**Table S1.** The total number (N) of lipids in each class, the number and percentage of significantly different lipids between Dys and Healthy samples. *FDR <0.05; fc > 1.5 | fc<(1/1.5) and vip > 1

| Class | N | Significant Lipids* | % within class | GAGE p-value |
|---|---|---|---|---|
| PC | 127 | 21 | 16.5 | 0.0129 |
| TG | 93 | 7 | 7.5 | 0.8162 |
| FA | 29 | 4 | 13.8 | 0.4885 |
| PE | 27 | 3 | 11.1 | 0.2012 |
| DG | 12 | 3 | 25.0 | 0.4490 |
| SM | 30 | 1 | 3.3 | 0.9549 |
| LPC | 23 | 1 | 4.3 | 0.7732 |
| GlcCer | 3 | 1 | 33.3 | 0.2059 |
| Cer | 25 | 1 | 4.0 | 0.6166 |

**Table S2.** Significant lipids by descending VIP order contributing the most to differentiating Healthy from Dys states. Structural stereoisomers are denoted by A, B and C

| Annotation | FC | FDR | VIP |
|---|---|---|---|
| PC(35:3) | 1.6291 | 0.0010 | 2.3798 |
| PC(38:3) | 1.9543 | 0.0010 | 2.3796 |
| PC(37:6) | 1.5146 | 0.0010 | 2.2654 |
| PC(33:1) | 1.9531 | 0.0028 | 2.2511 |
| PC(35:1) | 1.7966 | 0.0054 | 2.1368 |
| PC (42:6) | 2.1149 | 0.0046 | 2.1325 |
| PC(36:4) B | 1.6885 | 0.0051 | 2.1221 |
| PC (37:3) | 1.6103 | 0.0046 | 2.0473 |
| LPC (18:2) | 0.3663 | 0.0074 | 2.0141 |
| TG(54:8) | 3.8418 | 0.0028 | 2.0138 |
| PC(34:3) A | 1.6837 | 0.0090 | 1.9501 |
| PC(36:5) C | 1.6584 | 0.0121 | 1.8901 |
| PC (p-34:0) or PC (o-34:1) | 2.2122 | 0.0187 | 1.8164 |
| TG(58:5) | 1.6978 | 0.0200 | 1.7891 |
| PC (p-34:1) or PC (o-34:2) A | 2.0098 | 0.0200 | 1.7673 |
| PC(32:1) | 1.6560 | 0.0297 | 1.7563 |
| PC(36:1) | 1.5741 | 0.0357 | 1.7519 |
| PE (p-36:5) or PE (o-36:6) | 1.6803 | 0.0214 | 1.7406 |
| PC(34:4) | 1.5108 | 0.0250 | 1.7343 |
| TAG 55:4; TAG 18:1-18:2-19:1; | 1.9117 | 0.0239 | 1.7332 |
| PE (p-34:2) or PE (o-34:3) | 1.8494 | 0.0279 | 1.7270 |
| PC (38:3) | 1.7275 | 0.0279 | 1.7046 |
| FA (15:0) (pentadecylic acid) | 1.8609 | 0.0214 | 1.7006 |
| DG(36:2) | 1.6525 | 0.0239 | 1.6966 |
| PC(38:7) | 1.6715 | 0.0239 | 1.6868 |
| GlcCer (d40:1) | 2.8442 | 0.0279 | 1.6376 |
| DG(34:3) | 1.7987 | 0.0325 | 1.6206 |
| TG(58:9) | 1.5475 | 0.0297 | 1.6145 |

| | | | |
|---|---|---|---|
| PC (p-40:4) or PC (o-40:5) | 1.8630 | 0.0362 | 1.5959 |
| TG(54:4) | 1.7486 | 0.0325 | 1.5877 |
| TG(56:9) | 1.7266 | 0.0297 | 1.5875 |
| TG(54:2) | 1.7510 | 0.0411 | 1.5852 |
| FA (17:0) (margaric acid) | 1.7754 | 0.0282 | 1.5743 |
| PC (p-38:4) or PC (o-38:5) B | 1.6465 | 0.0409 | 1.5719 |
| PC(36:3) B | 1.9695 | 0.0454 | 1.5549 |
| PC (37:4) | 1.7006 | 0.0331 | 1.5450 |
| PE (p-38:4) or PE (o-38:5) | 2.1205 | 0.0297 | 1.5284 |
| DG(36:5) | 2.0419 | 0.0357 | 1.5260 |
| FA (13:0) (tridecylic acid) | 1.6763 | 0.0379 | 1.5150 |
| Cer(d42:2) B | 2.2252 | 0.0482 | 1.4527 |
| SM (d38:1) | 1.9396 | 0.0419 | 1.4259 |
| FA (28:0) (montanic acid) | 1.6503 | 0.0411 | 1.4208 |

**Table S3.** Selected lipids (in descending VIP order) contributing to differentiating Dia from Dys. *FDR <0.05; fc > 1.5 | fc<(1/1.5) and vip > 1

| Annotation | FC | FDR* | VIP |
|---|---|---|---|
| DG(38:6) | 2.3479 | 0.0006 | 2.1354 |
| PC(p-40:5)/PC(o-40:6) | 1.5045 | 0.0152 | 1.9714 |
| TG(58:10) | 2.8705 | 0.0006 | 1.9499 |
| TG(54:6) C | 2.7686 | 0.0009 | 1.9051 |
| LPC (18:2) | 2.7829 | 0.0006 | 1.8916 |
| TG(58:9) | 2.2372 | 0.0009 | 1.8612 |
| TG(56:8) A | 2.1503 | 0.0009 | 1.8549 |
| LPC(22:5) | 1.6075 | 0.0062 | 1.8284 |
| TG(54:7) B | 2.1795 | 0.0022 | 1.7912 |
| TG(44:0) | 1.8526 | 0.0062 | 1.7474 |
| TG(59:2) | 2.1577 | 0.0152 | 1.7261 |
| TG(57:1) | 1.7444 | 0.0143 | 1.7194 |
| PE (p-38:4) or PE (o-38:5) | 0.3858 | 0.0167 | 1.7079 |
| TAG 47:0; TAG 14:0-16:0-17:0; | 1.6289 | 0.0104 | 1.6929 |
| LPC(16:1) | 0.6308 | 0.0157 | 1.6831 |
| TG(62:2) | 2.0503 | 0.0184 | 1.6714 |
| TG(56:7) A | 3.006 | 0.0023 | 1.6689 |
| TG(55:1) | 1.6543 | 0.0174 | 1.6589 |
| FA (26:0) (cerotic acid) | 0.6473 | 0.0353 | 1.6369 |
| TG(64:2) | 2.2618 | 0.0143 | 1.6211 |
| TG(46:3) B | 2.0152 | 0.0176 | 1.619 |
| TAG 50:4; TAG 16:0-16:3-18:1; | 2.6137 | 0.0121 | 1.6114 |
| DG(38:5) | 1.7635 | 0.0082 | 1.607 |
| TG(54:5) B | 1.8599 | 0.0069 | 1.6006 |
| PC(32:1) | 0.5496 | 0.0094 | 1.5971 |

| | | | |
|---|---|---|---|
| TAG 58:7; TAG 18:0-18:1-22:6; | 2.6645 | 0.0069 | 1.5917 |
| SM (d33:1) | 0.3542 | 0.0143 | 1.589 |
| LPC(18:0) | 1.6601 | 0.0152 | 1.5711 |
| TG(52:4) | 2.4427 | 0.0094 | 1.5614 |
| DG(36:4) A | 2.7465 | 0.0069 | 1.5404 |
| PC(34:3) A | 0.624 | 0.0168 | 1.5394 |
| TG(46:0) | 1.7424 | 0.0252 | 1.5257 |
| TG(57:2) | 1.8018 | 0.0247 | 1.5114 |
| TG(49:3) | 2.3189 | 0.0229 | 1.5081 |
| PE (36:3) | 0.4972 | 0.0216 | 1.508 |
| FA (15:0) (pentadecylic acid) | 0.5665 | 0.0239 | 1.5013 |
| TG(56:1) | 1.7879 | 0.0215 | 1.4993 |
| FA (28:0) (montanic acid) | 0.4401 | 0.0152 | 1.466 |
| PC(36:4) B | 0.6527 | 0.0118 | 1.4631 |
| TG(54:7) A | 3.2298 | 0.0062 | 1.4614 |
| TG(60:1) | 1.7024 | 0.0354 | 1.459 |
| CE(16:1) | 0.4568 | 0.0143 | 1.4573 |
| TG(51:4) | 2.9867 | 0.0099 | 1.4533 |
| TG(62:3) | 2.2629 | 0.0251 | 1.4401 |
| TG(56:5) C | 2.1027 | 0.0135 | 1.4372 |
| LPC (20:0) | 1.5805 | 0.0422 | 1.4356 |
| TG(54:6) A | 2.8895 | 0.009 | 1.4279 |
| PE (p-36:5) or PE (o-36:6) | 0.4114 | 0.0094 | 1.4112 |
| TG(58:1) | 1.7301 | 0.0299 | 1.409 |
| TG(46:3) A | 2.4822 | 0.0176 | 1.3936 |
| TG(60:3) | 2.1477 | 0.0277 | 1.3908 |
| TG(62:4) | 2.3849 | 0.0252 | 1.378 |
| PC(33:1) | 0.6247 | 0.0143 | 1.3747 |
| FA (17:0) (margaric acid) | 0.5839 | 0.0155 | 1.3741 |
| TG(46:2) | 2.0299 | 0.0315 | 1.3688 |
| TG(56:9) | 2.1311 | 0.0104 | 1.3613 |
| TG(58:6) | 2.5194 | 0.0143 | 1.3479 |
| TG(64:3) | 1.8311 | 0.0466 | 1.3411 |
| SM (d34:1) | 0.5203 | 0.0293 | 1.3385 |
| DG(32:0) | 1.7208 | 0.0229 | 1.336 |
| TG(53:4) | 2.5001 | 0.0143 | 1.3174 |
| TG(51:5) | 2.0261 | 0.0352 | 1.3111 |
| TG(49:2) | 2.6427 | 0.0315 | 1.3084 |
| TG(50:5) | 2.2246 | 0.0184 | 1.308 |
| TG(52:5) | 2.8341 | 0.0135 | 1.3015 |
| TG(48:4) B | 1.6353 | 0.0315 | 1.2996 |
| FA (20:5) (eicosapentaenoic acid) | 2.306 | 0.0045 | 1.2975 |
| TG(56:6) | 2.0436 | 0.0155 | 1.2874 |
| TG(58:2) | 1.9212 | 0.0315 | 1.2868 |

| | | | |
|---|---|---|---|
| TG(48:4) A | 1.8733 | 0.0229 | 1.2803 |
| TG(58:3) | 1.9127 | 0.0374 | 1.2782 |
| TG(60:6) | 2.1764 | 0.0152 | 1.2563 |
| TG (53:5) | 2.5106 | 0.0143 | 1.2529 |
| PC(36:1) | 0.6425 | 0.0263 | 1.2504 |
| SM (d34:2) | 0.4784 | 0.0393 | 1.2317 |
| TG(58:4) | 2.0458 | 0.0315 | 1.2017 |
| FA (18:3) (linolenic acid) | 1.8606 | 0.0176 | 1.2006 |
| Cer(d42:2) B | 0.4905 | 0.0354 | 1.1863 |
| FA (18:2) (linoleic acid) | 1.6259 | 0.0163 | 1.1825 |
| TG(54:5) A | 1.9687 | 0.0283 | 1.1767 |
| TG(53:3) | 2.0163 | 0.0347 | 1.1645 |
| TG(60:2) | 1.8369 | 0.0474 | 1.1587 |
| TAG 52:6; TAG 16:1-18:2-18:3; | 2.422 | 0.0176 | 1.142 |
| TG(50:4) | 2.1943 | 0.0374 | 1.1114 |
| FA (22:6) (docosahexaenoic acid) | 2.0256 | 0.019 | 1.0628 |

**Table S4.** The total number (N) of lipids in each class, the number and percentage of significantly different lipids between Dys and Dia samples. *FDR <0.05; fc > 1.5 | fc<(1/1.5) and vip > 1

| Class | N | Significant lipids* | % within class | GAGE p-value |
|---|---|---|---|---|
| TG | 93 | 54 | 58.1 | 4.2E-07 |
| FA | 29 | 8 | 27.6 | 0.4624 |
| PC | 127 | 6 | 4.7 | 0.9791 |
| LPC | 23 | 5 | 21.7 | 0.3552 |
| DG | 12 | 4 | 33.3 | 0.1887 |
| SM | 30 | 3 | 10.0 | 0.9944 |
| PE | 27 | 3 | 11.1 | 0.5856 |
| Cer | 25 | 1 | 4.0 | 0.9441 |
| CE | 10 | 1 | 10.0 | 0.8361 |

**Table S5.** Bile acids significantly reduced in Dys/Dia animals. Univariate weighted T-test result

| Annotation | FC | FDR | VIMP (normalized) |
|---|---|---|---|
| GCDCA | 0.2575 | 4.021E-07 | 1 |
| GCA | 0.2830 | 0.0043 | 0.75 |
| TCDCA | 0.3117 | 1.8927E-05 | 0.32 |
| TCA | 0.3670 | 0.0006 | 0.18 |
| TLCA | 0.4535 | 0.0143 | 0.13 |
| TUDCA | 0.3836 | 0.0007 | 0.11 |

**Table S6.** Feces bile acids significantly changed in Dys/Dia animals. Univariate descriptive statistics (i.e. AUROC and the associated 95% confidence intervals for predicting T2D status)

| Feces bile acids | AUROC and 95% CI | Dys/Dia vs. Healthy |
|---|---|---|
| TCA | 0.30 [0.16, 0.44] | Down |
| TUDCA | 0.28 [0.15, 0.42] | Down |
| TCDCA | 0.23 [0.11, 0.35] | Down |
| GCA | 0.19 [0.07, 0.30] | Down |
| GCDCA | 0.17 [0.06, 0.27] | Down |