# Supplemental data

Supplement 1. Metabolites detected in the analysis presented with loadings value and variable of importance (VIP) for each metabolite.

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| --- | --- | --- | --- |
|  | **Fasting**  |  | **Non-fasting** |
| **Metabolite** | **Loadings value** | **VIP** | **Loadings value** | **VIP** |
| 1,5-ANHYDRO-D-GLUCITOL | -0.13 | 1.23 | 0.00 | 0.58 |
| 1-PALMITOYL-sn-GLYCERO-3-PHOSPHOCHOLINE | -0.06 | 0.54 | 0.01 | 0.75 |
| 2-AMINOBUTYRIC ACID | -0.06 | 0.46 | 0.10 | 0.84 |
| 3-HYDROXYBUTYRIC ACID | 0.08 | 0.65 | 0.15 | 1.30 |
| 4-HYDROXYPHENYLACETIC ACID | -0.14 | 1.11 | 0.01 | 0.50 |
| ACETOMINOPHEN | 0.08 | 0.70 | 0.05 | 0.49 |
| ACONITIC ACID, cis-  | -0.11 | 1.07 | -0.04 | 0.79 |
| ADENOSINE-5-MONOPHOSPHATE | -0.12 | 0.94 | -0.20 | 1.72 |
| ALANINE | -0.07 | 0.87 | 0.03 | 0.63 |
| ALPHA-TOCOPHEROL | -0.08 | 0.65 | 0.10 | 1.12 |
| ARABITOL | -0.13 | 1.35 | 0.05 | 1.06 |
| ASPARAGINE | 0.04 | 0.62 | 0.01 | 0.64 |
| ASPARAGINE | -0.06 | 1.07 | 0.06 | 1.03 |
| BETA-ALANINE | 0.00 | 0.19 | -0.02 | 0.34 |
| CELLOTRIOSE | 0.00 | 0.07 | -0.07 | 0.64 |
| CITRIC ACID | -0.11 | 1.07 | 0.00 | 0.66 |
| CITRULLINE | -0.09 | 1.14 | 0.15 | 1.41 |
| CREATININE | 0.01 | 0.69 | -0.04 | 0.75 |
| CYSTEINE | -0.17 | 1.57 | 0.08 | 1.06 |
| CYSTINE | -0.08 | 0.90 | 0.08 | 0.69 |
| DOCOSAHEXAENOIC ACID | -0.01 | 0.11 | 0.01 | 0.43 |
| DODECANOIC ACID | 0.16 | 1.25 | 0.05 | 0.66 |
| GAMMA-TOCOPHEROL | -0.13 | 1.09 | 0.11 | 0.98 |
| GLUCONIC ACID | -0.11 | 1.01 | -0.15 | 1.40 |
| GLUTAMINE | -0.11 | 1.36 | -0.08 | 1.25 |
| GLYCINE | -0.17 | 1.42 | -0.18 | 1.50 |
| GLYCINE | 0.04 | 0.55 | 0.08 | 0.77 |
| GLYCOLIC ACID | -0.12 | 0.96 | -0.02 | 0.42 |
| HEPTADECANOIC ACID | 0.08 | 0.78 | 0.08 | 0.67 |
| HEXADECANOIC ACID | 0.19 | 1.54 | 0.09 | 0.86 |
| INDOLE-3-ACETIC ACID | -0.09 | 0.80 | -0.02 | 0.62 |
| INOSITOL, scyllo | -0.10 | 1.20 | 0.13 | 1.45 |
| LACTULOSE | -0.06 | 0.52 | -0.11 | 1.27 |
| LYSINE | 0.15 | 1.27 | 0.23 | 1.89 |
| MALIC ACID | -0.06 | 0.47 | -0.15 | 1.34 |
| MALTOSE | -0.05 | 0.43 | 0.03 | 0.43 |
| METHIONINE | -0.10 | 1.20 | -0.01 | 0.77 |
| OCTADECADIENOIC ACID | 0.17 | 1.43 | 0.02 | 0.49 |
| OCTADECANOIC ACID | 0.09 | 0.86 | 0.13 | 1.16 |
| OCTADECENOIC ACID | 0.19 | 1.54 | 0.11 | 1.03 |
| ORNITHINE | -0.06 | 0.96 | -0.05 | 0.85 |
| PHENYLALANINE | -0.11 | 1.34 | 0.04 | 1.10 |
| PIPECOLIC ACID | -0.12 | 0.95 | 0.00 | 0.68 |
| PYROGLUTAMIC ACID | -0.11 | 1.13 | 0.08 | 1.09 |
| RI 1349 M/z 203 1 M/z293 | -0.02 | 0.15 | 0.14 | 1.15 |
| RI 1450 M/z 170  | -0.12 | 1.36 | 0.04 | 1.10 |
| RI 1473 M/z 205 1 M/z205 | -0.10 | 0.80 | 0.02 | 0.85 |
| RI 1675 M/z 243 1 | -0.15 | 1.45 | 0.01 | 0.96 |
| RI 1725 M/z 199 1 M/z245 | -0.03 | 0.79 | -0.07 | 0.79 |
| RI 2021 M/z 152 1 M/z132 | 0.11 | 0.99 | -0.01 | 0.44 |
| RI 2163 M/z 202 1 | -0.12 | 1.15 | 0.03 | 0.81 |
| RI 2171 M/z 290 1 M/z523 | -0.09 | 0.76 | -0.17 | 1.43 |
| RIBITOL | -0.09 | 1.18 | 0.08 | 1.19 |
| SALICYLIC ACID | -0.08 | 0.84 | 0.09 | 0.92 |
| SERINE | -0.10 | 1.02 | -0.13 | 1.33 |
| TARTARIC ACID | 0.03 | 0.27 | -0.12 | 1.03 |
| THREONINE | -0.04 | 0.98 | 0.05 | 1.04 |
| TRYPTOPHAN | -0.15 | 1.48 | 0.01 | 1.06 |
| TYROSINE | 0.05 | 0.62 | -0.01 | 0.31 |
| UREA | -0.07 | 0.58 | -0.02 | 0.49 |
| URIC ACID | -0.04 | 0.69 | 0.18 | 1.50 |
| VALINE | -0.03 | 0.93 | 0.12 | 1.33 |
| XYLITOL | -0.13 | 1.35 | 0.05 | 1.06 |

Supplement 2. Pathway analysis results from the fasting condition; significant metabolites according to the OPLS-DA model were used as the input for the analysis.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** | **Total metabolites in pathway** | **Expected hits** | **Observed hits** | **Raw *p*** | **-log(*p*)** | **Holm adjust** | **FDR** | **Metabolites with VIP>1 in pathway (hits)** |
| Aminoacyl-tRNA biosynthesis | 75 | 0.71666 | 9 | 9.81E-09 | 18.44 | 7.85E-07 | 7.85E-07 | Asparagine, Phenylalanine, Glutamine, Cysteine, Glycine, Serine, Methionine, Lysine, Tryptophan |
| Nitrogen metabolism | 39 | 0.37266 | 5 | 2.33E-05 | 10.665 | 0.001844 | 0.000933 | Phenylalanine, Tryptophan, Asparagine, Glutamine, Glycine |
| Cyanoamino acid metabolism | 16 | 0.15289 | 3 | 0.000394 | 7.8395 | 0.030722 | 0.010503 | Asparagine, Glycine, Serine |
| Glycine, serine and threonine metabolism | 48 | 0.45866 | 4 | 0.000934 | 6.9763 | 0.071899 | 0.018675 | Serine, Glycine, Cysteine, Tryptophan |
| Glutathione metabolism | 38 | 0.36311 | 3 | 0.005172 | 5.2645 | 0.39305 | 0.082748 | Glycine, Cysteine, Pyroglutamic acid |
| Fatty acid biosynthesis | 49 | 0.46822 | 3 | 0.010547 | 4.552 | 0.791 | 0.12153 | Dodecanoic acid, Octadecenoic acid, Hexadecanoic acid |
| Sulfur metabolism | 18 | 0.172 | 2 | 0.01218 | 4.408 | 0.90129 | 0.12153 | Serine, Cysteine |
| Pentose and glucuronate interconversions | 53 | 0.50644 | 3 | 0.01308 | 4.3367 | 0.95485 | 0.12153 | Ribitol, Arabitol, Xylitol |
| Citrate cycle (TCA cycle) | 20 | 0.19111 | 2 | 0.014951 | 4.203 | 1 | 0.12153 | Aconitic acid, Citric acid |
| Cysteine and methionine metabolism | 56 | 0.53511 | 3 | 0.015191 | 4.187 | 1 | 0.12153 | Serine, Methionine, Cysteine |
| Thiamine metabolism | 24 | 0.22933 | 2 | 0.021221 | 3.8528 | 1 | 0.14147 | Glycine, Cysteine |
| Alanine, aspartate and glutamate metabolism | 24 | 0.22933 | 2 | 0.021221 | 3.8528 | 1 | 0.14147 | Aspargine, Glutamine |
| Phenylalanine, tyrosine and tryptophan biosynthesis | 27 | 0.258 | 2 | 0.026523 | 3.6297 | 1 | 0.16322 | Phenylalanine, Tryptophan |
| Methane metabolism | 34 | 0.32489 | 2 | 0.040715 | 3.2011 | 1 | 0.23266 | Glycine, Serine |
| Phenylalanine metabolism | 45 | 0.43 | 2 | 0.067454 | 2.6963 | 1 | 0.35976 | Phenylalanine, Hydroxyphenylacetic acid |
| Lysine degradation | 47 | 0.44911 | 2 | 0.072816 | 2.6198 | 1 | 0.36408 | Lysine, Glycine |
| Fatty acid biosynthesis | 49 | 0.47777 | 2 | 0.072422 | 2.5119 | 1 | 0.38171 | Dodecanoic acid, Hexadecanoic acid |
| Biotin metabolism | 11 | 0.10511 | 1 | 0.10043 | 2.2983 | 1 | 0.42286 | Lysine |
| D-Glutamine and D-glutamate metabolism | 11 | 0.10511 | 1 | 0.10043 | 2.2983 | 1 | 0.42286 | Glutamine |
| Arginine and proline metabolism | 77 | 0.73577 | 2 | 0.16625 | 1.7943 | 1 | 0.665 | Glutamine, Citrulline |
| Taurine and hypotaurine metabolism | 20 | 0.19111 | 1 | 0.17535 | 1.741 | 1 | 0.66652 | Cysteine |
| Citrate cycle (TCA cycle) | 20 | 0.16837 | 1 | 0.16837 | 1.7876 | 1 | 0.67062 | Citric acid |
| Riboflavin metabolism | 21 | 0.20066 | 1 | 0.18329 | 1.6967 | 1 | 0.66652 | Ribitol |
| Sphingolipid metabolism | 25 | 0.23889 | 1 | 0.21435 | 1.5401 | 1 | 0.70601 | Serine |
| Purine metabolism | 92 | 0.8791 | 2 | 0.21867 | 1.5202 | 1 | 0.70601 | Glycine, Glutamine |
| Fatty acid elongation in mitochondria | 27 | 0.258 | 1 | 0.22945 | 1.4721 | 1 | 0.70601 | Hexadecanoic acid |
| Pantothenate and CoA biosynthesis | 27 | 0.258 | 1 | 0.22945 | 1.4721 | 1 | 0.70601 | Cysteine |
| Pentose phosphate pathway | 32 | 0.30577 | 1 | 0.266 | 1.3242 | 1 | 0.76001 | Gluconic acid |
| Lysine biosynthesis | 32 | 0.30577 | 1 | 0.266 | 1.3242 | 1 | 0.76001 | Lysine |
| Primary bile acid biosynthesis | 47 | 0.44911 | 1 | 0.36597 | 1.0052 | 1 | 1 | Glycine |
| Fatty acid metabolism | 50 | 0.47777 | 1 | 0.38433 | 0.95625 | 1 | 1 | Hexadecanoic acid |
| Pyrimidine metabolism | 60 | 0.57333 | 1 | 0.44195 | 0.81657 | 1 | 1 | Glutamine |
| Tyrosine metabolism | 76 | 0.72622 | 1 | 0.52354 | 0.64714 | 1 | 1 | Hydroxyphenylacetic acid |
| Tryptophan metabolism | 79 | 0.75488 | 1 | 0.53751 | 0.6208 | 1 | 1 | Tryptophan |
| Porphyrin and chlorophyll metabolism | 104 | 0.99377 | 1 | 0.63964 | 0.44685 | 1 | 1 | Glycine |

Supplement 3. Pathway analysis results from the non-fasting condition; significant metabolites according to the OPLS-DA model were used as the input for the analysis.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** | **Total metabolites in pathway** | **Expected hits** | **Observed hits** | **Raw *p*** | **-log(*p*)** | **Holm adjust** | **FDR** | **Metabolites with VIP>1 in pathway (hits)** |
| Aminoacyl-tRNA biosynthesis | 75 | 0.77898 | 10 | 1.06E-09 | 20.67 | 8.44E-08 | 8.44E-08 | Asparagine, Phenylalanine, Glutamine, Cysteine, Glycine, Serine, Valine, Threonine, Lysine, Tryptophan |
| Nitrogen metabolism | 39 | 0.40507 | 6 | 1.72E-06 | 13.274 | 0.000136 | 6.87E-05 | Phenylalanine, Tryptophan, Asparagine, Glutamine, Glycine, Adenosine monophosphate |
| Glycine, serine and threonine metabolism | 48 | 0.49855 | 5 | 0.0001 | 9.2055 | 0.007838 | 0.00268 | Serine, Glycine, Threonine, Cysteine, Tryptophan |
| Cyanoamino acid metabolism | 16 | 0.16618 | 3 | 0.000507 | 7.5863 | 0.039068 | 0.010147 | Asparagine, Glycine, Serine |
| Glutathione metabolism | 38 | 0.39468 | 3 | 0.006572 | 5.0249 | 0.49947 | 0.10515 | Glycine; Cysteine; Pyroglutamic acid; |
| Purine metabolism | 92 | 0.95555 | 4 | 0.013653 | 4.2938 | 1 | 0.1636 | Adenosine monophosphate, uric acid, Glycine  |
| Sulfur metabolism | 18 | 0.18695 | 2 | 0.014315 | 4.2464 | 1 | 0.1636 | Cysteine, Serine |
| Pentose and glucuronate interconversions | 53 | 0.55048 | 3 | 0.01647 | 4.1062 | 1 | 0.1647 | Ribitol, Arabitol, Xylitol |
| Thiamine metabolism | 24 | 0.24927 | 2 | 0.02486 | 3.6945 | 1 | 0.1909 | Glycine, Cysteine |
| Alanine, aspartate and glutamate metabolism | 24 | 0.24927 | 2 | 0.02486 | 3.6945 | 1 | 0.1909 | Aspargine, Glutamine |
| Pantothenate and CoA biosynthesis | 27 | 0.28043 | 2 | 0.031022 | 3.4731 | 1 | 0.1909 | Cysteine, Valine |
| Phenylalanine, tyrosine and tryptophan biosynthesis | 27 | 0.28043 | 2 | 0.031022 | 3.4731 | 1 | 0.1909 | Phenylalanine, Tryptophan |
| Valine, leucine and isoleucine biosynthesis | 27 | 0.28043 | 2 | 0.031022 | 3.4731 | 1 | 0.1909 | Threonine, Valine |
| Methane metabolism | 34 | 0.35314 | 2 | 0.047442 | 3.0483 | 1 | 0.2711 | Serine, Glycine |
| Synthesis and degradation of ketone bodies | 6 | 0.062318 | 1 | 0.060784 | 2.8004 | 1 | 0.32418 | Hydroxybutyric acid |
| Lysine degradation | 47 | 0.48816 | 2 | 0.084264 | 2.4738 | 1 | 0.42132 | Lysine, Glycine |
| Glyoxylate and dicarboxylate metabolism | 50 | 0.51932 | 2 | 0.093718 | 2.3675 | 1 | 0.44103 | Malic acid, Tartaric acid |
| Biotin metabolism | 11 | 0.11425 | 1 | 0.10871 | 2.219 | 1 | 0.454 | Lysine |
| D-Glutamine and D-glutamate metabolism | 11 | 0.11425 | 1 | 0.10871 | 2.219 | 1 | 0.454 | Glutamine |
| Cysteine and methionine metabolism | 56 | 0.58164 | 2 | 0.1135 | 2.1759 | 1 | 0.454 | Serine, Cysteine |
| Taurine and hypotaurine metabolism | 20 | 0.20773 | 1 | 0.18913 | 1.6653 | 1 | 0.65874 | Cysteine |
| Citrate cycle (TCA cycle) | 20 | 0.20773 | 1 | 0.18913 | 1.6653 | 1 | 0.65874 | Malic acid |
| Arginine and proline metabolism | 77 | 0.79975 | 2 | 0.18945 | 1.6636 | 1 | 0.65874 | Glutamine, Citrulline |
| Riboflavin metabolism | 21 | 0.21811 | 1 | 0.19762 | 1.6214 | 1 | 0.65874 | Ribitol |
| Sphingolipid metabolism | 25 | 0.25966 | 1 | 0.23075 | 1.4664 | 1 | 0.73839 | Serine |
| Pyruvate metabolism | 32 | 0.33236 | 1 | 0.28558 | 1.2532 | 1 | 0.81208 | Malic acid |
| Pentose phosphate pathway | 32 | 0.33236 | 1 | 0.28558 | 1.2532 | 1 | 0.81208 | Gluconic acid |
| Lysine biosynthesis | 32 | 0.33236 | 1 | 0.28558 | 1.2532 | 1 | 0.81208 | Lysine |
| Porphyrin and chlorophyll metabolism | 104 | 1.0802 | 2 | 0.29438 | 1.2229 | 1 | 0.81208 | Glycine, Threonine |
| Propanoate metabolism | 35 | 0.36352 | 1 | 0.30791 | 1.1779 | 1 | 0.81344 | Valine |
| Ubiquinone and other terpenoid-quinone biosynthesis | 36 | 0.37391 | 1 | 0.31521 | 1.1545 | 1 | 0.81344 | Alpha-Tocopherol |
| Valine, leucine and isoleucine degradation | 40 | 0.41545 | 1 | 0.34365 | 1.0681 | 1 | 0.8331 | Valine |
| Butanoate metabolism | 40 | 0.41545 | 1 | 0.34365 | 1.0681 | 1 | 0.8331 | Hydroxybutyric acid |
| Phenylalanine metabolism | 45 | 0.46739 | 1 | 0.37762 | 0.97387 | 1 | 0.88851 | Phenylalanine |
| Primary bile acid biosynthesis | 47 | 0.48816 | 1 | 0.39073 | 0.93975 | 1 | 0.89309 | Glycine |
| Fatty acid biosynthesis | 49 | 0.40357 | 1 | 0.40357 | 0.9074 | 1 | 0.89682 | Stearic acid |
| Pyrimidine metabolism | 60 | 0.62318 | 1 | 0.46969 | 0.75569 | 1 | 1 | Glutamine |
| Tryptophan metabolism | 79 | 0.82052 | 1 | 0.56766 | 0.56623 | 1 | 1 | Tryptophan |