Supplementary Table 2.

Associations of 78 metabolites with metabolic syndrome in the original population (n=594).

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| --- | --- | --- | --- | --- |
|  |  | Model 1 |  | Model 2 |
| 　 | **Metabolites**a | **%change**b  | **95%CI** | ***P***c |  | **%change**d | **95%CI** | ***P***c |
| log | Alanine | 13.3% | 8.9 | - | 17.8 | 8.5\*10-8 |  | 12.2% | 7.8 | - | 16.8 | 3.7\*10-6 |
| log | Glutamate | 26.2% | 16.8 | - | 36.4 | 2.6\*10-7 |  | 26.8% | 17.1 | - | 37.3 | 2.1\*10-6 |
| log | Leucine | 10.2% | 6.6 | - | 14.0 | 3.4\*10-7 |  | 10.8% | 7.1 | - | 14.6 | 2.1\*10-6 |
| log | Cystine | 10.3% | 6.6 | - | 14.2 | 4.4\*10-7 |  | 9.8% | 6.1 | - | 13.7 | 1.2\*10-5 |
| log | Valine | 10.3% | 6.5 | - | 14.3 | 1.1\*10-6 |  | 10.7% | 6.8 | - | 14.8 | 5.3\*10-6 |
| log | Isoleucine | 10.6% | 6.5 | - | 14.7 | 1.9\*10-6 |  | 10.9% | 6.8 | - | 15.2 | 1.2\*10-5 |
| log | alpha-Aminoadipate | 11.9% | 6.4 | - | 17.6 | 1.6\*10-4 |  | 12.6% | 7.0 | - | 18.5 | 5.2\*10-4 |
| log | Proline | 12.4% | 6.3 | - | 18.9 | 4.2\*10-4 |  | 11.8% | 5.7 | - | 18.4 | 0.006 |
| log | 4-methyl-2-oxopentanoate | 7.4% | 3.2 | - | 11.8 | 0.004 |  | 8.0% | 3.7 | - | 12.5 | 0.01 |
|  | 2-Oxoisopentanoate | 8.2% | 3.6 | - | 12.8 | 0.004 |  | 8.0% | 3.4 | - | 12.6 | 0.02 |
| log | Lactate | 10.8% | 4.6 | - | 17.5 | 0.004 |  | 9.4% | 3.1 | - | 16.0 | 0.06 |
| log | Mucate | -9.3% | -14.4 | - | -3.8 | 0.007 |  | -8.9% | -14.2 | - | -3.3 | 0.05 |
| log | Tyrosine | 5.6% | 2.2 | - | 9.0 | 0.007 |  | 4.3% | 1.0 | - | 7.8 | 0.15 |
|  | Pyruvate | 9.9% | 3.6 | - | 16.3 | 0.01 |  | 8.7% | 2.8 | - | 14.7 | 0.07 |
| log | Guanidinosuccinate | -22.6% | -34.5 | - | -8.7 | 0.01 |  | -20.9% | -33.2 | - | -6.4 | 0.11 |
| log | 3-Hydroxybutyrate | -17.9% | -28.4 | - | -5.7 | 0.02 |  | -19.8% | -30.2 | - | -7.8 | 0.048 |
| log | Phenylalanine | 5.0% | 1.5 | - | 8.7 | 0.02 |  | 4.6% | 1.0 | - | 8.3 | 0.16 |
| log | cis-Aconitate | 7.2% | 1.8 | - | 12.8 | 0.04 |  | 5.8% | 0.5 | - | 11.3 | 0.28 |
| log | Threonine | 5.2% | 1.3 | - | 9.2 | 0.04 |  | 5.2% | 1.2 | - | 9.3 | 0.15 |
| log | Asparagine | -3.3% | -5.9 | - | -0.5 | 0.08 |  | -3.3% | -6.0 | - | -0.5 | 0.23 |
| log | Terephthalate | -16.2% | -28.0 | - | -2.4 | 0.08 |  | -16.1% | -28.3 | - | -2.0 | 0.27 |
| log | Creatine | 7.9% | 0.5 | - | 16.0 | 0.12 |  | 9.2% | 1.6 | - | 17.5 | 0.22 |
| log | Glycine | -5.8% | -11.0 | - | -0.4 | 0.12 |  | -5.2% | -10.5 | - | 0.5 | 0.43 |
| log | Proline betaine | -17.8% | -31.7 | - | -1.1 | 0.12 |  | -19.8% | -33.6 | - | -3.1 | 0.24 |
| log | Tryptophan | 4.1% | 0.3 | - | 8.0 | 0.12 |  | 4.6% | 0.6 | - | 8.6 | 0.24 |
| log | CSSG | -8.4% | -16.2 | - | 0.1 | 0.15 |  | -5.6% | -13.5 | - | 3.0 | 0.60 |
| log | 2-Hydroxybutyrate | 7.2% | 0.0 | - | 14.9 | 0.15 |  | 6.9% | -0.4 | - | 14.7 | 0.41 |
| log | Betaine | -5.4% | -10.6 | - | 0.2 | 0.15 |  | -4.9% | -10.3 | - | 0.7 | 0.46 |
| log | Choline | 4.6% | -0.1 | - | 9.6 | 0.15 |  | 4.4% | -0.5 | - | 9.4 | 0.44 |
| log | 3-Methylhistidine | 10.4% | -0.7 | - | 22.7 | 0.18 |  | 12.3% | 0.8 | - | 25.1 | 0.29 |
| log | o-Acetylcarnitine | 21.5% | -1.8 | - | 50.3 | 0.18 |  | 18.0% | -4.6 | - | 45.8 | 0.54 |
| log | 3-Aminoisobutanoate | -11.1% | -22.0 | - | 1.3 | 0.19 |  | -13.6% | -24.2 | - | -1.5 | 0.27 |
| log | Kynurenine | 6.4% | -0.8 | - | 14.2 | 0.20 |  | 7.1% | -0.3 | - | 15.1 | 0.40 |
| log | Methionine | 8.5% | -1.2 | - | 19.3 | 0.20 |  | 9.4% | -0.4 | - | 20.2 | 0.40 |
| log | 5-Oxoproline | 4.1% | -0.9 | - | 9.4 | 0.24 |  | 3.6% | -1.6 | - | 9.0 | 0.59 |
| log | Threonate | -4.1% | -8.9 | - | 1.0 | 0.24 |  | -3.9% | -8.9 | - | 1.2 | 0.55 |
| log | Citrate | -4.9% | -11.2 | - | 1.7 | 0.30 |  | -5.6% | -11.8 | - | 1.2 | 0.49 |
| log | Pipecolate | 6.2% | -2.2 | - | 15.3 | 0.30 |  | 3.3% | -4.8 | - | 12.1 | 0.78 |
| log | Trimethylamine N-oxide | 13.4% | -4.3 | - | 34.3 | 0.30 |  | 13.3% | -4.5 | - | 34.5 | 0.57 |
| log | Hexanoate | -7.2% | -16.6 | - | 3.1 | 0.31 |  | -7.5% | -16.7 | - | 2.8 | 0.57 |
| log | Histidine | 2.1% | -0.8 | - | 5.2 | 0.31 |  | 2.2% | -0.8 | - | 5.4 | 0.57 |
| log | Uridine | -4.3% | -10.0 | - | 1.8 | 0.31 |  | -4.4% | -10.2 | - | 1.7 | 0.57 |
| log | Carnitine | 2.7% | -1.2 | - | 6.8 | 0.31 |  | 2.6% | -1.4 | - | 6.6 | 0.60 |
| log | Lysine | 2.3% | -1.2 | - | 6.0 | 0.34 |  | 2.5% | -1.1 | - | 6.2 | 0.59 |
| log | Succinate | -3.1% | -7.7 | - | 1.7 | 0.35 |  | -3.4% | -8.1 | - | 1.5 | 0.59 |
| log | SDMA | 5.2% | -2.8 | - | 13.9 | 0.35 |  | 3.1% | -4.9 | - | 11.7 | 0.78 |
| log | Alpha-aminobutanoate | 3.4% | -2.1 | - | 9.2 | 0.37 |  | 3.7% | -1.8 | - | 9.6 | 0.60 |
| log | Aspartate | 6.5% | -4.1 | - | 18.3 | 0.37 |  | 6.6% | -4.2 | - | 18.7 | 0.63 |
| log | Azelate | -7.4% | -18.3 | - | 4.9 | 0.37 |  | -6.0% | -17.3 | - | 6.8 | 0.71 |
| log | Guanidinoacetate | -3.1% | -8.0 | - | 2.0 | 0.37 |  | -3.3% | -8.2 | - | 2.0 | 0.61 |
| log | Malate | 4.0% | -3.0 | - | 11.4 | 0.41 |  | 2.4% | -4.5 | - | 9.7 | 0.80 |
| log | Ornithine | 2.5% | -1.9 | - | 7.1 | 0.41 |  | 1.8% | -2.6 | - | 6.4 | 0.78 |
| log | gamma-Butyrobetaine | -2.7% | -7.5 | - | 2.3 | 0.42 |  | -3.0% | -7.9 | - | 2.2 | 0.65 |
| log | Isethionate | -3.8% | -10.5 | - | 3.5 | 0.43 |  | -3.9% | -10.8 | - | 3.5 | 0.67 |
| log | Serine | -2.3% | -6.4 | - | 2.1 | 0.43 |  | -2.5% | -6.7 | - | 1.8 | 0.64 |
| log | 1-Methylnicotinamide | 7.1% | -6.2 | - | 22.2 | 0.44 |  | 8.5% | -5.1 | - | 24.2 | 0.63 |
| log | ADMA | 5.7% | -5.4 | - | 18.1 | 0.45 |  | 6.1% | -5.4 | - | 18.9 | 0.69 |
| log | 3-Indoxyl sulfate | 7.6% | -7.4 | - | 25.0 | 0.45 |  | 10.0% | -5.7 | - | 28.3 | 0.61 |
| log | Beta-Alanine | 3.4% | -3.7 | - | 11.2 | 0.47 |  | 3.6% | -3.7 | - | 11.5 | 0.71 |
| log | Arginine | 1.5% | -2.0 | - | 5.0 | 0.53 |  | 1.4% | -2.1 | - | 4.9 | 0.78 |
| log | Citrulline | -2.1% | -7.4 | - | 3.4 | 0.54 |  | -3.0% | -8.2 | - | 2.6 | 0.67 |
| log | Glutamine | -0.9% | -3.1 | - | 1.4 | 0.54 |  | -0.7% | -2.9 | - | 1.6 | 0.83 |
| log | 2-Hydroxypentanoate | 6.9% | -9.7 | - | 26.5 | 0.54 |  | 6.3% | -10.4 | - | 26.0 | 0.79 |
| log | Hydroxyproline | 2.2% | -3.4 | - | 8.1 | 0.54 |  | 3.3% | -2.4 | - | 9.4 | 0.65 |
| log | N-Acetylaspartate | -4.2% | -14.4 | - | 7.3 | 0.55 |  | -5.1% | -15.6 | - | 6.6 | 0.73 |
| log | Glycerophosphocholine | -2.0% | -7.4 | - | 3.8 | 0.58 |  | -2.2% | -7.7 | - | 3.7 | 0.78 |
| log | Isocitrate | 4.7% | -9.9 | - | 21.7 | 0.64 |  | 4.4% | -10.6 | - | 21.9 | 0.83 |
| log | Octanoate | -3.9% | -17.6 | - | 12.0 | 0.70 |  | -3.4% | -17.5 | - | 13.2 | 0.88 |
| log | Creatinine | -0.8% | -4.5 | - | 3.0 | 0.77 |  | -0.9% | -4.7 | - | 3.0 | 0.86 |
| log | Sarcosine | -2.3% | -13.7 | - | 10.5 | 0.79 |  | -0.9% | -12.3 | - | 12.1 | 0.95 |
| log | Glutarate | -1.4% | -9.2 | - | 7.0 | 0.80 |  | -2.3% | -10.1 | - | 6.2 | 0.83 |
| log | Urea | -1.3% | -9.0 | - | 7.0 | 0.81 |  | -1.3% | -9.1 | - | 7.2 | 0.91 |
| log | Indole-3-acetate | 2.0% | -11.9 | - | 18.0 | 0.83 |  | 3.1% | -11.2 | - | 19.8 | 0.88 |
| log | 2-Oxoglutarate | -0.7% | -5.9 | - | 4.8 | 0.83 |  | -1.5% | -6.8 | - | 4.1 | 0.83 |
| log | Urate | 2.5% | -15.4 | - | 24.1 | 0.83 |  | 1.2% | -16.6 | - | 22.9 | 0.95 |
| log | Pelargonate | 0.5% | -10.4 | - | 12.7 | 0.96 |  | 0.0% | -11.2 | - | 12.5 | 1.00 |
| log | Taurine | 0.1% | -4.0 | - | 4.4 | 0.96 |  | 1.3% | -3.0 | - | 5.7 | 0.83 |
| log | Dimethylglycine | 0.0% | -7.3 | - | 7.8 | 0.99 |  | -0.2% | -7.6 | - | 7.7 | 0.97 |

The results for the metabolites are listed in the order of significance. Asymmetric dimethylarginine, ADMA; Branched-chain amino acid, BCAA; Cysteine-glutathione disulfide; CSSG, Symmetric dimethylarginine; SDMA.

Model 1: unadjusted.

Model 2: adjusted for age, LDL-C, current smoker or not, current alcohol drinker or not, physical exercise level (high/low) and calorie intake (high/low).

aMetabolites labeled (log) were log-transformed.

bFor log-transformed metabolites, regression coefficients were backtransformed. For normal metabolites, regression coefficients were divided by the means.

cFDR p values are shown.

dSame as c for log-transformed metabolites. For normal metabolites, coefficients were divided by the adjusted means.