl palmitate | 0.73 | ethyl palmitate | 0.8 |
| 7,9-Di-tert-butyl-1-oxaspiro | 0.67 | cedrol | 0.76 |
| Ethyl tetradecanoate | 0.65 | (E)-2-octenal | 0.73 |
| (E)-2-octenal | 0.62 | 2,4-Di-tert-butylphenol | 0.62 |
| 2-pentylfuran | 0.52 | 1,3,3-Trimethyl-1-phenylindane | 0.61 |
| 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)- | 0.52 | Tetradecane | 0.49 |
| Phenol | 0.45 | Dimethyltrisulfide | 0.43 |
| 1,3,3-Trimethyl-1-phenylindane | 0.44 | Hexadecanoic | 0.4 |
| Hexadecanoic | 0.37 | Pyrazine, 2-ethenyl-6-methyl- | 0.3 |
| Tetradecane | 0.37 | Ethyl tetradecanoate | 0.26 |
| Pyrazine, 2-ethenyl-6-methyl- | 0.36 | 5,9-Undecadien-2-one, 6,10-dimethyl-, (E)- | 0.2 |
| Dimethyltrisulfide | 0.27 | 2,6-Di-tert-butyl-p-benzoquinone | 0.2 |
| 2,6-Di-tert-butyl-p-benzoquinone | 0.14 | Phenol | 0.15 |