

Supplementary Material

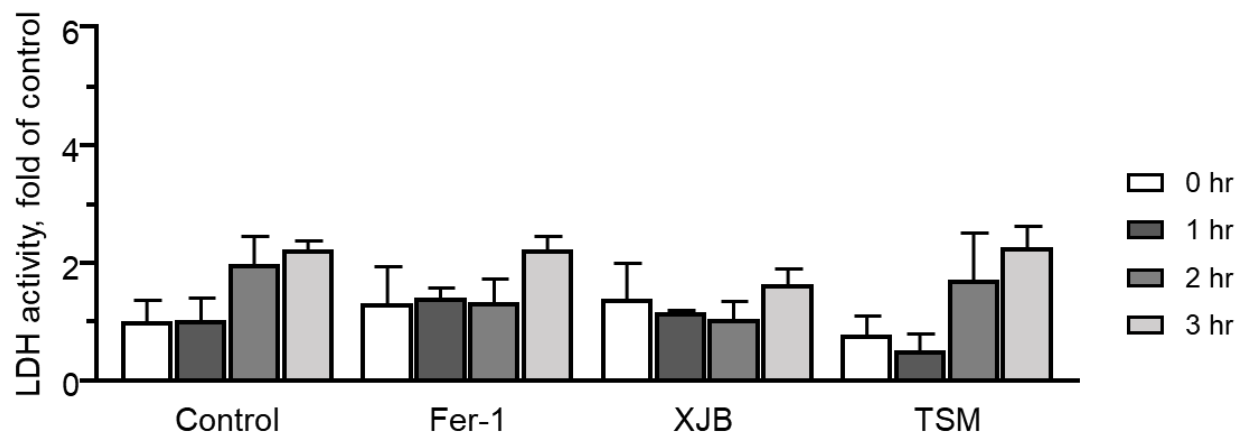


Figure S1. Time-dependence analysis of the effects of antioxidants (Fer-1, XJB, and TSM) on LDH activity in control (no RSL3) cells. LDH activity was measured in the culture medium containing H9c2 cells that were incubated with 1 μ M Fer-1, 0.2 μ M XJB, or 0.6 μ M TSM for 1, 2, and 3 hr. Data were normalized to control for each time-point and presented as a fold increase. n=3 per group.

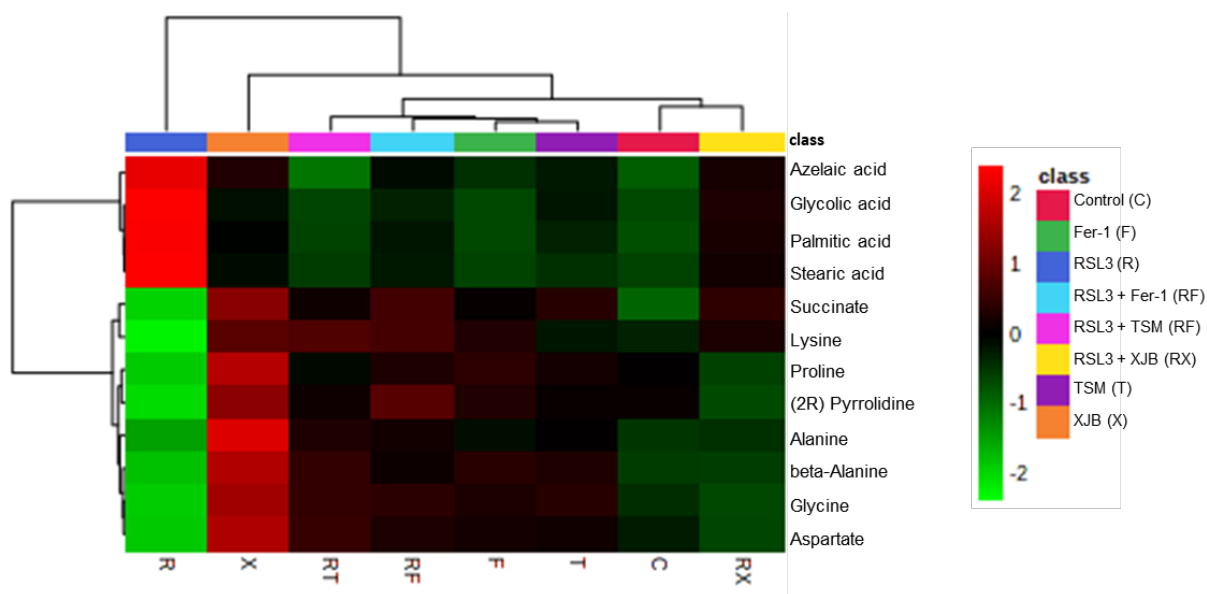


Figure S2. The metabolome of H9c2 cells exposed to RSL3 in the presence and absence of Fer-1, XJB or TSM. Heatmap displays average metabolites concentration (mM) for each group as compared to control and RSL3 groups after Bonferroni correction. The conditions (in the abscise axis) and the bins/metabolites (in the ordinate axis) have been sorted according to cluster analysis. The fold change is color-coded according to the bar legend. C, control; R, RSL3; F, Fer-1; X, XJB; T, TSM; RF, RSL3+Fer-1; RX, RSL3+XJB; RT, RSL3+TSM. Green represents lower concentration; red represents higher concentrations. n=4-6 per group.

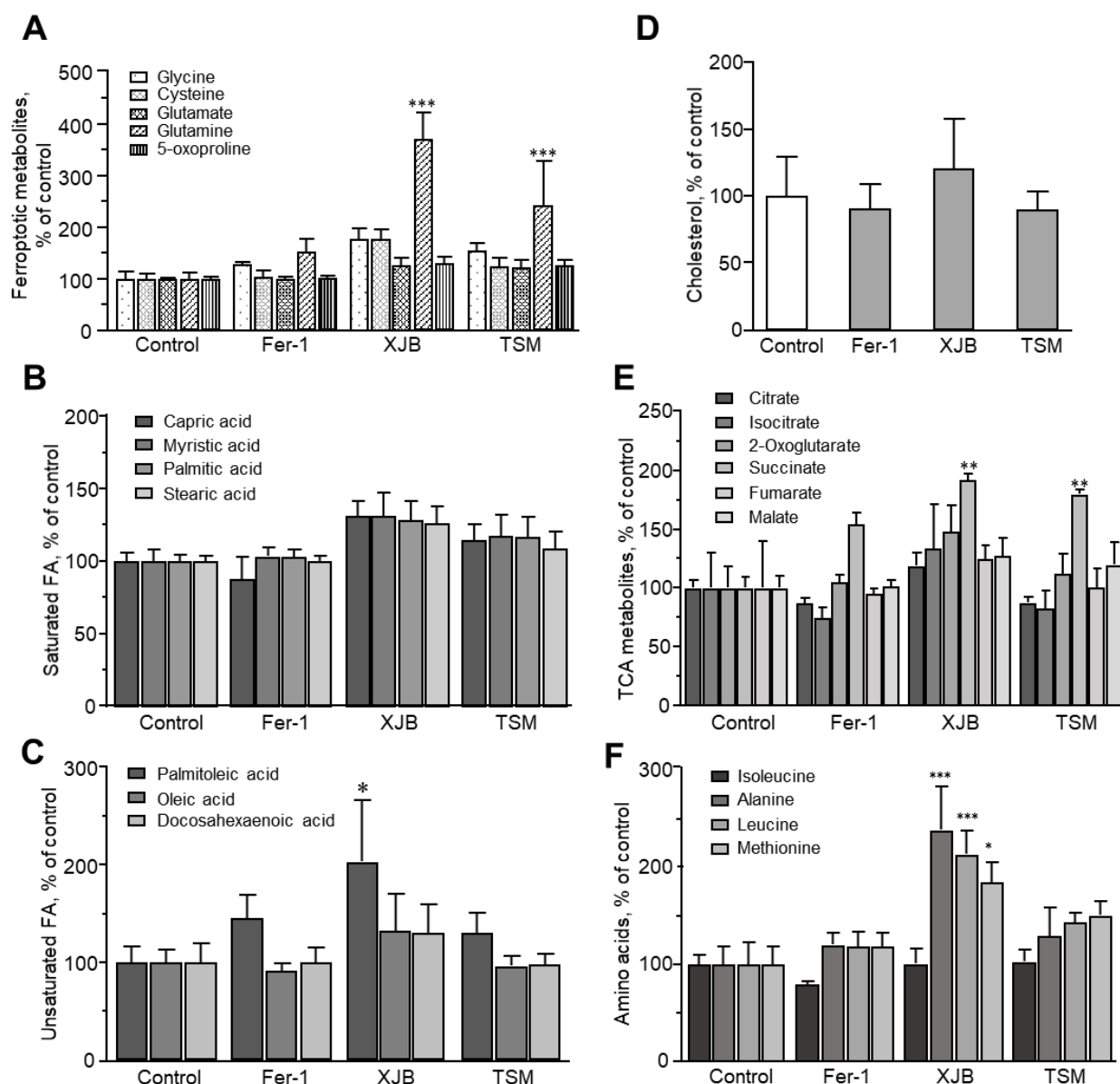


Figure S3. The effects of antioxidants (Fer-1, XJB and TSM) on GSH precursor metabolites, saturated and unsaturated FA, cholesterol, TCA metabolites and amino acids in control (no RSL3) cells. Glycine, cysteine, glutamate, and glutamine represent GSH precursors, while 5-oxoproline is a marker of GSH degradation within the cell (**A**). Saturated FA include capric, myristic, palmitic, and stearic acid (**B**). Unsaturated FA include palmitoleic, oleic, and docosahexaenoic acid (**C**). Cholesterol levels in control and antioxidant-treated cells (**D**). The TCA metabolites (**E**) identified were citrate, isocitrate, 2-oxoglutarate, succinate, fumarate, and malate. The amino acids identified are isoleucine, alanine, leucine, and methionine (**F**). Data are presented as percentage of control. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ vs control. $n = 4-6$ per group.

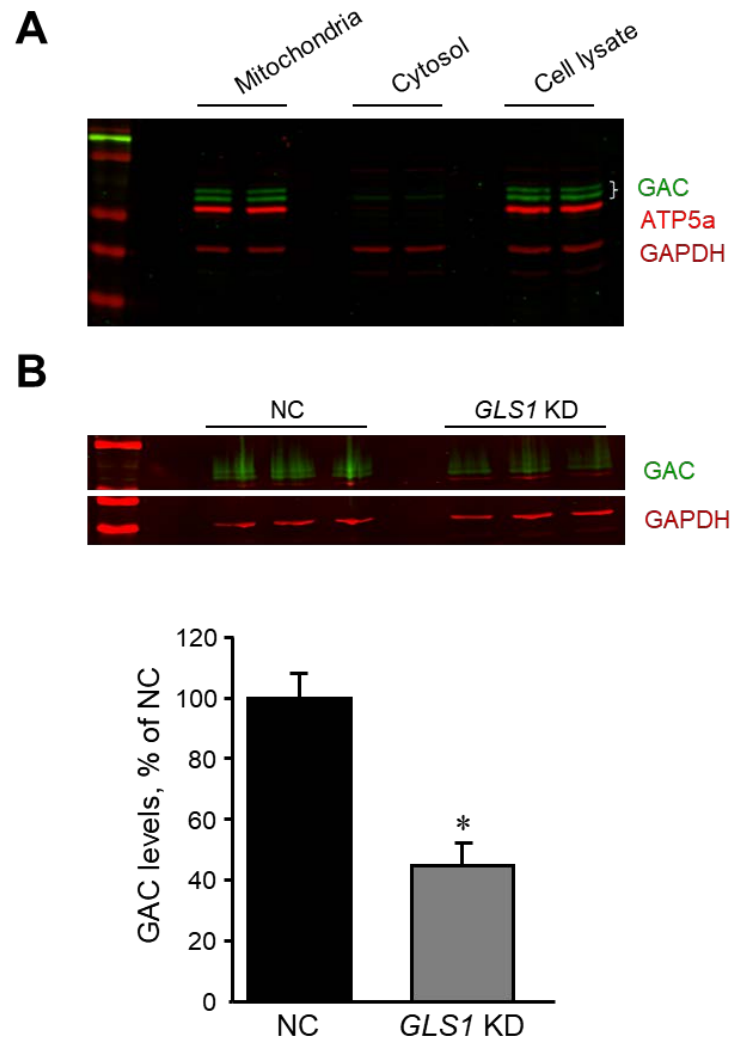


Figure S4. Mitochondrial *GLS1* silencing in H9c2 cells. Representative immunoblots (*top*) that represent localization of GAC in mitochondria isolated from H9c2 cells (**A**). Immunoblot representing GAC in non-coding (NC) and *GLS1* KD cardiomyocytes (**B**). ATP5A and GAPDH expression were used to validate the mitochondrial expression of GAC. Expression of GAC was normalized to GAPDH. Quantitative data of GAC from NC and *GLS1* KD are presented as percentage of NC. * $p < 0.05$ vs NC. $n = 3$ per group.

Table S1. Characterization of identified metabolites

| ID | Fragment Ions | Retention time | HMDB | PubChem | KEGG | Formula | Exact mass | Super class | Main class | Sub class | |
|-----|-----------------------|-------------------|--------|--------------|----------|---------|--------------|-------------|------------------------------|-------------------------------|----------------------------|
| 1. | Alanine | 158, 232, 260 | 10.754 | HMDB0000161 | 5950 | C00041 | C3H7NO2 | 89.0477 | Organic acids | Amino acids and peptides | Amino acids |
| 2. | Glycine | 218, 246 | 11.071 | HMDB0000123 | 750 | C00037 | C2H5NO2 | 75.032 | Organic acids | Amino acids and peptides | Amino acids |
| 3. | beta-Alanine | 144, 218, 260 | 12.236 | HMDB0000056 | 239 | C00099 | C3H7NO2 | 89.0477 | Organic acids | Amino acids and peptides | Amino acids |
| 4. | Valine | 186, 260, 288 | 12.471 | HMDB0000883 | 6287 | C00183 | C5H11NO2 | 117.079 | Organic acids | Amino acids and peptides | Amino acids |
| 5. | Leucine | 200, 274, 302 | 13.04 | HMDB0000687 | 6106 | C00123 | C6H13NO2 | 131.0946 | Organic acids | Amino acids and peptides | Amino acids |
| 6. | Isoleucine | 200, 274, 302 | 13.48 | HMDB0000172 | 6306 | C00407 | C6H13NO2 | 131.0946 | Organic acids | Amino acids and peptides | Amino acids |
| 7. | L-Isoleucine | 86, 170, 188 | 8.737 | HMDB0000172 | 6306 | C00407 | C6H13NO2 | 131 | Organic acids | Amino acids and peptides | Amino acids |
| 8. | Proline | 184, 258, 286 | 13.991 | HMDB0000162 | 145742 | C00148 | C5H9NO2 | 115.0633 | Organic acids | Amino acids and peptides | Amino acids |
| 9. | Sarcosine | 158, 232, 260 | 14.873 | HMDB0000271 | 1088 | C00213 | C3H7NO2 | 89.0477 | Organic acids | Amino acids and peptides | Amino acids |
| 10. | Methionine | 218, 292, 320 | 16.551 | HMDB0000696 | 6137 | C00073 | C5H11NO2S | 149.0511 | Organic acids | Amino acids and peptides | Amino acids |
| 11. | N-Acetylaspartic acid | 73, 225, 346 | 16.601 | HMDB0000812 | 65065 | C01042 | C6H9NO5 | 175.0481 | Organic acids | Amino acids and peptides | Amino acids |
| 12. | N-Acetylglutamic acid | 186, 216, 318 | 16.8 | HMDB0001138 | 185 | C00624 | C7H11NO5 | 189.0637 | Organic acids | Amino acids and peptides | Amino acids |
| 13. | Serine | 288, 362, 390 | 16.823 | HMDB0000187 | 5951 | C00065 | C3H7NO3 | 105.0426 | Organic acids | Amino acids and peptides | Amino acids |
| 14. | Threonine | 303, 376, 404 | 17.212 | HMDB0000167 | 6288 | C00188 | C4H9NO3 | 119.0582 | Organic acids | Amino acids and peptides | Amino acids |
| 15. | DL-Phenylalanine | 120, 130, 146 | 14.32 | HMDB0250791 | 994 | C02265 | NA | 165.079 | Organic acids | Amino acids and peptides | Amino acids |
| 16. | Phenylalanine | 234, 302, 336 | 18.02 | HMDB0000159 | 6140 | C00079 | C9H11NO2 | 165.079 | Organic acids | Amino acids and peptides | Amino acids |
| 17. | Aspartic acid | 302, 316, 418 | 18.933 | HMDB0000191 | 5960 | C00049 | C4H7NO4 | 133.0375 | Organic acids | Amino acids and peptides | Amino acids |
| 18. | Cysteine | 302, 378, 406 | 19.315 | HMDB0000574 | 5862 | C00097 | C3H7NO2S | 121.0198 | Organic acids | Amino acids and peptides | Amino acids |
| 19. | Glutamic acid | 272, 330, 432 | 20.026 | HMDB0000148 | 33032 | C00025 | C5H9NO4 | 147.0532 | Organic acids | Amino acids and peptides | Amino acids |
| 20. | Asparagine | 302, 400, 417 | 20.361 | HMDB0000168 | 6267 | C00152 | C4H8N2O3 | 132.0535 | Organic acids | Amino acids and peptides | Amino acids |
| 21. | Lysine | 198, 272, 300 | 21.144 | HMDB0000182 | 5962 | C00047 | C6H14N2O2 | 146.1055 | Organic acids | Amino acids and peptides | Amino acids |
| 22. | Glutamine | 198, 271, 431 | 21.596 | HMDB0000641 | 5961 | C00064 | C5H10N2O3 | 146.0691 | Organic acids | Amino acids and peptides | Amino acids |
| 23. | Tyrosine | 302, 364, 466 | 23.7 | HMDB0000158 | 6057 | C00082 | C9H11NO3 | 181.0739 | Organic acids | Amino acids and peptides | Amino acids |
| 24. | Urea | 73, 147, 231 | 12.371 | HMDB0000294 | 2447 | C00086 | CH4N2O | 60.0324 | Organic acids | Organic carbonic acids | Ureas |
| 25. | Glycolic acid | 189, 247 | 10.282 | HMDB0000115 | 757 | C03547 | C2H4O3 | 76.016 | Fatty Acyls | Fatty acids | Hydroxy FA |
| 26. | Capric acid | 75, 229 | 12.83 | HMDB0000511 | 2969 | C01571 | C10H20O2 | 172.1463 | Fatty Acyls | Fatty acids | Saturated FA |
| 27. | Azelaic acid | 129, 359, 401 | 17.57 | HMDB00784 | 2266 | C08261 | C9H16O4 | 188.1049 | Fatty Acyls | Fatty Acids | Saturated FA |
| 28. | Myristic acid | 75, 129, 285 | 17.892 | HMDB0000806 | 11005 | C06424 | C14H28O2 | 228.2089 | Fatty Acyls | Fatty acids | Saturated FA |
| 29. | Palmitoleic acid | 75, 311, 353 | 20.051 | HMDB0003229 | 5312427 | C08362 | C16H30O2 | 254.2246 | Fatty Acyls | Fatty acids | Saturated FA |
| 30. | Palmitic acid | 75, 117, 129, 313 | 20.12 | HMDB0000220 | 985 | C00249 | C16H32O2 | 256.2402 | Fatty Acyls | Fatty acids | Saturated FA |
| 31. | Oleic acid | 75, 129, 339 | 21.946 | HMDB0000207 | 445639 | C00712 | C18H34O2 | 282.2559 | Fatty Acyls | Fatty acids | Unsaturated FA |
| 32. | Stearic acid | 75, 341 | 22.176 | HMDB0000827 | 5281 | C01530 | C18H36O2 | 284.2715 | Fatty Acyls | Fatty acids | Saturated FA |
| 33. | Docosahexaenoic acid | 75, 209, 385, 427 | 25.482 | HMDB00002183 | 445580 | C06429 | C22H32O2 | 328.2402 | Fatty Acyls | Fatty acids | Unsaturated FA |
| 34. | Pantothenic acid | 75, 87, 504 | 24.138 | HMDB0000210 | 6613 | C00864 | C9H17NO5 | 219.11 | Organic Oxygen | Organooxygen | Secondary alcohols |
| 35. | Erythronic acid | 261, 344, 476 | 24.56 | HMDB0000613 | 2781043 | NA | C4H8O5 | 136.0372 | Carbohydrates | Monosaccharides | Sugar acids |
| 36. | Glycerol | 245, 289, 377 | 15.43 | HMDB00131 | 753 | C00116 | C3H8O3 | 92.0473 | Organic Oxygen | Organooxygen | Sugar alcohol |
| 37. | Hypoxanthine | 73, 193, 307 | 19.554 | HMDB0000157 | 790 | C00262 | C5H4N4O | 136.0385 | Nucleic acids | Purines | Hypoxanthines |
| 38. | Nicotinamide | 75, 136, 180 | 13.209 | HMDB0001406 | 936 | C00153 | C6H6N2O | 122.048 | Organoheterocyclic compounds | Pyridinecarboxylic acids | Nicotinamides |
| 39. | Uracil | 75, 179, 195 | 11.632 | HMDB0000300 | 1174 | C00106 | C4H4N2O2 | 112.0273 | Nucleic acids | Pyrimidines | Pyrimidines |
| 40. | 5-oxoprolinate | 84, 158, 186 | 13.578 | HMDB0000805 | 499 | C02237 | C5H7NO3 | 129.0426 | Organoheterocyclic compounds | Pyrroline carboxylic acids | Pyrroline carboxylic acids |
| 41. | 5-oxoproline | 198, 272, 300 | 16.349 | HMDB0000267 | 7405 | C01879 | C5H7NO3 | 129.0426 | Organoheterocyclic compounds | Pyrroline carboxylic acids | Pyrroline carboxylic acids |
| 42. | (2R)-Pyrrolidine | 184, 214, 330 | 17.487 | NA | 91742919 | NA | C18H37NO4Si2 | 387.7 | Organoheterocyclic compounds | Pyrroline carboxylic acids | Pyrroline carboxylic acids |
| 43. | Lactic acid | 189, 233, 261 | 10.048 | HMDB0000190 | 61503 | C00256 | C3H6O3 | 90.0317 | Organic acids | Short-chain acids | Short-chain acids |
| 44. | Cholesterol | 75, 367, 443 | 35.95 | HMDB0000067 | 5997 | C00187 | C27H46O | 386.3549 | Sterol Lipids | Sterols | Cholesterols |
| 45. | Taurine | 88, 158, 296 | 15.844 | HMDB0000251 | 1123 | C00245 | C2H7NO3S | 125.0147 | Organic acids | Sulfonic acids | Sulfonic acids |
| 46. | Phosphoric acid | 124, 383, 384 | 16.013 | HMDB0001429 | 1004 | C00009 | H3PO4 | 97.9769 | Non-metal compounds | Non-metal oxanionic compounds | Non-metal phosphates |
| 47. | Succinic acid | 73,147, 289, 331 | 14.028 | HMDB0000254 | 1110 | C00042 | C4H6O4 | 118.0266 | Organic acids | TCA acids | TCA acids |
| 48. | Fumarate | 147, 287, 329 | 17.02 | HMDB00134 | 444972 | C00122 | C4H4O4 | 116.011 | Organic acids | TCA acids | TCA acids |
| 49. | Malate | 115, 287, 419 | 18.233 | HMDB0000744 | 525 | C03668 | C4H6O5 | 134.0215 | Organic acids | TCA acids | TCA acids |
| 50. | 2-Oxoglutarate | 157, 215, 317 | 19.22 | HMDB0000208 | 51 | C00026 | C5H6O5 | 146.0215 | Organic acids | TCA acids | TCA acids |
| 51. | Citrate | 431, 459, 591 | 23.494 | HMDB0000094 | 311 | C00158 | C6H8O7 | 192.027 | Organic acids | TCA acids | TCA acids |
| 52. | Isocitrate | 73, 147, 202, 345 | 24.435 | HMDB0000193 | 1198 | C00311 | C6H8O7 | 192.027 | Organic acids | TCA acids | TCA acids |

Table S2. Statistics and fold of change of identified metabolites

| Metabolite | p-value | t-value | FDR | Fold of Change | | | | | | |
|---------------------------|----------|---------|----------|----------------|----------|----------|----------|----------|----------|----------|
| | | | | R vs C | R vs F | R vs X | R vs T | R vs RF | R vs RX | R vs RT |
| 1. Alanine | 0.000465 | 5.0466 | 0.002418 | 0.45137 | 0.37607 | 0.18929 | 0.35014 | 0.32965 | 0.43809 | 0.31546 |
| 2. Glycine | 0.02179 | 2.7411 | 0.049265 | 0.19123 | 0.13228 | 0.091055 | 0.12677 | 0.12213 | 0.21731 | 0.099866 |
| 3. beta-Alanine | 0.000287 | 5.3627 | 0.001866 | 0.1929 | 0.15826 | 0.099807 | 0.16058 | 0.15327 | 0.23905 | 0.13984 |
| 4. Valine | 0.000257 | 5.4369 | 0.001866 | 0.24701 | 0.1578 | 0.10604 | 0.16462 | 0.17595 | 0.25106 | 0.1528 |
| 5. Leucine | 0.007599 | 3.3409 | 0.024698 | 0.35956 | 0.28363 | 0.16565 | 0.29166 | 0.25887 | 0.41709 | 0.2798 |
| 6. Isoleucine | 0.60092 | 0.78927 | 0.62496 | 0.98795 | 1.3862 | 1.1175 | 0.9781 | 0.88436 | 1.4176 | 1.5679 |
| 7. L-Isoleucine | 0.037546 | 2.4367 | 0.072311 | 0.56393 | 0.49211 | 0.38737 | 0.49741 | 0.44157 | 0.52644 | 0.44593 |
| 8. Proline | 0.004702 | 3.6207 | 0.017465 | 0.28874 | 0.15206 | 0.074829 | 0.11893 | 0.14032 | 0.22088 | 0.1046 |
| 9. Sarcosine | 0.000354 | 5.2243 | 0.002046 | 0.3995 | 0.31348 | 0.22418 | 0.30365 | 0.29913 | 0.44146 | 0.29343 |
| 10. Methionine | 0.01659 | 2.8947 | 0.041622 | 0.7699 | 0.64735 | 0.36015 | 0.64545 | 0.5003 | 0.72852 | 0.62107 |
| 11. N-Acetylaspartic acid | 0.019701 | 2.7978 | 0.046566 | 0.82832 | 0.6981 | 0.38823 | 0.70483 | 0.55032 | 0.7638 | 0.6565 |
| 12. N-Acetylglutamic acid | 0.52812 | 0.88499 | 0.57147 | 1.1664 | 1.471 | 1.1613 | 1.1406 | 0.99626 | 1.5696 | 1.605 |
| 13. Serine | 0.002185 | 4.0779 | 0.009468 | 0.000472 | 0.000355 | 0.000296 | 0.000445 | 0.000315 | 0.000364 | 0.000306 |
| 14. Threonine | 0.025802 | 2.6462 | 0.052951 | 0.69375 | 0.58752 | 0.37516 | 0.55415 | 0.45267 | 0.70688 | 0.53603 |
| 15. DL-Phenylalanine | 0.44528 | 1.003 | 0.50336 | 1.4925 | 1.5375 | 1.127 | 1.3296 | 1.0458 | 1.2883 | 1.2784 |
| 16. Phenylalanine | 0.21984 | 1.4405 | 0.32662 | 0.64705 | 0.69121 | 0.59704 | 0.59199 | 0.58943 | 0.76147 | 0.66882 |
| 17. Aspartic acid | 0.026475 | 2.6318 | 0.052951 | 0.6764 | 0.55633 | 0.34423 | 0.58467 | 0.46216 | 0.68584 | 0.52749 |
| 18. Cysteine | 3.47E-05 | 6.8366 | 0.000433 | 0.000238 | 0.000197 | 0.000128 | 0.000219 | 0.000212 | 0.000355 | 0.000252 |
| 19. Glutamic acid | 0.045525 | 2.3293 | 0.084546 | 0.000581 | 0.001381 | 0.001788 | 0.000835 | 0.000456 | 0.001617 | 0.00051 |
| 20. Asparagine | 0.010846 | 3.1364 | 0.031333 | 0.60375 | 0.74758 | 0.51682 | 0.48858 | 0.50718 | 0.73506 | 0.51826 |
| 21. Lysine | 0.002986 | 3.8899 | 0.011946 | 0.38805 | 0.34158 | 0.2292 | 0.29799 | 0.26614 | 0.39116 | 0.25894 |
| 22. Glutamine | 0.11779 | 1.7984 | 0.19758 | 0.81884 | 0.68182 | 0.43508 | 0.7074 | 0.57742 | 0.77872 | 0.62213 |
| 23. Tyrosine | 0.055225 | 2.2218 | 0.099025 | 0.97292 | 0.83104 | 0.50012 | 0.85398 | 0.65368 | 0.90055 | 0.82471 |
| 24. Urea | 0.32319 | 1.2088 | 0.40014 | 1.1075 | 1.0997 | 0.64372 | 1.0435 | 0.82103 | 1.2533 | 1.2083 |
| 25. Glycolic acid | 0.005742 | 3.5037 | 0.019905 | 2.3734 | 2.7078 | 1.8082 | 2.0671 | 1.9256 | 1.6432 | 2.2905 |
| 26. Capric acid | 0.31347 | 1.2276 | 0.40014 | 1.2454 | 1.2416 | 0.95396 | 1.2768 | 0.805 | 1.1376 | 1.7431 |
| 27. Azelaic acid | 1.06E-05 | 7.734 | 0.000276 | 2.6263 | 2.6005 | 2.0449 | 2.0847 | 2.211 | 1.7472 | 2.5882 |
| 28. Myristic acid | 0.009365 | 3.2205 | 0.028647 | 1.8381 | 1.7802 | 1.4001 | 1.5659 | 1.5228 | 1.419 | 1.8331 |
| 29. Palmitoleic acid | 0.42477 | 1.0344 | 0.49084 | 1.6845 | 1.8374 | 1.5878 | 1.7512 | 1.3004 | 1.4191 | 1.831 |
| 30. Palmitic acid | 4.16E-05 | 6.7047 | 0.000433 | 2.2618 | 2.1988 | 1.7549 | 1.9399 | 1.8504 | 1.6213 | 2.1604 |
| 31. Oleic acid | 0.35335 | 1.153 | 0.42731 | 1.5926 | 1.0924 | 0.78291 | 1.2217 | 1.2425 | 1.7377 | 1.5305 |
| 32. Stearic acid | 2.71E-06 | 8.8408 | 0.000141 | 2.5305 | 2.525 | 2.001 | 2.3283 | 2.1007 | 1.7921 | 2.4322 |
| 33. Docosahexaenoic acid | 0.000163 | 5.7449 | 0.001408 | 2.2962 | 1.9396 | 1.5314 | 1.8022 | 1.7361 | 1.5706 | 2.5398 |
| 34. Pantothenic acid | 0.28645 | 1.2827 | 0.38194 | 2.2998 | 3.1513 | 1.8185 | 3.3046 | 1.1078 | 2.3149 | 2.5826 |
| 35. Erythronic acid | 0.16206 | 1.6172 | 0.24785 | 1.6191 | 1.6229 | 1.3566 | 1.3703 | 1.4073 | 1.2689 | 1.4847 |
| 36. Glycerol | 0.016809 | 2.8873 | 0.041622 | 1.957 | 2.0572 | 1.8127 | 1.4226 | 1.5894 | 1.5685 | 1.7877 |
| 37. Hypoxanthine | 0.22754 | 1.4203 | 0.32867 | 1.1823 | 1.2588 | 0.67865 | 0.77958 | 0.79017 | 0.87667 | 0.77361 |
| 38. Nicotinamide | 0.13347 | 1.7278 | 0.21033 | 0.32507 | 0.28327 | 0.21812 | 0.23745 | 0.23077 | 0.36964 | 0.21747 |
| 39. Uracil | 0.31647 | 1.2217 | 0.40014 | 0.85145 | 0.67819 | 0.5304 | 0.75509 | 0.66592 | 0.82839 | 0.74868 |
| 40. 5-oxoprolinate | 0.39199 | 1.0868 | 0.46326 | 0.94553 | 1.3068 | 1.1293 | 1.5626 | 1.2069 | 1.2157 | 1.6754 |
| 41. 5-oxoproline | 0.00054 | 4.9504 | 0.002552 | 0.37115 | 0.34784 | 0.27225 | 0.3703 | 0.30489 | 0.47757 | 0.36355 |
| 42. (2R)-Pyrrolidine | 0.5385 | 0.87098 | 0.57147 | 0.7844 | 1.2809 | 1.2132 | 0.6724 | 0.784 | 1.2053 | 1.3607 |
| 43. Lactic acid | 0.6719 | 0.69981 | 0.68507 | 0.95744 | 0.94621 | 0.73264 | 0.92467 | 0.79855 | 0.98463 | 0.84251 |
| 44. Cholesterol | 0.023495 | 2.6987 | 0.050907 | 1.6771 | 1.7759 | 1.3832 | 1.4606 | 1.4441 | 1.6606 | 1.732 |
| 45. Taurine | 0.89159 | 0.40708 | 0.89159 | 1.575 | 1.7294 | 1.3052 | 1.7509 | 1.3196 | 1.6924 | 1.5237 |
| 46. Phosphoric acid | 0.013254 | 3.022 | 0.036274 | 0.003135 | 2.6869 | 0.01528 | 0.00454 | 0.032471 | 1.8459 | 2.4323 |
| 47. Succinic acid | 0.075114 | 2.0505 | 0.1302 | 1.7281 | 1.6461 | 1.1658 | 1.5381 | 1.4972 | 1.5413 | 1.7869 |
| 48. Fumarate | 0.27536 | 1.3066 | 0.38194 | 1.404 | 1.3857 | 1.0112 | 1.7191 | 1.0962 | 1.2708 | 1.4542 |
| 49. Malate | 0.27925 | 1.2981 | 0.38194 | 1.5184 | 1.595 | 1.2156 | 1.507 | 1.5141 | 1.3863 | 1.5939 |
| 50. 2-Oxoglutarate | 0.13348 | 1.7278 | 0.21033 | 2.3038 | 3.0796 | 1.7249 | 2.788 | 1.1437 | 2.3368 | 2.6068 |
| 51. Citrate | 0.50409 | 0.918 | 0.55772 | 0.87385 | 0.86159 | 0.68413 | 0.72851 | 0.73753 | 0.93917 | 0.86398 |
| 52. Isocitrate | 1.83E-05 | 7.3164 | 0.000317 | 0.44452 | 0.28792 | 0.20215 | 0.26053 | 0.2404 | 0.25537 | 0.28154 |

Table S3. Significant differences in metabolite concentrations between groups

| Metabolite | Difference between groups | <i>p</i> -value [*] | <i>f</i> -value | FDR |
|----------------------|--|------------------------------|-----------------|----------|
| 1. Stearic acid | R vs. C, F, RF RT, RX, T, X | 2.71E-06 | 8.8408 | 0.000141 |
| 2. Glycolic acid | R vs. C, F, RF RT, RX, T, X | 1.06E-05 | 7.734 | 0.000276 |
| 3. Succinic Acid | C vs. RF, RX, T, X R vs. F, RF, RT, RX, T, X X vs. F, RT | 1.83E-05 | 7.3164 | 0.000317 |
| 4. Proline | C vs. R X R vs. F, RF, RT, RX, T, X X vs F, RF, RT, RX, T | 3.47E-05 | 6.8366 | 0.000433 |
| 5. Palmitic Acid | R vs. C, F, RF, RT, RX, T, X | 4.16E-05 | 6.7047 | 0.000433 |
| 6. Azelaic acid | R vs. C, F, RF, RT, RX, T, X RX vs. RT X vs. RT | 0.000163 | 5.7449 | 0.001408 |
| 7. beta-Alanine | C vs. R, X R vs. F, RF, RT, RX, T, X X vs. F, RF, RX, T | 0.000257 | 5.4369 | 0.001866 |
| 8. Aspartic acid | C vs R, X R vs. F, RF, RT, RX, T, X X vs F, RF, RX, T | 0.000287 | 5.3627 | 0.001866 |
| 9. Glycine | C vs R, X R vs F, RF, RT, RX, T, X X vs. RX | 0.000354 | 5.2243 | 0.002046 |
| 10. Alanine | C vs X R vs. F, RF, RT, T, X X vs F, RF, RT, RX, T | 0.000465 | 5.0466 | 0.002418 |
| 11. (2R)-Pyrrolidine | R vs C, F, RF, RT, RX, T, X RX vs RF, X | 0.00054 | 4.9504 | 0.002552 |
| 12. Lysine | R vs C, F, RF, RT, RX, T, X | 0.002185 | 4.0779 | 0.009468 |