Fig.S1: OPLS-DA plot of fecal in positive mode and negative mode (a, fecal OPLS-DA plot of control and model group in positive mode; b, fecal OPLS-DA plot of GMDZ and model group in positive mode; c, fecal OPLS-DA plot of control and model group in negative mode; d, fecal OPLS-DA plot of GMDZ and model group in negative mode)

Fig.S2: Gut microbiota PICRUSt2 predictions result





Table S1 GMDZ components screening in positive mode

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number** | **Name** | **Formula** | **Calculated Mass** | **m/z** | **Mass Error (mDa)** | **Rt(min)** | **Adducts** | **Fragment ion（m/z）** | **Source** | **Structure** |
| 1\* | Berberine | C20H18NO4 | 336.1236 | 337.1294 | -1.4 | 0.1 | +H | 279.0956 | jujube |  |
| 2\* | Astragalin | C21H20O11 | 448.1006 | 466.1298 | -4.6 | 0.58 | NH4 | 295.11398、251.03585、133.06047 | licorice |  |
| 3\* | Daechualkaloid A | C7H9NO2 | 139.0633 | 140.0711 | 0.5 | 0.61 | +H | 126.05387、112.07488 | jujube |  |
| 4\*# | Vomifoliol | C13H20O3 | 224.1412 | 247.1297 | -0.7 | 0.83 | +Na | 116.0689、131.0501 | jujube |  |
| 5\* | Heteroauxin | C10H9NO2 | 175.0633 | 193.0977 | 0.5 | 0.97 | NH4 | 132.0797 | jujube |  |
| 6\* | CMP | C10H12N5O6P | 329.0525 | 330.0598 | 0 | 1.03 | +H | 136.0621、119.0349 | jujube |  |
| 7\* | Yinyanghuo D | C20H18O5 | 338.1154 | 341.1362 | -2.1 | 1.07 | +H | 216.1226、249.1219、233.1128、 | licorice |  |
| 8\* | Sigmoidin-B | C20H20O6 | 356.126 | 357.1298 | -3.4 | 1.22 | +H | 216.1226、287.0607 | licorice |  |
| 9\* | Cinnamic acid | C9H8O2 | 148.0524 | 166.0865 | 0.2 | 1.3 | +NH4,+H | 103.0545 | wheat |  |
| 10\* | 4-Hydroxy-3,5-dimethoxycinnamic acid | C11H12O5 | 224.0685 | 242.1015 | -0.8 | 1.47 | NH4 | 178.0720、127.0380 | wheat |  |
| 11\* | 7-Methoxy-2-methyl isoflavone | C17H14O3 | 266.0943 | 284.1277 | -0.4 | 2.22 | NH4 | 236.0920、223.0753、 | licorice |  |
| 12\* | Chlorogenic acid | C16H18O9 | 354.0951 | 372.1289 | 0 | 2.31 | NH4 | 295.1129、274.0916 | wheat |  |
| 13\* | Vitamin E | C29H50O2 | 430.3811 | 448.4105 | -4.4 | 2.93 | NH4 | 175.0756、137.0580 | wheat |  |
| 14\* | Zuztvisude I | C25H40O12 | 532.2520 | 450.1966 | -0.4 | 3.81 | +NH4,+Na | 265.0861、165.0709、144.0802 | jujube |  |
| 15\* | Stepholidine | C19H21NO4 | 327.1471 | 328.1531 | -1.2 | 5.12 | +H | 286.1431、165.0689、137.0601 | jujube |  |
| 16\* | Myristicin | C11H12O3 | 192.0786 | 193.0851 | -0.9 | 6.11 | +H | 177.0551、163.0377、137.0597、149.0574 | jujube |  |
| 17\* | 1-Methoxyficifolinol | C26H30O5 | 422.2093 | 445.1962 | -2.3 | 6.48 | +Na | 137.0236 | licorice |  |
| 18\* | 4H-1-Benzopyran-4-one, 2-(4-(beta-D-glucopyranosyloxy)phenyl)-2,3-dihydro-5,7-dihydroxy-, (2S)- | C21H22O10 | 434.1213 | 457.1079 | -2.6 | 6.85 | +Na,+H | 419.1358、273.0752、25.0805、147.0432、137.0226、119.0483 | licorice |  |
| 19\* | Eurycarpin A | C20H18O5 | 338.1154 | 339.1208 | -1.9 | 6.92 | +H | 216.1226、109.0283 | licorice |  |
| 20\* | Rutin | C27H30O16 | 610.1534 | 611.1606 | -0.1 | 6.93 | +H,+Na | 303.0495、133.0879、146.0569 | licorice, jujube |  |
| 21\* | Narcissoside | C28H32O16 | 624.169 | 647.1629 | 4.6 | 6.97 | +Na | 573.1616、520.0781、457、.0889、443.0922 | licorice |  |
| 22\* | Afrormosin | C17H14O5 | 298.0841 | 299.0913 | -0.1 | 7.1 | +H | 147.0438、119.0486 | licorice |  |
| 23\* | Asimilobine | C17H17NO2 | 267.1259 | 268.133 | -0.2 | 7.23 | +H | 251.1076、208.0874、191.0851、165.0688 | jujube |  |
| 24\* | Licochalcone C | C21H22O4 | 338.1518 | 361.1387 | -2.4 | 7.26 | +Na | 161.0605、137.0599 | licorice |  |
| 25\* | Ononin | C22H22O9 | 430.1264 | 431.1334 | -0.3 | 9.68 | +H,+Na | 269.0809、291.0628、254.0565、237.0546 | licorice |  |
| 26\* | 24-Hydroxy-11-deoxyglycyrrhetic acid | C29H46O4 | 458.3396 | 476.37 | -3.5 | 9.96 | NH4 | 209.1634、228.1584、189.1623、149.1318 | licorice |  |
| 27\*# | Jujubasaponin VI | C42H68O14 | 796.4609 | 797.4674 | -0.7 | 9.97 | +H | 601.4098、439.3569、341.2425、269.0805 | jujube |  |
| 28\* | Alphitotic acid | C30H48O4 | 472.3553 | 473.3621 | -0.5 | 10.39 | +H | 322.2486、341.2439、228.1582 | jujube |  |
| 29\* | Isoformononetin | C16H12O4 | 268.0736 | 269.0807 | -0.1 | 13.38 | +H,+Na | 253.0492、237.0544 | licorice |  |
| 30\* | Vestitol | C16H16O4 | 272.1049 | 273.1114 | -0.8 | 13.52 | +H | 149.0224 | licorice |  |
| 31\* | 24-Hydroxyglycyrrhetic acid | C30H46O5 | 486.3345 | 487.3423 | 0.5 | 14.32 | +H | 469.3317、451.3209、423.3256、405.3143 | licorice |  |
| 32\* | Glabrolide | C30H44O4 | 468.324 | 469.3317 | 0.4 | 14.44 | +H | 451.3209、439.3208、357.2419、283.2057 | licorice |  |
| 33\*# | Medicarpin | C16H14O4 | 270.0892 | 271.0961 | -0.4 | 14.77 | +H | 136.0606 | licorice |  |
| 34\* | 3-Hydroxyglabrol | C25H28O5 | 408.1937 | 431.182 | -0.9 | 15.34 | +Na | 161.0695、147.1166 | licorice |  |
| 35\* | 24-Dehydrocholesterol | C27H44O | 384.3392 | 407.3308 | 2.4 | 15.34 | +Na | 285.2212、189.1638、175.1482、121.1006 | jujube |  |
| 36\* | Jujuboside | C52H84O21 | 1044.5505 | 1045.5567 | -1.1 | 15.49 | +H | 495.3346、266.1508 | jujube |  |
| 37\* | Licorice-saponin C2 | C42H62O15 | 806.4089 | 807.4164 | 0.2 | 17.85 | +H,+Na,+NH4 | 453.3371、437.3430、409.3467、177.0371 | licorice |  |
| 38\* | Dibutyl phthalate | C16H22O4 | 278.1518 | 301.1409 | -0.2 | 22.46 | +Na,+H | 218.0581、149.0229 | licorice |  |
| 39\*# | Zizyphus saponin II | C47H76O17 | 912.5083 | 913.5074 | -8.1 | 24.1 | +H | 457.3100、373.2170、329.1896、221.1382、133.0859 | jujube |  |
| 40\*# | Glepidotin A | C20H18O5 | 338.1154 | 285.1108 | -1.3 | 24.2 | +H | 135.0421 | licorice |  |
| 41\* | Darutoside | C26H44O8 | 484.3036 | 507.2888 | -4.1 | 24.62 | +Na | 176.0624、156.0420 | jujube |  |
| 42\* | Scutianine C | C31H42N4O4 | 534.3206 | 535.323 | -4.9 | 24.93 | +H | 327.2016、283.1756、239.1484、172.1155 | jujube |  |
| 43\* | α-cadinol | C15H26O | 222.1984 | 240.2331 | 0.9 | 24.95 | NH4 | 172.1155、161.1336、135.1165 | licorice |  |
| 44\* | Ruvoside | C30H46O9 | 550.3142 | 551.3209 | -0.5 | 25.73 | +H | 313.1683、300.1431、185.0827、161.0695 | jujube |  |
| 45\*# | Malkangunin | C24H32O7 | 432.2148 | 455.2068 | 2.7 | 27.3 | +Na | 221.0858、191.1058、181.0841、169.0482 | jujube |  |
| 46\* | Vanillin | C8H8O3 | 152.0473 | 153.0536 | -1 | 27.38 | +H | 135.0429、121.0290、111.0430 | wheat |  |
| 47\* | Mauritine A | C32H41N5O5 | 575.3108 | 593.3462 | 1.6 | 27.57 | NH4 | 421.2413、232.11282、199.1253、166.0902 | jujube |  |
| 48\* | Araboglycyrrhizin | C41H62O14 | 778.414 | 779.4287 | 7.5 | 27.66 | +H | 694.4345、557.3031、547.3427、529.3822 | licorice |  |
| 49\* | Fumarine | C20H19NO5 | 353.1263 | 371.1618 | 1.7 | 28.73 | NH4 | 149.0221 | jujube |  |
| 50\*# | Liquoric acid | C30H44O5 | 484.3189 | 502.3504 | -2.3 | 29.86 | NH4 | 172.1156、295.2048 | licorice |  |
| 51\* | Spinosin | C28H32O15 | 608.1741 | 631.1671 | 3.8 | 31.12 | +Na | 445.1220、355.0702、281.0513、147.0647 | jujube |  |
| 52\* | Zizyphine A | C33H49N5O6 | 611.3683 | 629.3996 | -2.5 | 31.17 | NH4 | 336.2316、151.0773、135.0822 | jujube |  |
| 53\* | Roseoside | C19H30O8 | 386.1941 | 409.1839 | 0.6 | 32.78 | +Na | 147.1127、133.0862 | jujube |  |
| 54 | GLO | C6H12O6 | 192.0583 | 215.0724 | 0.3 | 0.57 | +Na | 162.07585、144.06486 | jujube |  |
| 55 | beta-Glucan | C24H42021 | 666.2219 | 667.2304 | 1.3 | 0.62 | +H,+Na | 505.17758、476.17643、343.12376、325.11332 | wheat |  |
| 56# | Odoratin | C15H22O4 | 266.1518 | 289.142 | 0.9 | 0.65 | +Na | 232.1181、216.1229、204.0869 | licorice |  |
| 57 | Licopyranocoumarin | C21H20O7 | 384.1209 | 385.1261 | -2.1 | 0.66 | +H | 343.1276、260.1136、246.0595 | licorice |  |
| 58 | Jaranol | C17H14O6 | 314.079 | 315.0848 | -1.5 | 0.67 | +H | 225.0166、232.0791、 | licorice |  |
| 59 | Citric acid | C6H8O7 | 192.027 | 215.0153 | -0.9 | 0.68 | +Na | 148.0378、125.0207、132.0417 | wheat |  |
| 60 | Hispaglabridin B | C25H26O4 | 390.1831 | 413.169 | -3.3 | 0.81 | +Na | 296.0966、220.1041、182.0806 | licorice |  |
| 61 | Syringic acid | C9H10O5 | 198.0528 | 216.0865 | -0.2 | 0.87 | NH4 | 165.0551、109.0283 | wheat |  |
| 62 | Protocatechuic acid | C7H6O4 | 154.0266 | 172.0595 | -0.9 | 0.89 | NH4 | 109.0283 | licorice |  |
| 63 | Sinapyl alcohol | C11H14O4 | 210.0892 | 228.1232 | 0.2 | 0.92 | NH4 | 109.0283、165.0551 | jujube |  |
| 64 | (2S)-2-hydroxysuccinic acid | C4H6O5 | 134.0215 | 135.0284 | -0.4 | 1.09 | +H | 119.0349 | jujube |  |
| 65 | Inositol | C6H12O6 | 180.0634 | 203.0523 | -0.3 | 1.13 | +Na | 146.0588、130.0641 | wheat |  |
| 66 | Caffeic acid | C9H8O4 | 180.0423 | 198.0758 | -0.3 | 1.25 | NH4 | 109.0283 | wheat |  |
| 67 | 4,2',4',alpha-Tetrahydroxydihydrochalcone | C15H14O5 | 274.0841 | 292.1177 | -0.3 | 1.27 | NH4 | 136.0607 | licorice |  |
| 68 | Catechin | C15H14O6 | 290.079 | 308.1143 | 1.4 | 1.46 | NH4 | 274.0916、123.0429 | jujube |  |
| 69# | Ferulic Acid | C10H10O4 | 194.0579 | 212.0918 | 0.1 | 2.07 | NH4 | 165.0551、147.0449 | wheat |  |
| 70 | Vanillic acid | C8H8O4 | 168.0423 | 186.0748 | -1.3 | 2.25 | +NH4,+H | 139.0393、 | wheat |  |
| 71 | （S）-Aconitine | C34H47NO11 | 645.3149 | 286.1437 | -0.1 | 5.1 | +H | 269.1176、237.0898、165.0689、10.0483 | jujube |  |
| 72 | Isoglycyrol | C21H18O6 | 366.1103 | 367.1198 | 2.2 | 5.23 | +H | 324.1423 | licorice |  |
| 73 | Stepharine | C18H19NO3 | 297.1365 | 298.1437 | -0.1 | 5.5 | +H | 269.1178、238.0998、192.1009、161.0831、146.0595 | jujube |  |
| 74 | Corylifolinin | C20H20O4 | 324.1362 | 342.1701 | 0.1 | 5.58 | NH4 | 282.0887、2551.0698、239.698 | licorice |  |
| 75 | Nicotiflorin | C27H30O15 | 594.1585 | 595.1658 | 0.1 | 5.59 | +H | 297.1122、265.0862、222.0676、165.0699 | licorice |  |
| 76 | Isoschaftoside | C26H28O14 | 564.1479 | 565.1555 | 0.3 | 6.28 | +H,+Na | 511.1237、481.1097、4271027、325.0705、147.0418 | licorice |  |
| 77 | Licoricone | C22H22O6 | 382.1416 | 383.1457 | -3.2 | 6.55 | +H | 274.0916、165.0551 | licorice |  |
| 78 | Naringenin | C15H12O5 | 272.0685 | 273.0755 | -0.3 | 6.56 | +H | 255.0649、153.0176、119.0475 | licorice |  |
| 79# | Gancaonin A | C21H20O5 | 352.1311 | 257.0807 | -0.2 | 6.83 | +H | 239.0675、137.0226、119.0483 | licorice |  |
| 80 | Quercetin 3-O-β-D-glucopyranoside | C21H18O12 | 462.0798 | 465.1013 | -1.4 | 6.93 | +H | 303.0495、133.0879、 | licorice |  |
| 81 | Vitexin | C21H20O10 | 432.1056 | 433.1122 | -0.8 | 6.95 | +H | 303.0495、165.0687、147.0438、119.0486 | licorice |  |
| 82 | Liquiritin | C21H22O9 | 418.1264 | 441.1156 | 0 | 6.97 | +Na,+H,+NH4 | 257.0807、181.0643、165.0687、147.0638、 | licorice |  |
| 83 | Medicocarpin | C22H24O9 | 432.142 | 450.1753 | -0.6 | 6.97 | NH4 | 257.0807、281.0489、147.0438 | licorice |  |
| 84 | Naringin | C27H32O14 | 580.1792 | 581.1871 | 0.6 | 6.98 | +H | 441.1149、257.0807、147.0438、119.0486 | licorice |  |
| 85 | Calycosin | C16H12O5 | 284.0685 | 285.0755 | -0.2 | 7.08 | +H | 147.0438、135.0437 | licorice |  |
| 86 | Thiamine | C12H18Cl2N4OS | 336.0578 | 337.0682 | 3.1 | 7.1 | +H | 181.0628、128.0605、119.0486 | jujube |  |
| 87 | Isotrifoliol | C16H10O6 | 298.0477 | 316.079 | -2.6 | 7.1 | NH4 | 285.0755、257.0807、242.0566 | licorice |  |
| 88 | Violanthin | C27H30O14 | 578.1636 | 579.1707 | -0.1 | 7.11 | +H, +Na | 365.1041、379.0804、147.0438、165.0695 | licorice |  |
| 89 | Apigenin | C15H10O5 | 270.0528 | 271.0594 | -0.7 | 7.35 | +H | 257.0814 | wheat |  |
| 90 | Coumestrol | C15H8O5 | 268.0372 | 269.0434 | -1 | 8.17 | +H | 134.0345、163.0346 | jujube |  |
| 91 | 7,2,4'-Trihydroxy-5-methoxy-3-arylcoumarin | C16H12O6 | 300.0634 | 301.0706 | 0 | 8.17 | +H | 269.0443、167.0327、134.0345 | licorice |  |
| 92 | Moupinamide | C18H19NO4 | 313.1314 | 331.1646 | -0.6 | 8.31 | NH4 | 147.0431 | jujube |  |
| 93 | 7-Hydroxy-2-methyl-3-phenyl-chromone | C16H12O3 | 252.0786 | 270.1116 | -0.9 | 9.2 | NH4 | 239.0686、137.0228、119.0475 | licorice |  |
| 94 | Glycyroside | C27H30O13 | 562.1686 | 563.176 | 0.1 | 9.49 | +H,+Na | 269.0808、181.0646、152.0630、237.0542 | licorice |  |
| 95 | Isolicoflavonol | C20H18O6 | 354.1103 | 355.1162 | -1.4 | 12.34 | +H | 269.0807、254.0565、26.0609 | licorice |  |
| 96# | 18beta-glycyrrhetinic acid | C30H46O4 | 470.3396 | 471.3475 | 0.6 | 15.34 | +H | 453.3366、435、3259、407.3308、285.2213、217.1588 | licorice |  |
| 97 | Licoisoflavone B | C20H16O6 | 352.0947 | 353.1011 | -0.9 | 15.87 | +H | 153.0019 | licorice |  |
| 98# | Glycyrrhizin | C42H62O16 | 822.4038 | 823.4109 | -0.2 | 16.65 | +H,+Na | 669.3611、493.3279、435.3251、407.3290、280.1879 | licorice |  |
| 99 | Jujubasaponin IV | C48H78O18 | 942.5188 | 943.5251 | -1 | 16.77 | +H,+Na | 798.4703、599.3932、423.3623、119.0841 | jujube |  |
| 100 | Glabrone | C20H16O5 | 336.0998 | 337.1059 | -1.1 | 18.64 | +H | 201.0454 | licorice |  |
| 101 | Sitosterol | C29H50O | 414.3862 | 437.3714 | -3.9 | 22.09 | +Na | 281.2934 | licorice |  |
| 102 | Glyasperin A. | C25H26O6 | 422.1729 | 423.1776 | -2.6 | 23.37 | +H | 285.0746、269.0809 | licorice |  |
| 103 | Gadelaidic acid | C20H38O2 | 310.2872 | 311.2939 | -0.5 | 24.21 | +H | 227.2000、137.1296 | licorice |  |
| 104 | Zeaxanthin | C40H56O2 | 568.428 | 591.423 | 5.8 | 25.71 | +Na | 172.1156、137.1322 | wheat |  |
| 105 | Swertisin | C22H22O11 | 462.1162 | 485.1101 | 4.6 | 26.34 | +Na | 268.0255、280.0333、171.9734 | jujube |  |
| 106 | Kanzonol F | C26H28O5 | 420.1937 | 421.2015 | 0.6 | 27.3 | +H | 204.0869、211.0919 | licorice |  |
| 107 | Licoriisoflavan A | C27H34O5 | 438.2406 | 439.2509 | 3 | 27.88 | +H | 397.2435、422.2444 | licorice |  |
| 108 | Icosanoic acid | C20H40O2 | 312.3028 | 330.3358 | -0.9 | 34.37 | NH4 | 283.2636、227.1991 | licorice |  |

Note: \* represents component in feces; # represents component in blood.

TableS2 GMDZ components screening in negative mode

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number** | **Name** | **Formula** | **Calculated Mass** | **m/z** | **Mass Error (mDa)** | **Rt(min)** | **Adducts** | **Fragment ion（m/z）** | **Source** | **Structure** |
| 1\* | beta-Glucan | C24H42O21 | 666.2219 | 665.2159 | 1.3 | 0.77 | -H | 341.1089、267.0723、221.0661、179.0555 | wheat |  |
| 2\* | Syringic acid | C9H10O5 | 198.0528 | 243.0532 | 2.2 | 0.99 | +HCOO | 181.0469、153.0180、121.0269 | wheat |  |
| 3\*# | Glepidotin A | C20H18O5 | 338.1154 | 283.0957 | -1.8 | 1.04 | -H | 109.0254 | licorice |  |
| 4\* | Vanillic acid | C8H8O4 | 168.0423 | 167.0344 | -0.6 | 1.12 | -H | 135.0459 | wheat |  |
| 5\* | Uralenneoside | C12H14O8 | 286.0689 | 285.0618 | 0.2 | 1.18 | -H | 164.0708、108.0174 | licorice |  |
| 6\* | CMP | C10H12N5O6P | 329.0525 | 328.0455 | 0.3 | 1.25 | -H | 192.9898、134.0451 | jujube |  |
| 7\* | Vestitol | C16H16O4 | 272.1049 | 271.095 | -2.6 | 4.06 | -H | 255.0666、148.0154、119.0472 | licorice |  |
| 8\* | 1-(4-Coumaroyl)alpha-rhamnopyranose | C15H18O7 | 310.1053 | 355.102 | -1.4 | 6.45 | +HCOO | 255.0663、135.0068、119.0472、165.0553 | jujube |  |
| 9\* | 4H-1-Benzopyran-4-one, 2-(4-(beta-D-glucopyranosyloxy)phenyl)-2,3-dihydro-5,7-dihydroxy-, (2S)- | C21H22O10 | 434.1213 | 433.1138 | -0.2 | 6.72 | -H | 271.0613、284.0321、151.0024、125.0196 | licorice |  |
| 10\* | Naringenin | C15H12O5 | 272.0685 | 271.0614 | 0.2 | 6.87 | -H | 151.0024、15.0272、125.0196 | licorice |  |
| 11\* | Naringin | C27H32O14 | 580.1792 | 579.1719 | -0.1 | 6.9 | -H | 433.1136、271.0613、151.0024、125.0196 | licorice |  |
| 12\* | Rutin | C27H30O16 | 610.1534 | 609.1464 | 0.3 | 6.98 | -H | 417.1192、383.0775、300.0278、161.0234 | jujube, licorice |  |
| 13\* | Swertisin | C22H22O10 | 446.1213 | 507.1144 | 0 | 7.01 | +HCOO | 417.1192、135.0069、119.00473 | jujube |  |
| 14\* | Vitexin | C21H20O10 | 432.1057 | 431.0986 | 0.2 | 7.06 | -H | 311.0574、341.0621、283.0600 | licorice |  |
| 15\* | Violanthin | C27H30O14 | 578.1636 | 577.1565 | 0.2 | 7.16 | -H | 549.1618、457.1139、429.1183、399.1082、383.0773、353.0667、325.074 | licorice |  |
| 16\* | Chlorogenic acid | C16H18O9 | 354.0951 | 353.086 | -1.8 | 7.28 | -H | 271.0614、165.0556、135.0431 | wheat |  |
| 17\* | Isoviolanthin | C15H10O4 | 254.0579 | 253.051 | 0.4 | 9.15 | -H | 117.0315 | licorice |  |
| 18\* | Spinosin | C28H32O15 | 608.1741 | 607.1668 | -0.1 | 9.51 | -H | 549.1610、429.1044、267.0666、252.0429 | jujube |  |
| 19\* | Glycyroside | C27H30O13 | 562.1686 | 561.1615 | 0.1 | 9.51 | -H,+HCOO | 429.1044、267.0666、252.0429 | licorice |  |
| 20\* | Ononin | C22H22O9 | 430.1264 | 475.1247 | 0.1 | 9.7 | +HCOO,-H | 267.0666、252.0430、132.0195 | licorice |  |
| 21\* | Alphitotic acid | C30H48O4 | 472.3553 | 471.3469 | -1 | 10.26 | -H | 279.2333 | jujube |  |
| 22\* | Calycosin | C16H12O5 | 284.0685 | 283.0607 | -0.5 | 11.94 | -H | 137.0225 | licorice |  |
| 23\*# | Medicarpin | C16H14O4 | 270.0892 | 269.0815 | -0.4 | 14.72 | -H | 254.0583 | licorice |  |
| 24\* | Jujuboside | C52H84O21 | 1044.5505 | 1089.5472 | -1.5 | 15.42 | +HCOO,-H | 953.4739、925.4801、911.5006、849.4261、171.1019 | jujube |  |
| 25\* | 24-Hydroxyglycyrrhetic acid | C30H46O5 | 486.3345 | 485.3269 | -0.4 | 15.66 | -H | 441.3374、371.2587、323.2389 | licorice |  |
| 26\*# | Zizyphus saponin II | C47H76O17 | 912.5083 | 911.5006 | -0.4 | 16.64 | -H | 823.4108、629.3687、647.3844、585.37、471.3475、4112019 | jujube |  |
| 27\* | beta-Glycyrrhetinic acid | C30H46O4 | 470.3396 | 469.3322 | -0.1 | 22.7 | -H | 303.2330、355.2642、337.2493 | licorice |  |
| 28\* | Eleutheroside A | C35H60O6 | 576.4390 | 621.437 | -0.2 | 28.4 | +HCOO | 325.1846 | jujube |  |
| 29 | Medicocarpin | C22H24O9 | 432.1420 | 431.1386 | 3.8 | 0.66 | -H | 326.0992、245.0427、179.0554 | licorice |  |
| 30 | Xylose | C5H10O5 | 150.0528 | 195.0504 | -0.6 | 0.7 | +HCOO | 102.9991 | wheat |  |
| 31 | Glucuronic acid | C5H6O4 | 130.0266 | 193.0338 | -1.5 | 0.72 | -H | 125.0221、111.0516 | licorice |  |
| 32 | Citric acid | C6H8O7 | 192.0270 | 191.0192 | -0.5 | 0.74 | -H | 133.0121、117.0160、111.0051 | wheat |  |
| 33 | Inositol | C6H12O6 | 180.0634 | 180.0654 | 1.4 | 0.78 | -H | 161.0444、143.0336、119.0317、101.0198 | wheat |  |
| 34 | Eurycarpin A | C20H18O5 | 338.1154 | 383.1128 | -0.9 | 1.03 | +HCOO | 109.0254、121.0269 | licorice |  |
| 35 | Caffeic acid | C9H8O4 | 180.0423 | 179.0333 | -1.7 | 1.05 | -H,+HCOO | 109.0254 | wheat |  |
| 36 | 3-[[(2S)-2,4-dihydroxy-3,3-dimethylbutyryl]amino]propionic acid | C9H17NO5 | 219.1107 | 218.1031 | -0.3 | 1.07 | -H | 124.0375、146.0803 | jujube |  |
| 37 | p-Coumaric acid | C9H8O3 | 164.0473 | 209.0453 | -0.2 | 1.24 | +HCOO | 119.0474 | wheat, jujube |  |
| 38 | Zuztvisude I | C25H40O12 | 532.2520 | 431.1557 | -0.1 | 3.68 | -H,+HCOO | 269.1025 | jujube |  |
| 39 | ZizybeosideII | C25H38O16 | 594.216 | 593.2086 | -0.1 | 4.91 | -H,+HCOO | 431.1551 | jujube |  |
| 40 | Nicotiflorin | C27H30O15 | 594.1585 | 593.1513 | 0.1 | 5.63 | -H | 473.1096、383.0772、365.0646、353.0671 | licorice |  |
| 41 | Sinapyl alcohol | C11H14O4 | 210.0892 | 209.082 | 0 | 6.16 | -H | 165.0545、151.0384 | jujube |  |
| 42 | Isoschaftoside | C26H28O14 | 564.1479 | 563.1407 | 0 | 6.33 | -H | 545.1322、503.1189、473.1093、443.0985、425.0866、383.0772、353.0666 | licorice |  |
| 43 | Glycyrrhiza flavonol A | C20H18O7 | 370.1053 | 415.1034 | -0.1 | 6.38 | +HCOO | 295.0641、252.0439 | licorice |  |
| 44# | Vomifoliol | C13H20O3 | 224.1412 | 223.1339 | -0.1 | 6.46 | -H | 165.0553、119.0472 | jujube |  |
| 45# | Gancaonin A | C21H20O5 | 352.1311 | 301.0726 | 0.9 | 6.66 | +HCOO | 119.042 | licorice |  |
| 46 | Narcissoside | C28H32O16 | 624.169 | 624.1755 | 5.9 | 6.86 | +e | 563.1407、443.0977、383.0756、353.0671 | licorice |  |
| 47 | Liquiritin | C21H22O9 | 418.1264 | 417.1195 | 0.3 | 7.01 | -H | 255.0667、213.0669、135.0069、148.0151 | licorice |  |
| 48 | Glyasperin A | C25H26O6 | 422.1729 | 467.1679 | -3.2 | 7.31 | +HCOO | 151.0382、135.0431 | licorice |  |
| 49 | Methoxyficifolinol | C26H30O5 | 422.2093 | 467.2121 | 4.6 | 11.29 | +HCOO | 269.0441 | licorice |  |
| 50 | 6,8-Bis(C-β-glucosyl)-apigenin | C15H10O5 | 270.0528 | 269.046 | 0.5 | 11.31 | -H | 252.0391、163.0397、119.0469 | wheat |  |
| 51 | Licoricidin | C₂₆H₃₂O₅ | 424.225 | 469.2251 | 1.9 | 12.59 | +HCOO | 121.0267 | licorice |  |
| 52 | Inflacoumarin A | C20H18O4 | 322.1205 | 367.1179 | -0.8 | 13.29 | +HCOO | 121.0265 | licorice |  |
| 53 | Isoformononetin | C16H12O4 | 268.0736 | 267.0665 | 0.2 | 13.36 | -H | 252.0429、121.0265、135.0070 | licorice |  |
| 54 | Araboglycyrrhizin | C41H62O14 | 778.414 | 823.41 | -2.2 | 14.98 | +HCOO | 731.4028、585.3441、411.2001、377.2823、323.2372 | licorice |  |
| 55 | jujubasaponin IV | C48H78O18 | 942.5188 | 941.5112 | -0.3 | 16.42 | -H | 807.4176、747.4296、661 .3602、601.3712、583.3645、339.0937 | jujube |  |
| 56 | Sigmoidin-B | C20H20O6 | 356.126 | 355.1188 | 0.1 | 16.42 | -H | 148.0519、125.0216、205.1235、177.0918 | licorice |  |
| 57 | Licoisoflavone B | C20H16O6 | 352.0947 | 351.0874 | 0 | 16.52 | -H | 175.0792、 | licorice |  |
| 58# | Glycyrrhizin | C42H62O16 | 822.4038 | 821.3965 | 0 | 16.85 | -H | 807.4175、645.3641、583.3636、469.3325、113.0209 | licorice |  |
| 59 | Pentadecanoic acid | C15H30O2 | 242.2246 | 287.223 | 0.2 | 17.06 | +HCOO | 183.1376 | wheat |  |
| 60 | Isolicoflavonol | C20H18O6 | 354.1103 | 353.1032 | 0.1 | 17.54 | -H | 125.0220、284.0324 | licorice |  |
| 61 | 12-O-Nicotinoylisolineolone | C27H35NO6 | 469.63 | 469.2439 | -3.1 | 17.58 | -H | 285.114 | jujube |  |
| 62 | licorice-saponin C2 | C42H62O15 | 806.4089 | 805.4012 | -0.4 | 18.65 | -H | 743.3981、613.3717、351.0571、193.0351、113. 0206 | licorice |  |

Note: \* represents component in feces; # represents component in blood.

Table S3 The standard curve concentration of each endogenous metabolite.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Analyte | Diluent | DP(eV) | CE(eV) | Precursor Ion/Product Ion [m/z] | Rt | Standard curve(ug/ml) | R2 |
| 1 | Phe | 50% Methanol | 57 | 16 | 166.3/120.1 | 1.31 | y = 54.299x + 2.0239 (0.05~2) | 0.9944 |
| 2 | PPA | 50% Methanol | 75 | 16 | 165.3/123.0 | o.93 | y = 54.299x + 2.0239 (0.05~2) | 0.9924 |
| 3 | Tyr | 50% Methanol with 0.1% formic acid | 45 | 17 | 182.3/165.1 | 0.94 | y = 14.842x + 0.4495 (0.05~2) | 0.9931 |
| 4 | IS | 50% Methanol | 33 | 19 | 154.1/136.0 | 2.66 | / | / |

Table S4: Correlations of inflammatory factors, the GM and metabolites

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data1 | Data2 | rho | pvalue | relation |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | g\_\_Candidatus\_Saccharimonas | 0.690402 | 0.002049 | positive |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | g\_\_Collinsella | 0.688833 | 0.00157 | positive |
| Calcitriol | g\_\_Erysipelatoclostridium | 0.682147 | 0.002415 | positive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | g\_\_Lachnospiraceae\_UCG-010 | 0.677239 | 0.002018 | positive |
| LysoPC(22:6(4Z,7Z,10Z,13Z,16Z,19Z)) | g\_\_Negativibacillus | 0.668441 | 0.002425 | positive |
| LysoPC(14:0/0:0) | TNF-α | 0.665635 | 0.003306 | positive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | g\_\_Lachnospiraceae\_UCG-010 | 0.664481 | 0.002629 | positive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | g\_\_Candidatus\_Saccharimonas | 0.659443 | 0.003701 | positive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | g\_\_Candidatus\_Saccharimonas | 0.647059 | 0.004607 | positive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | g\_\_Negativibacillus | 0.635071 | 0.004629 | positive |
| LysoPC(18:1(11Z)) | g\_\_Tyzzerella | 0.634675 | 0.005684 | positive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | g\_\_Candidatus\_Saccharimonas | 0.622291 | 0.006957 | positive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | g\_\_Negativibacillus | 0.612129 | 0.006932 | positive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | g\_\_Negativibacillus | 0.610044 | 0.00718 | positive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | g\_\_Collinsella | 0.60726 | 0.007523 | positive |
| LysoPC(20:2(11Z,14Z)) | IL-18 | 0.603715 | 0.009289 | positive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | g\_\_Corynebacterium\_1 | 0.602728 | 0.008109 | positive |
| (24S)-7alpha,24-Dihydroxycholesterol | g\_\_Christensenellaceae\_unclassified | 0.594734 | 0.009233 | positive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | g\_\_Lachnospiraceae\_UCG-010 | 0.592186 | 0.009616 | positive |
| LysoPC(14:0/0:0) | IL-1β | 0.589876 | 0.009974 | positive |
| PC(16:0/20:4(5Z,8Z,11Z,14Z)) | g\_\_Candidatus\_Saccharimonas | 0.589267 | 0.011509 | positive |
| Lithocholate 3-O-glucuronide | g\_\_Erysipelatoclostridium | 0.583075 | 0.012583 | positive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | g\_\_Corynebacterium\_1 | 0.575538 | 0.012446 | positive |
| Calcitriol | g\_\_Phascolarctobacterium | 0.570774 | 0.013368 | positive |
| LysoPC(18:1(11Z)) | g\_\_Ruminococcaceae\_UCG-002 | 0.563904 | 0.014792 | positive |
| LysoPC(22:6(4Z,7Z,10Z,13Z,16Z,19Z)) | g\_\_Corynebacterium\_1 | 0.559676 | 0.015726 | positive |
| (24S)-7alpha,24-Dihydroxycholesterol | g\_\_Phascolarctobacterium | 0.557109 | 0.016316 | positive |
| 3a,6b,7a,12a-Tetrahydroxy-5b-cholanoic acid | TNF-α | 0.556244 | 0.018205 | positive |
| PC(18:0/18:2(9Z,12Z)) | g\_\_Candidatus\_Saccharimonas | 0.556244 | 0.018205 | positive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | g\_\_Collinsella | 0.555145 | 0.016779 | positive |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | g\_\_Lachnospiraceae\_UCG-010 | 0.553912 | 0.017075 | positive |
| g\_\_Tyzzerella | TNF-α | 0.546578 | 0.018921 | positive |
| 20a,22b-Dihydroxycholesterol | g\_\_Erysipelatoclostridium | 0.541796 | 0.021975 | positive |
| 21-Hydroxypregnenolone | g\_\_Dorea | 0.539426 | 0.020869 | positive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | g\_\_Collinsella | 0.535885 | 0.02189 | positive |
| PC(18:0/18:2(9Z,12Z)) | g\_\_Negativibacillus | 0.532876 | 0.022789 | positive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | g\_\_Corynebacterium\_1 | 0.529087 | 0.023961 | positive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | g\_\_Negativibacillus | 0.526619 | 0.024749 | positive |
| LysoPC(18:1(11Z)) | g\_\_Muribaculaceae\_unclassified | 0.525284 | 0.027017 | positive |
| PC(18:0/18:2(9Z,12Z)) | g\_\_Collinsella | 0.521156 | 0.026566 | positive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | g\_\_Collinsella | 0.51889 | 0.027349 | positive |
| 4,6-Dihydroxyquinoline | TNF-α | 0.517028 | 0.029861 | positive |
| Ethyl Arachidonate | g\_\_Candidatus\_Saccharimonas | 0.514964 | 0.030607 | positive |
| (24S)-7alpha,24-Dihydroxycholesterol | g\_\_Erysipelatoclostridium | 0.508772 | 0.032935 | positive |
| 20a,22b-Dihydroxycholesterol | g\_\_Phascolarctobacterium | 0.507705 | 0.031482 | positive |
| 3a,6b,7a,12a-Tetrahydroxy-5b-cholanoic acid | IL-1β | 0.507232 | 0.031667 | positive |
| PC(18:0/18:2(9Z,12Z)) | g\_\_Lachnospiraceae\_UCG-010 | 0.505006 | 0.032549 | positive |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | g\_\_Negativibacillus | 0.503677 | 0.033084 | positive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | g\_\_Lachnospiraceae\_UCG-010 | 0.502879 | 0.033408 | positive |
| 17a-Hydroxypregnenolone | g\_\_Clostridiales\_Family\_IV.\_Incertae\_Sedis\_unclassified | 0.501552 | 0.033953 | positive |
| 7-a,27-Dihydroxycholesterol | g\_\_Phascolarctobacterium | 0.501399 | 0.034017 | positive |
| Calcitriol | g\_\_Escherichia-Shigella | 0.500516 | 0.036253 | positive |
| 4,6-Dihydroxyquinoline | g\_\_Christensenellaceae\_unclassified | -0.50387 | 0.033005 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Negativibacillus | -0.50576 | 0.032247 | negtive |
| Cholic acid | g\_\_Ruminococcaceae\_UCG-002 | -0.50672 | 0.031869 | negtive |
| g\_\_Collinsella | IL-1β | -0.51381 | 0.029171 | negtive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | TNF-α | -0.51496 | 0.030607 | negtive |
| Tetrahydrocorticosterone | g\_\_Collinsella | -0.51776 | 0.027747 | negtive |
| Phytosphingosine | g\_\_Collinsella | -0.51776 | 0.027747 | negtive |
| Phenylpyruvic acid | g\_\_Lachnospiraceae\_UCG-010 | -0.52627 | 0.024862 | negtive |
| 7-a,27-Dihydroxycholesterol | g\_\_Muribaculaceae\_unclassified | -0.52735 | 0.026341 | negtive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | TNF-α | -0.52941 | 0.025678 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Dorea | -0.53735 | 0.021463 | negtive |
| LysoPC(22:6(4Z,7Z,10Z,13Z,16Z,19Z)) | TNF-α | -0.53973 | 0.022561 | negtive |
| Leukotriene D4 | TNF-α | -0.56244 | 0.016757 | negtive |
| 20a,22b-Dihydroxycholesterol | g\_\_Muribaculaceae\_unclassified | -0.56244 | 0.016757 | negtive |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | TNF-α | -0.5645 | 0.016296 | negtive |
| Docosahexaenoic acid | IL-1β | -0.56715 | 0.014105 | negtive |
| Phytosphingosine | g\_\_Christensenellaceae\_unclassified | -0.56892 | 0.013741 | negtive |
| 4,6-Dihydroxyquinoline | g\_\_Collinsella | -0.56987 | 0.013548 | negtive |
| 3a,6b,7a,12a-Tetrahydroxy-5b-cholanoic acid | g\_\_Candidatus\_Saccharimonas | -0.57069 | 0.014972 | negtive |
| Calcitriol | g\_\_Muribaculaceae\_unclassified | -0.5872 | 0.011858 | negtive |
| PC(16:0/20:4(5Z,8Z,11Z,14Z)) | IL-1β | -0.59298 | 0.009496 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Corynebacterium\_1 | -0.59366 | 0.009392 | negtive |
| Phenylpyruvic acid | g\_\_Christensenellaceae\_unclassified | -0.61435 | 0.006675 | negtive |
| Phenylpyruvic acid | g\_\_Coprococcus\_2 | -0.61625 | 0.006461 | negtive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | TNF-α | -0.62023 | 0.00719 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Escherichia-Shigella | -0.63261 | 0.005882 | negtive |
| g\_\_Lachnospiraceae\_UCG-010 | IL-1β | -0.6346 | 0.004669 | negtive |
| Ethyl Arachidonate | IL-1β | -0.63946 | 0.00427 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Lachnospiraceae\_UCG-010 | -0.65172 | 0.003384 | negtive |
| PE(20:5(5Z,8Z,11Z,14Z,17Z)/18:4(6Z,9Z,12Z,15Z)) | IL-1β | -0.65289 | 0.003309 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Phascolarctobacterium | -0.66958 | 0.002369 | negtive |
| LysoPC(22:6(4Z,7Z,10Z,13Z,16Z,19Z)) | IL-1β | -0.71488 | 0.000855 | negtive |
| PE(20:5(5Z,8Z,11Z,14Z,17Z)/18:4(6Z,9Z,12Z,15Z)) | TNF-α | -0.71517 | 0.001207 | negtive |
| Cholic acid | g\_\_Clostridiales\_Family\_IV.\_Incertae\_Sedis\_unclassified | -0.72079 | 0.000739 | negtive |
| LysoPC(18:1(11Z)) | g\_\_Erysipelatoclostridium | -0.72136 | 0.001048 | negtive |
| PC(18:0/18:2(9Z,12Z)) | TNF-α | -0.73787 | 0.000702 | negtive |
| LysoPE(20:4(8Z,11Z,14Z,17Z)/0:0) | IL-1β | -0.76033 | 0.00025 | negtive |
| LysoPC(20:4(8Z,11Z,14Z,17Z)) | IL-1β | -0.7686 | 0.000194 | negtive |
| PC(14:0/22:4(7Z,10Z,13Z,16Z)) | IL-1β | -0.78822 | 0.000102 | negtive |
| LysoPE(22:6(4Z,7Z,10Z,13Z,16Z,19Z)/0:0) | IL-1β | -0.80579 | 5.42E-05 | negtive |
| PC(18:0/18:2(9Z,12Z)) | IL-1β | -0.85021 | 7.88E-06 | negtive |
| PE(18:3(6Z,9Z,12Z)/20:5(5Z,8Z,11Z,14Z,17Z)) | IL-1β | -0.8657 | 3.46E-06 | negtive |