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Supplementary information

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Data-driven cluster analysis identifies distinct types of metabolic dysfunction-associated steatotic liver disease

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Supplementary Table 1: The liver gene expression and plasma metabolites with significant differences between the cardiometabolic and liver-specific clusters (A), cardiometabolic and control (B), and liver-specific and (C). Metabolites with significant differences between the cardiometabolic and liver-specific clusters (D), cardiometabolic and control (E), and liver-specific and CTRL (F). Molecular features that were differentially expressed between type 2 diabetes and non-T2D groups, and between cardiometabolic and control clusters (G).

Supplementary Table 2: Definition of self-reported history of liver disease, cardiovascular disease, and type 2 diabetes (UK Biobank data-field 20002) and ICD-10 codes used to define liver disease, cardiovascular disease, and type 2 diabetes.

Supplementary Table 1 : The liver gene expression with significant differences between the cardiometabolic and liver-specific clusters (A), cardiometabolic and control clusters (B), and liver-specific and control clusters (C). Gene expression differential analysis across clusters was conducted using moderated t-tests. Statistical significance was assigned to differences where p-values, adjusted for multiple comparisons using the Benjamini-Hochberg method to control the False Discovery Rate, were below 0.05 and the absolute value of log2 fold change was greater than 0.26. **Metabolites with significant differences between the cardiometabolic and liver-specific clusters (D), cardiometabolic and control clusters (E), and liver-specific and control clusters (F).** Metabolite differential analysis across clusters was conducted using moderated t-tests, excluding xenobiotics. Statistical significance was assigned to differences where p-values, adjusted for multiple comparisons using the Benjamini-Hochberg method to control the False Discovery Rate, were below 0.05 and the absolute value of log2 fold change was greater than 0.26**. Molecular features that were differentially expressed between type 2 diabetes and non-T2D groups, and between cardiometabolic and control clusters (G).**

Cluster cardiometabolic vs Cluster Liver specific (A)		
Liver gene	**logFC**	**adj.P.Val**
CHI3L1	2,69765	0,00011
LGALS4	1,3935	0,00023
HMGCS1	1,35382	0,0005
MVD	1,20644	0,00003
LDLR	1,09458	0,00506
CYP51A1	1,07094	0,00006
ACAT2	0,91356	0,00506
DCPS	0,88803	0,00006
DHCR7	0,83545	0,01948
NSDHL	0,82669	0,01418
SC5D	0,79568	0,00207
SLC25A18	0,79217	0,00108
LSS	0,79216	0,00023
ERG28	0,77461	0,01127
CAPN12	0,75505	0,00084
RETREG1	0,74751	0,02853
ALDOC	0,54497	0,0164
ACLY	0,52824	0,03395
CPT1B	0,52063	0,02902
SYT17	0,51289	0,02245
POU6F1	0,50896	0,02256
EXT1	0,449	0,02898
RRM2B	0,41109	0,02902

DDB2	0,3911	0,02719
MAP3K6	0,37267	0,02189
HNRNPH3	-0,3932	0,00356
RAI14	-0,4747	0,04647
A1CF	-0,5391	0,01127
DPP4	-0,547	0,00305
ZG16	-0,579	0,0247
RGS5	-0,8278	0,00305
TCP10L2	-0,8754	0,00086
ETNPPL	-0,8899	0,03578
POSTN	-0,9896	0,00677
FAM151A	-1,3683	0,00084

Cluster cardiometabolic vs Cluster control (B)		
Liver gene	**logFC**	**adj.P.Val**
CHI3L1	3,27236	0
EIF1AY	1,52125	0,00058
HMGCS1	1,41908	0
LGALS4	1,24443	0
AKR1B10	1,21135	0
SPP1	1,13682	0
MVD	1,11938	0
SCD	1,007	0,00001
DEFB1	0,99607	0
LDLR	0,96179	0
LPL	0,94914	0
OLFM2	0,94256	0,00002
SNORA14A	0,91952	0,00059
UTY	0,90849	0,0007
SULF2	0,90487	0
LINC01554	0,86349	0,03627
CYP51A1	0,86273	0
INSIG1	0,86129	0
NSDHL	0,85209	0
HKDC1	0,84117	0,00011
DTNA	0,83339	0
IL32	0,82629	0,00005
CSTA	0,82119	0,00001
HSPA4L	0,81489	0
CAPN12	0,79988	0

CXCL9	0,79753	0,01269
DHCR7	0,79139	0
KDM5D	0,78481	0,00086
PTGDS	0,78331	0,00454
ITGBL1	0,77501	0
FABP5	0,77165	0
ANXA2P2	0,77046	0
CXCL10	0,76675	0,00036
VCAN	0,76582	0
CCND1	0,76422	0
CCL20	0,75162	0,00194
LUM	0,74679	0,01151
RPS27L	0,74557	0
STMN2	0,73492	0
ERG28	0,72243	0
TYMS	0,71192	0
ZMAT3	0,71036	0
SC5D	0,7081	0
LSS	0,68554	0
ACAT2	0,64739	0,00024
KDELR3	0,64206	0,00409
USP9Y	0,636	0,01659
ACLY	0,6324	0
ANKRD18B	0,62674	0,01216
ANKRD18A	0,62674	0,01216
PYGB	0,61888	0
DCPS	0,61099	0
TIMP1	0,61089	0,001
PURPL	0,60657	0,00068
ZFP36	0,59077	0,03646
SNX10	0,59016	0,00049
HSD17B7P2	0,58025	0,00013
RETREG1	0,56104	0,00065
ALDOC	0,55794	0
ARHGAP10	0,55175	0,01153
TNNC1	0,54168	0,00024
DDB2	0,5349	0
PODN	0,52576	0,01469
LOC101927136	0,52222	0,00001
PRKAA2	0,51863	0,00082
FDFT1	0,51006	0

AKR1B15	0,50473	0
ALDH3A1	0,50099	0,00027
INMT-MINDY4	0,49774	0
MIR622	0,49356	0
EEF1A2	0,48771	0,00021
KRT75	0,48638	0,00039
KRT6C	0,48638	0,00039
KRT6A	0,48638	0,00039
GAS6	0,47767	0,00072
ODC1	0,47365	0,00006
ABCC4	0,46942	0,00012
PHPT1	0,46683	0,00139
TNFAIP3	0,46502	0,00393
ACSS3	0,46478	0,00352
SREBF2	0,46243	0,00079
FASN	0,45841	0,00217
TP53I3	0,45801	0,00281
CDKN1A	0,45664	0,00746
SULT1C2	0,4531	0,0026
EBP	0,45234	0,00103
RPS4Y1	0,44788	0,00102
CES1	0,44352	0,00211
PCCB	0,4424	0,00183
LAPTM4B	0,44206	0,03977
NPM2	0,44115	0,0003
TTTY14	0,42928	0,00939
CKS2	0,428	0,00075
IDO2	0,4181	0,03844
VTRNA1-1	0,41572	0,00104
KRT79	0,41527	0,02188
RGCC	0,41011	0,01308
RRM2B	0,39767	0
USP22	0,39765	0,00248
SPATA18	0,39709	0,01552
IDH2	0,39659	0,00011
PEPD	0,39659	0,00251
PINK1	0,39367	0,00183
PRDX5	0,39256	0,00003
EXT1	0,38911	0,00004
MAP4	0,38689	0,00322
VAMP5	0,38498	0,00251

PDP2	0,3842	0,01306
ANTXR1	0,38312	0,02316
AKR1C3	0,38221	0,00031
STOM	0,38202	0,00605
NPC1L1	0,37824	0,00608
CSTB	0,37636	0,00139
CAPN2	0,37079	0,01381
GUCA2B	0,37073	0,02007
ATP9A	0,36919	0,00012
GAS6-AS1	0,36786	0
ACP5	0,36726	0,01695
CAP2	0,36689	0,00704
ALPL	0,3662	0,00591
PCOLCE	0,36594	0,00288
PIEZO1	0,36396	0,00082
NEK8	0,36237	0,00329
TRIM35	0,35877	0,01566
NOS2	0,35857	0,00102
TMEM92	0,3571	0,03003
ANKRD29	0,35709	0,038
CPT1B	0,35096	0,00352
TNFRSF10A	0,35049	0,00014
NAP1L1	0,34358	0,01793
SHISA4	0,34021	0,0012
DLGAP1-AS3	0,3394	0,01151
PLXNA4	0,33866	0,0042
MMP14	0,33767	0,03423
ARPC5L	0,33727	0,02106
ANXA2P1	0,3358	0
DCBLD2	0,33571	0,04851
CPEB4	0,33434	0,04317
ZNF329	0,33252	0,00925
DPYSL2	0,33225	0,02726
PADI1	0,3314	0,02076
LOC100422781	0,32468	0,00101
SRPX2	0,32414	0,02308
TXNRD1	0,32028	0,01216
MYL12B	0,31964	0,00036
FDXR	0,31846	0,00419
P2RX5	0,31641	0,01481
HNRNPA1	0,31585	0,00191

MSN	0,3135	0,04095
C1orf198	0,31292	0,02823
ETFA	0,31268	0,00224
PLK2	0,31244	0,00925
SKAP2	0,31156	0,04783
ASPN	0,31041	0,04162
CNPPD1	0,31014	0,0354
GNL2	0,31006	0,0341
TNIP1	0,30767	0,00255
RGMA	0,30552	0,04655
PRXL2A	0,30499	0,002
CASTOR2	0,29919	0,03858
SKP2	0,29875	0,00569
HSD11B1	0,29603	0,01763
ALDH1L1	0,29497	0,03315
PTPN11	0,29468	0,00088
EHD4	0,29376	0,00393
RBM24	0,29322	0,04213
CEP89	0,29259	0,01791
WDPCP	0,28705	0,0102
EPHA3	0,2867	0,02811
TNFRSF10D	0,28657	0,00281
FABP4	0,28543	0,01695
TWSG1	0,28222	0,03749
CETN2	0,28094	0,00065
IKBKE	0,27794	0,0138
SUSD2	0,27694	0,00195
PRKAG1	0,27664	0,00056
PPA1	0,27629	0,001
DLAT	0,27626	0,025
RSU1	0,27169	0,02154
NLRP9	0,26809	0,00096
ABLIM1	0,26541	0,00608
JUND	0,26089	0,00297
KLF3	-0,2605	0,02711
CACTIN-AS1	-0,2622	0,02984
HNRNPH3	-0,2662	0,00037
CCR1	-0,2672	0,01476
TANGO6	-0,2684	0,0224
HOMER2	-0,2701	0,00084
MET	-0,2717	0,0085

FNDC3A	-0,2717	0,00024
HLA-E	-0,2731	0,04053
SCCPDH	-0,2732	0,00072
APOM	-0,2735	0,01519
TESK2	-0,2738	0,01163
ZKSCAN1	-0,2771	0,00176
SLC27A2	-0,2775	0,04818
SNTB1	-0,2779	0,0313
FBXW11	-0,2794	0,04004
GSTA7P	-0,2798	0,00111
MIR644A	-0,28	0,00125
PCDH12	-0,2822	0,02233
LRP6	-0,2825	0,00479
RXYLT1	-0,285	0,04523
PER2	-0,2865	0,01155
GALK1	-0,2872	0,00637
SARDH	-0,2906	0,01989
ESPN	-0,2918	0,00267
SPINK4	-0,2925	0,01574
C4B	-0,2958	0,03856
MPC2	-0,3006	0,00331
SCARNA17	-0,3007	0
NHSL1	-0,3019	0,00045
NR1I3	-0,3034	0,01571
NCAM2	-0,3041	0,03243
HAAO	-0,3044	0,00562
C8B	-0,3049	0,008
MTFP1	-0,3061	0,00017
ERVK-7	-0,3082	0,01111
CPVL	-0,3084	0,0285
XRCC5	-0,3106	0,00345
GPBP1L1	-0,3121	0,01112
RSBN1L	-0,3137	0,02585
KDM6A	-0,314	0,0379
SPICE1	-0,315	0,00078
SCARNA9L	-0,3153	0,02719
MT3	-0,3169	0,00001
MARCH1	-0,318	0,03763
SORD	-0,3186	0,02274
PAFAH2	-0,3196	0,00349
SIPA1L2	-0,3208	0,01469

ARRDC3	-0,3218	0,01053
IDNK	-0,3229	0,00013
SLC22A3	-0,3236	0,01746
GRTP1	-0,3248	0,00285
SDC2	-0,3252	0,00195
AGMO	-0,3253	0,00072
PGLYRP2	-0,3283	0,00635
RELN	-0,3328	0,00251
NAAA	-0,3422	0,00164
AZGP1	-0,3428	0,01204
FGB	-0,3458	0,04746
SLC9A9	-0,3473	0,00324
DBX1	-0,3486	0,00033
HAO2	-0,3521	0,00038
TUBE1	-0,3531	0,01978
C8A	-0,3557	0,00047
ZNF16	-0,356	0,00204
MT1E	-0,3565	0
ANG	-0,3572	0,01894
SPP2	-0,3573	0,00175
C6	-0,3591	0,00704
PNPLA4	-0,361	0,00479
PAIP2B	-0,3622	0,00111
FBXO32	-0,3634	0,00098
SNORD70	-0,3647	0,00789
RBP5	-0,3665	0,0005
FCN2	-0,3687	0,01439
TMEM132C	-0,3691	0,00103
STX3	-0,3695	0,0298
EFNA1	-0,3704	0,00017
ACADSB	-0,3712	0,04218
AGXT2	-0,3715	0,038
ESR1	-0,3719	0,00045
MACO1	-0,3754	0,00171
GDF5	-0,3763	0,00005
AGXT	-0,3765	0,00117
NAT8L	-0,377	0,01117
CPN1	-0,3771	0,00415
ZBTB32	-0,3776	0,00745
MPV17L	-0,3783	0,03899
ADAMTSL3	-0,3796	0,00002

ABCG5	-0,3813	0,0003
CD163L1	-0,3823	0,00161
BPIFB1	-0,3824	0,00867
LINC02396	-0,3831	0,00052
ACOX2	-0,3864	0,00033
MT1JP	-0,3866	0,0001
NID2	-0,394	0,01285
TEF	-0,3943	0,04091
MAP2K1	-0,3966	0,0066
MIR505	-0,3967	0,00014
SIRT5	-0,3973	0,03113
PCNT	-0,398	0,00082
ALAS1	-0,398	0,00511
KCNE3	-0,3985	0,01376
CFAP298	-0,3992	0
LIN28B	-0,3994	0,02984
CCL15-CCL14	-0,4017	0,00005
CD82	-0,4028	0,00003
NTN4	-0,4034	0,00013
MARC2	-0,4041	0,00017
DPYD	-0,4053	0,00029
GCH1	-0,4055	0,00637
FRMD4B	-0,406	0,00119
SGO2	-0,4063	0,0179
SLC6A13	-0,4125	0,00161
MAPKAPK3	-0,4128	0,00128
MS4A14	-0,4134	0,01287
PON1	-0,4176	0,0138
CD4	-0,4216	0,00255
C3orf85	-0,4219	0,01188
AOC4P	-0,4258	0,00698
MT1IP	-0,427	0,00107
MYO9A	-0,43	0,04002
PLCB1	-0,4318	0,00314
MT1DP	-0,4331	0,00007
AADAT	-0,4391	0
PRRG4	-0,4398	0,00005
FGF2	-0,4409	0,01162
PTPRD	-0,4432	0,00049
MBNL3	-0,449	0,00021
WNK3	-0,4498	0,00813

ENPEP	-0,4528	0,00002
ZFP1	-0,4546	0,00084
CPA3	-0,4554	0,01578
COLEC10	-0,4578	0,00008
GPR82	-0,4597	0,01124
GGH	-0,4611	0
ARSD	-0,4643	0,00024
LINC02291	-0,4693	0,01153
RAI14	-0,4698	0
PPP1R1A	-0,47	0,00172
CLPTM1L	-0,4784	0,00262
C3P1	-0,4784	0,00072
DNAJC12	-0,4821	0,00042
CXCR2P1	-0,4894	0,00265
NRN1	-0,4917	0,00055
NT5E	-0,5015	0,00029
VIL1	-0,5101	0,00251
TMED6	-0,5159	0,01763
SGCE	-0,5178	0,00449
GNMT	-0,5241	0,0156
CETP	-0,5247	0
MAP4K4	-0,5275	0,00139
TMTC1	-0,5379	0,00274
ZG16	-0,5517	0
TFPI2	-0,5526	0,04927
CXADR	-0,5546	0,00009
MT1A	-0,5576	0,01308
PLN	-0,5699	0,04851
UGT2A2	-0,5831	0,03833
APOF	-0,5925	0
MT1F	-0,6034	0,00081
A1CF	-0,6069	0
MT1H	-0,6291	0,00029
CYP2C8	-0,6333	0,00745
CPS1-IT1	-0,6356	0,0037
SLCO4C1	-0,6366	0,00082
OAT	-0,6423	0,00143
DOK6	-0,6534	0
CLEC4M	-0,6642	0
CFHR5	-0,6724	0
SH3BP5L	-0,6764	0,00001

MT1B	-0,6956	0,0005
MT1G	-0,7132	0,00005
HYDIN	-0,7268	0,0066
RALGDS	-0,7319	0,00001
SERPINA1	-0,7492	0
SLCO1B7	-0,7528	0,00142
SLC22A10	-0,7554	0,00082
VCAM1	-0,762	0
CYP2C19	-0,7788	0
MT1M	-0,797	0,00001
FAM151A	-0,9087	0,00011
RGS5	-1,0094	0
POSTN	-1,02	0
TIMD4	-1,0458	0
TCP10L2	-1,0977	0
SPINK1	-1,3058	0,03186
PZP	-2,1803	0
XIST	-2,4226	0,0005

Clusters liver specific vs Cluster control (C)		
Liver gene	**logFC**	**adj.P.Val**
EIF1AY	1,86898	0,00301
SPP1	1,41634	0
HULC	1,1743	0,00301
CXCL9	1,16509	0,00478
LPL	1,1208	0
FABP5	1,02792	0
CCL20	0,98958	0,0033
UTY	0,9538	0,03157
USP9Y	0,94953	0,00486
CYP7A1	0,88766	0,04621
ENO3	0,8743	0,0024
PLA2G7	0,84478	0,00003
DTNA	0,84369	0,0024
CXCL10	0,80077	0,01993
DDX3Y	0,74976	0,00289
CD83	0,71029	0,02172
TPX2	0,68238	0,00335
TTTY14	0,64671	0,00269
RRM2	0,59777	0,01158

ACP5	0,56035	0,00418
RPS4Y1	0,54993	0,0047
CCNB1	0,54813	0,00418
ANXA2P2	0,54382	0,0024
ZWINT	0,52704	0,0024
MKI67	0,51645	0,0033
TP53I3	0,51498	0,04246
FABP4	0,50935	0,00039
AURKB	0,49873	0,00464
PRKG1-AS1	0,48434	0,01333
FBXO27	0,48008	0,00838
TMEM169	0,4662	0,01806
HIST1H3C	0,46374	0,0024
TXLNGY	0,45784	0,04754
TGFBI	0,44675	0,00171
ADAM2	0,41532	0,02628
HMGB3	0,37122	0,02172
MIR622	0,35915	0,03826
PCNA	0,35549	0,01641
ABCB1	0,33065	0,0024
PTPN11	0,31971	0,02557
ANXA2P1	0,29357	0,00154
LCE6A	0,28604	0,01517
AOX1	-0,3812	0,04528
CD82	-0,3957	0,01067
PNPLA4	-0,4248	0,03863
SCARNA9L	-0,4657	0,01317
FAM111A-DT	-0,5336	0,01975
APOF	-0,549	0,00433
FGB	-0,623	0,0024
VIL1	-0,663	0,0047
LPA	-0,7112	0,02908
CYP2C8	-0,7799	0,03173
TIMD4	-0,8142	0,00301
AVPR1A	-0,9464	0,01158
IGFBP2	-1,3116	0,01397
PZP	-2,0525	0,00091
XIST	-2,8372	0,0047

Cluster cardiometabolic vs Cluster Liver specific (D)

METABOLITE_NAME	logFC	adj.P.Val
tyramine O-sulfate	4,33663	0,0479
4-hydroxyphenylacetylglutamine	3,39016	0,00001
sucrose	2,3153	0,01285
orotidine	1,83506	0,01554
p-cresol glucuronide*	1,62583	0
homocitrulline	1,23214	0
pentose acid*	1,22366	0,00035
3-methylglutarylcarnitine (2)	1,19879	0
indoleacetylglutamine	1,18013	0,00241
4-hydroxyphenylacetate	1,16791	0,00171
4-hydroxyphenylacetoylcarnitine	1,13727	0,01075
imidazole propionate	1,0499	0,00106
phenylacetylglutamate	1,04822	0
deoxycholate	1,04822	0,00085
guanidinosuccinate	1,01478	0,00011
lactose	1,00781	0,02752
trigonelline (N'-methylnicotinate)	0,98041	0,00089
lyxonate	0,92866	0,00062
1-methyl-5-imidazoleacetate	0,91271	0,04254
arabonate/xylonate	0,89813	0
11beta-hydroxyetiocholanolone glucuronide*	0,87723	0,00036
1-carboxyethylvaline	0,86528	0
N2,N5-diacetylornithine	0,86501	0
1-carboxyethylisoleucine	0,82315	0
3-methylglutaconate	0,79542	0
glutamine conjugate of C6H10O2 (2)*	0,777	0,00191
palmitoyl-oleoyl-glycerol (16:0/18:1) [1]*	0,75123	0
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [1]*	0,74772	0
deoxycholic acid 12-sulfate*	0,74543	0,00473
palmitoyl-oleoyl-glycerol (16:0/18:1) [2]*	0,73008	0
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [2]*	0,72246	0
lithocholate sulfate (1)	0,69189	0,00114
oleoyl-arachidonoyl-glycerol (18:1/20:4) [2]*	0,68857	0
11beta-hydroxyandrosterone glucuronide	0,68719	0,00178
1-carboxyethylleucine	0,68583	0
glutamine conjugate of C7H12O2*	0,66986	0,00092
diacylglycerol (14:0/18:1, 16:0/16:1) [2]*	0,66894	0,00015
1-ribosyl-imidazoleacetate*	0,6629	0,00005
1-palmitoyl-2-oleoyl-GPE (16:0/18:1)	0,66264	0

1-palmitoyl-2-docosahexaenoyl-GPE (16:0/22:6)*	0,66195	0
1-stearoyl-2-docosahexaenoyl-GPE (18:0/22:6)*	0,65135	0
phenylacetylglutamine	0,64766	0
cholic acid glucuronide	0,64373	0,02929
oleoyl-arachidonoyl-glycerol (18:1/20:4) [1]*	0,64069	0
phenol sulfate	0,635	0,00029
1-oleoyl-2-linoleoyl-GPE (18:1/18:2)*	0,62497	0
N-acetylhomocitrulline	0,62072	0,00124
myristoyl-linoleoyl-glycerol (14:0/18:2) [2]*	0,61525	0,00051
linoleoyl-linoleoyl-glycerol (18:2/18:2) [2]*	0,61487	0,00062
1-stearoyl-2-oleoyl-GPE (18:0/18:1)	0,61117	0
glucuronide of C14H22O4 (2)*	0,604	0,00602
gulonate*	0,59901	0,00005
linoleoyl-arachidonoyl-glycerol (18:2/20:4) [1]*	0,59002	0
linoleoyl-linoleoyl-glycerol (18:2/18:2) [1]*	0,58314	0,00006
linoleoyl-arachidonoyl-glycerol (18:2/20:4) [2]*	0,58142	0
1-carboxyethylphenylalanine	0,57911	0
2,3-dihydroxy-2-methylbutyrate	0,57884	0
trimethylamine N-oxide	0,57837	0,00078
1-carboxyethyltyrosine	0,57749	0
fructosyllysine	0,57677	0
chenodeoxycholic acid sulfate (1)	0,57356	0,00176
palmitoleoyl-arachidonoyl-glycerol (16:1/20:4) [2]*	0,57338	0,00014
1-palmitoyl-2-arachidonoyl-GPE (16:0/20:4)*	0,57241	0
linoleoyl-linolenoyl-glycerol (18:2/18:3) [1]*	0,5666	0,01644
lanthionine	0,56379	0,00003
myristoyl-linoleoyl-glycerol (14:0/18:2) [1]*	0,56265	0,00023
phenol glucuronide	0,56128	0,01798
dopamine 4-sulfate	0,5608	0,00002
oleoyl-oleoyl-glycerol (18:1/18:1) [1]*	0,56012	0
N-carbamoylalanine	0,55787	0,00003
diacylglycerol (14:0/18:1, 16:0/16:1) [1]*	0,5546	0,00024
1-stearoyl-2-linoleoyl-GPE (18:0/18:2)*	0,54942	0
1-palmitoyl-2-linoleoyl-GPE (16:0/18:2)	0,54699	0
glutamine conjugate of C6H10O2 (1)*	0,54524	0,00058
oleoyl-oleoyl-glycerol (18:1/18:1) [2]*	0,52413	0
methylsuccinoylcarnitine	0,52017	0,01467
L-urobilin	0,51759	0,01253
tetrahydrocortisol glucuronide	0,51481	0,00014
xylose	0,51344	0,02348
ascorbic acid 3-sulfate*	0,50631	0

1-stearoyl-2-arachidonoyl-GPE (18:0/20:4)	0,49959	0
diacylglycerol (16:1/18:2 [2], 16:0/18:3 [1])*	0,49137	0,00023
linoleoyl-linolenoyl-glycerol (18:2/18:3) [2]*	0,48441	0,00609
docosatrienoate (22:3n6)*	0,48354	0
trans-2-hexenoylglycine	0,47959	0,00003
linoleoyl-docosahexaenoyl-glycerol (18:2/22:6) [1]*	0,47571	0,00839
N-acetyltaurine	0,47537	0
8-methoxykynurenate	0,4647	0,00516
glucose	0,46415	0
diacylglycerol (12:0/18:1, 14:0/16:1, 16:0/14:1) [2]*	0,46168	0,0101
11-ketoetiocholanolone glucuronide	0,45807	0,00026
methionine sulfone	0,45421	0
cystathionine	0,45343	0,00586
chenodeoxycholic acid 24-glucuronide	0,4529	0,03301
maltose	0,44647	0,00016
dopamine 3-O-sulfate	0,44545	0,00011
(S)-3-hydroxybutyrylcarnitine	0,44429	0,00044
palmitoyl-linoleoyl-glycerol (16:0/18:2) [2]*	0,44397	0,00057
stearoyl-arachidonoyl-glycerol (18:0/20:4) [1]*	0,43853	0
oleoyl-linoleoyl-glycerol (18:1/18:2) [2]	0,43731	0
prolylglycine	0,43098	0,00057
oleoyl-linoleoyl-glycerol (18:1/18:2) [1]	0,4236	0
N,N,N-trimethyl-5-aminovalerate	0,41748	0
ribonate	0,40856	0
palmitoyl-docosahexaenoyl-glycerol (16:0/22:6) [1]*	0,40426	0,01463
vanillactate	0,40125	0,00088
4-acetamidobutanoate	0,39846	0,00767
pyridoxate	0,39352	0,01516
cytosine	0,39015	0,00214
cis-3,4-methyleneheptanoylglycine	0,38555	0,00105
galactonate	0,38554	0,02824
N-acetyl-1-methylhistidine*	0,38512	0,02595
glucuronate	0,37981	0,00002
3-methyladipate	0,37968	0,02357
N-carbamoylvaline	0,37842	0,00043
fructose	0,37725	0
hydroxy-N6,N6,N6-trimethyllysine*	0,37616	0,00003
2-stearoyl-GPE (18:0)*	0,3751	0
1-methyl-4-imidazoleacetate	0,37395	0,00206

adrenate (22:4n6)	0,37185	0
4-imidazoleacetate	0,36853	0,00884
palmitoleoyl-linoleoyl-glycerol (16:1/18:2) [1]*	0,36733	0,00391
picolinoylglycine	0,3648	0,00027
hydantoin-5-propionate	0,36029	0,01364
alpha-hydroxycaproate	0,35707	0,00767
hexanoylglutamine	0,3502	0,02528
mannose	0,34869	0
N-delta-acetylornithine	0,34667	0,00328
ceramide (d18:1/17:0, d17:1/18:0)*	0,34411	0,00001
gamma-CEHC glucuronide*	0,34291	0,00062
3-indoxyl sulfate	0,34253	0,00052
N6-succinyladenosine	0,33757	0,00006
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [2]*	0,32951	0,02835
heptenedioate (C7:1-DC)*	0,32414	0,00054
pipecolate	0,32402	0,0408
N-acetylneuraminate	0,32022	0
arabitol/xylitol	0,31735	0
carnitine of C10H14O2 (5)*	0,31473	0,00604
margarate (17:0)	0,31359	0
acisoga	0,31347	0,00002
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [1]*	0,30997	0,03895
erythronate*	0,2972	0
ascorbic acid 2-sulfate	0,28778	0
3-hydroxymyristate	0,28551	0,00115
N1-methylinosine	0,27674	0,00087
arabinose	0,27307	0,00063
docosatrienoate (22:3n3)	0,27042	0,00511
N-stearoyl-sphingosine (d18:1/18:0)*	0,26489	0
2-O-methylascorbic acid	0,26169	0,00006
ceramide (d16:1/24:1, d18:1/22:1)*	0,26113	0,00043
pantoate	0,26076	0,02545
pregnenediol disulfate (C21H34O8S2)*	-0,2702	0,02837
stearoylcholine*	-0,2703	0,00086
3beta,7alpha-dihydroxy-5-cholestenoate	-0,2723	0,00025
octadecenedioylcarnitine (C18:1-DC)*	-0,2822	0,00694
dehydroepiandrosterone sulfate (DHEA-S)	-0,2901	0,0074
linoleoylcholine*	-0,2912	0,00012
behenoyl dihydrosphingomyelin (d18:0/22:0)*	-0,2932	0,00005
eicosapentaenoylcholine	-0,2959	0,03141
sphingomyelin (d18:0/18:0, d19:0/17:0)*	-0,3008	0,00231

glycosyl ceramide (d18:2/24:1, d18:1/24:2)*	-0,3028	0
glycosyl ceramide (d18:1/23:1, d17:1/24:1)*	-0,3118	0,00005
androstenediol (3alpha, 17alpha) monosulfate (2)	-0,3126	0,0143
dihomo-linolenoyl-choline	-0,3223	0,0022
phenylalanylhydroxyproline*	-0,3226	0,04873
glutamine_degradant*	-0,3245	0,01312
pregnenetriol sulfate*	-0,3285	0,00123
docosahexaenoylcarnitine (C22:6)*	-0,3405	0,00158
octadecadienedioate (C18:2-DC)*	-0,341	0,00145
pregnenediol sulfate (C21H34O5S)*	-0,3422	0,00396
androsterone glucuronide	-0,3449	0,0358
eicosanedioate (C20-DC)	-0,345	0,00051
N-stearoylserine*	-0,3582	0
1-stearoyl-2-oleoyl-GPI (18:0/18:1)*	-0,3713	0,00007
spermidine	-0,3716	0,00142
17alpha-hydroxypregnenolone 3-sulfate	-0,3742	0,01111
glycocholenate sulfate*	-0,3867	0
glycohyocholate	-0,4028	0,01672
N,N-dimethylalanine	-0,4255	0,0124
pregnenolone sulfate	-0,4276	0,00175
hydroxy-CMPF*	-0,4441	0,04481
andro steroid monosulfate C19H28O6S (1)*	-0,448	0,00698
GlcNAc sulfate conjugate of C21H34O2 steroid**	-0,4744	0,00297
16a-hydroxy DHEA 3-sulfate	-0,5671	0,00116
1,5-anhydroglucitol (1,5-AG)	-0,6057	0
N-methylproline	-0,7204	0,03895
taurocholenate sulfate*	-0,78	0
taurochenodeoxycholic acid 3-sulfate	-0,9593	0,00152

Cluster cardiometabolic vs Cluster control (E)		
METABOLITE_NAME	**logFC**	**adj.P.Val**
tyramine O-sulfate	5,52269	0,00003
4-hydroxyphenylacetylglutamine	3,36526	0
sucrose	1,86875	0,00109
orotidine	1,67048	0,00033
cholate	1,51295	0,0082
4-hydroxyphenylacetate	1,38339	0
4-hydroxyphenylacetoylcarnitine	1,32253	0
p-cresol glucuronide*	1,23014	0
deoxycholate	1,22076	0

1-carboxyethylisoleucine	1,21874	0
1-carboxyethylvaline	1,18947	0
imidazole propionate	1,16969	0
5alpha-androstan-3alpha,17beta-diol monosulfate (2)	1,16808	0,00219
palmitoyl-oleoyl-glycerol (16:0/18:1) [1]*	1,13997	0
lactose	1,12153	0,00005
palmitoyl-oleoyl-glycerol (16:0/18:1) [2]*	1,08933	0
pentose acid*	1,07619	0
1-carboxyethylleucine	1,06568	0
homocitrulline	1,06417	0
diacylglycerol (14:0/18:1, 16:0/16:1) [2]*	1,02945	0
deoxycholic acid glucuronide	0,99346	0
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [1]*	0,93825	0
diacylglycerol (12:0/18:1, 14:0/16:1, 16:0/14:1) [2]*	0,92719	0
1-carboxyethylphenylalanine	0,92133	0
phenol glucuronide	0,92056	0
myristoyl-linoleoyl-glycerol (14:0/18:2) [2]*	0,91343	0
lyxonate	0,91088	0
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [2]*	0,90537	0
indoleacetylglutamine	0,89499	0,00023
1-methyl-5-imidazoleacetate	0,88722	0,00117
guanidinosuccinate	0,88669	0
diacylglycerol (14:0/18:1, 16:0/16:1) [1]*	0,8792	0
1-stearoyl-2-oleoyl-GPE (18:0/18:1)	0,87768	0
chenodeoxycholic acid sulfate (1)	0,87373	0
arabonate/xylonate	0,87231	0
myristoyl-linoleoyl-glycerol (14:0/18:2) [1]*	0,86887	0
3-methylglutarylcarnitine (2)	0,83366	0
phenol sulfate	0,82708	0
phenylacetylglutamate	0,80726	0
deoxycholic acid 12-sulfate*	0,80636	0
1-palmitoyl-2-oleoyl-GPE (16:0/18:1)	0,7978	0
glutamine conjugate of C6H10O2 (2)*	0,79223	0
palmitoyl-docosahexaenoyl-glycerol (16:0/22:6) [1]*	0,79197	0
cholic acid glucuronide	0,78976	0,00001
1-carboxyethyltyrosine	0,7836	0
glucuronide of C14H22O4 (2)*	0,77253	0
oleoyl-arachidonoyl-glycerol (18:1/20:4) [2]*	0,77116	0

N2,N5-diacetylornithine	0,76064	0
formiminoglutamate	0,74487	0
oleoyl-arachidonoyl-glycerol (18:1/20:4) [1]*	0,73669	0
1-palmitoyl-2-docosahexaenoyl-GPE (16:0/22:6)*	0,73374	0
palmitoyl-linoleoyl-glycerol (16:0/18:2) [2]*	0,73276	0
ursodeoxycholate	0,72289	0,00038
1-stearoyl-2-docosahexaenoyl-GPE (18:0/22:6)*	0,72277	0
palmitoleoyl-arachidonoyl-glycerol (16:1/20:4) [2]*	0,70893	0
linoleoyl-docosahexaenoyl-glycerol (18:2/22:6) [1]*	0,69969	0
fructosyllysine	0,69366	0
11beta-hydroxyandrosterone glucuronide	0,69273	0
glycoursodeoxycholic acid sulfate (1)	0,69131	0,00295
N-acetylhomocitrulline	0,67585	0
1-oleoyl-2-linoleoyl-GPE (18:1/18:2)*	0,67347	0
trigonelline (N'-methylnicotinate)	0,66254	0,00033
2,3-dihydroxy-2-methylbutyrate	0,66049	0
oleoyl-oleoyl-glycerol (18:1/18:1) [2]*	0,65751	0
oleoyl-oleoyl-glycerol (18:1/18:1) [1]*	0,65336	0
1-stearoyl-2-linoleoyl-GPE (18:0/18:2)*	0,64908	0
linoleoyl-arachidonoyl-glycerol (18:2/20:4) [1]*	0,64195	0
isoursodeoxycholate	0,62945	0,01067
chenodeoxycholate	0,62623	0,00003
glutamine conjugate of C7H12O2*	0,62547	0
1-palmitoyl-2-linoleoyl-GPE (16:0/18:2)	0,62293	0
1-palmitoyl-2-arachidonoyl-GPE (16:0/20:4)*	0,62279	0
linoleoyl-arachidonoyl-glycerol (18:2/20:4) [2]*	0,62022	0
cystathionine	0,61072	0
I-urobilinogen	0,60637	0,00001
palmitoyl-linoleoyl-glycerol (16:0/18:2) [1]*	0,60243	0
3-methylglutaconate	0,59493	0
isoursodeoxycholate sulfate (1)	0,59088	0
trimethylamine N-oxide	0,58957	0
lithocholate sulfate (1)	0,58723	0,00001
dopamine 4-sulfate	0,57323	0
gulonate*	0,56995	0
prolylglycine	0,55833	0
1-ribosyl-imidazoleacetate*	0,55782	0
xylose	0,55502	0,00006
maltose	0,54784	0
diacylglycerol (16:1/18:2 [2], 16:0/18:3 [1])*	0,54033	0
5alpha-androstan-3alpha,17beta-diol disulfate	0,53746	0,00021

glutamine conjugate of C6H10O2 (1)*	0,5369	0
1-stearoyl-2-arachidonoyl-GPE (18:0/20:4)	0,53519	0
11beta-hydroxyetiocholanolone glucuronide*	0,52942	0,00057
glucose	0,52554	0
ribonate	0,51989	0
phenylacetylglutamine	0,51774	0
lanthionine	0,51647	0
1-methyl-5-imidazolelactate	0,5102	0,00332
linoleoyl-linoleoyl-glycerol (18:2/18:2) [1]*	0,50353	0
docosatrienoate (22:3n6)*	0,50351	0
linoleoyl-linolenoyl-glycerol (18:2/18:3) [1]*	0,50182	0,00053
methylsuccinoylcarnitine	0,49641	0,00015
ascorbic acid 3-sulfate*	0,49151	0
dopamine 3-O-sulfate	0,4814	0
tetrahydrocortisol glucuronide	0,47898	0
oleoyl-linoleoyl-glycerol (18:1/18:2) [2]	0,47233	0
palmitoleoyl-linoleoyl-glycerol (16:1/18:2) [1]*	0,47034	0
(S)-3-hydroxybutyrylcarnitine	0,46816	0
N-acetylcitrulline	0,46526	0,00038
picolinoylglycine	0,46322	0
galactonate	0,46207	0,00001
alpha-ketobutyrate	0,46176	0
oleoyl-linoleoyl-glycerol (18:1/18:2) [1]	0,45763	0
pipecolate	0,45293	0
glucuronate	0,44517	0
N,N,N-trimethyl-5-aminovalerate	0,44123	0
L-urobilin	0,43914	0,00055
fructose	0,43428	0
1-stearoyl-GPG (18:0)	0,43412	0
hydantoin-5-propionate	0,4339	0
chenodeoxycholic acid 24-glucuronide	0,43377	0,00082
stearoyl-arachidonoyl-glycerol (18:0/20:4) [1]*	0,4327	0
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [2]*	0,4311	0
8-methoxykynurenate	0,42149	0,00004
3-methyladipate	0,41326	0,00005
N-acetyltaurine	0,41221	0
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [1]*	0,40803	0,00001
alpha-hydroxyisovalerate	0,40765	0
pyridoxate	0,39576	0,00007
gamma-glutamylglutamate	0,39543	0
acisoga	0,39519	0

androstenediol (3beta,17beta) disulfate (1)	0,39334	0,00007
glutarate (C5-DC)	0,38581	0,00007
methionine sulfone	0,3846	0
3-hydroxysebacate	0,38347	0,01039
gentisate	0,38335	0,00001
erythronate*	0,38174	0
N-acetyl-1-methylhistidine*	0,3704	0,00042
N-acetyl-cadaverine	0,37017	0,01996
mannose	0,36985	0
glutamate	0,36433	0
hydroxy-N6,N6,N6-trimethyllysine*	0,35922	0
2-stearoyl-GPE (18:0)*	0,35653	0
alpha-hydroxycaproate	0,35503	0,00002
2-hydroxy-3-methylvalerate	0,35491	0
cytosine	0,35434	0,00001
4-acetamidobutanoate	0,35334	0,00012
2-hydroxy-4-(methylthio)butanoic acid	0,35198	0
N-carbamoylalanine	0,3485	0,00003
N-acetylneuraminate	0,34461	0
3-indoxyl sulfate	0,34187	0
7-ketodeoxycholate	0,33577	0,04357
N6-succinyladenosine	0,33327	0
N-stearoyl-sphinganine (d18:0/18:0)*	0,33257	0
gamma-glutamylisoleucine*	0,33247	0
succinylcarnitine (C4-DC)	0,3322	0
2-aminoadipate	0,33037	0
adrenate (22:4n6)	0,32861	0
cyclo(leu-pro)	0,32827	0,00188
1-methyl-4-imidazoleacetate	0,3274	0,00001
phenylacetylcarnitine	0,32498	0,00089
5alpha-androstan-3beta,17beta-diol disulfate	0,32134	0,00393
nisinate (24:6n3)	0,32112	0,0005
vanillactate	0,31915	0,00002
1-myristoylglycerol (14:0)	0,31825	0,00002
2-hydroxybutyrate/2-hydroxyisobutyrate	0,31747	0
3-hydroxymyristate	0,31739	0
margarate (17:0)	0,31629	0
heneicosapentaenoate (21:5n3)	0,31121	0,01479
beta-citrylglutamate	0,31005	0
1-myristoyl-2-palmitoyl-GPC (14:0/16:0)	0,30938	0
tetrahydrocortisone glucuronide (5)	0,30908	0

docosapentaenoate (n3 DPA; 22:5n3)	0,30855	0
ceramide (d16:1/24:1, d18:1/22:1)*	0,30472	0
pyruvate	0,30432	0
erucate (22:1n9)	0,30229	0
hexanoylglutamine	0,30103	0,00164
2-oxoarginine*	0,3007	0,00005
arabitol/xylitol	0,30028	0
11-ketoetiocholanolone glucuronide	0,30001	0,00013
N2-acetyl,N6,N6-dimethyllysine	0,29883	0,00766
N-carbamoylvaline	0,29812	0,00001
gamma-CEHC glucuronide*	0,29702	0
glycolithocholate sulfate*	0,29545	0,00443
1-palmitoyl-2-palmitoleoyl-GPC (16:0/16:1)*	0,29288	0
N-stearoyl-sphingosine (d18:1/18:0)*	0,2899	0
carnitine of C10H14O2 (5)*	0,28812	0,00004
3,4-dihydroxybutyrate	0,28519	0
2-aminoheptanoate	0,27973	0
maleate	0,27746	0
gamma-tocopherol/beta-tocopherol	0,27655	0
1-oleoyl-GPE (18:1)	0,27552	0
2,3-dihydroxy-5-methylthio-4-pentenoate (DMTPA)*	0,27371	0
3-hydroxyadipate	0,26694	0,002
linoleoyl-linoleoyl-glycerol (18:2/18:2) [2]*	0,26635	0,0201
1-palmitoyl-GPG (16:0)*	0,26459	0
lactate	0,2631	0
tetrahydrocortisol sulfate (1)	0,26184	0,00293
gamma-glutamylvaline	0,26128	0
xanthosine	0,26113	0,00019
eicosenedioate (C20:1-DC)*	-0,2661	0,01156
1-(1-enyl-palmitoyl)-2-palmitoleoyl-GPC (P-16:0/16:1)*	-0,2668	0
beta-cryptoxanthin	-0,2762	0,01678
sphingomyelin (d18:2/18:1)*	-0,2794	0
pregnenediol sulfate (C21H34O5S)*	-0,2798	0,00015
branched-chain, straight-chain, or cyclopropyl 10:1 fatty acid (1)*	-0,2837	0,00005
glycosyl ceramide (d18:1/23:1, d17:1/24:1)*	-0,2857	0
androstenediol (3alpha, 17alpha) monosulfate (2)	-0,291	0,0002
eicosapentaenoylcholine	-0,2913	0,00052

sphingomyelin (d18:1/22:2, d18:2/22:1, d16:1/24:2)*	-0,2919	0
androsterone glucuronide	-0,3029	0,0026
docosahexaenoylcholine	-0,3101	0
pregnenolone sulfate	-0,3108	0,00027
oleoylcholine	-0,3201	0
arachidonoylcholine	-0,3254	0
glycosyl ceramide (d18:2/24:1, d18:1/24:2)*	-0,3268	0
sphingomyelin (d18:2/14:0, d18:1/14:1)*	-0,33	0
N-stearoylserine*	-0,3377	0
taurolithocholate 3-sulfate	-0,3491	0,02194
palmitoylcholine	-0,352	0
sphingomyelin (d18:2/24:2)*	-0,3532	0
palmitoloelycholine	-0,3567	0
sphingomyelin (d18:1/20:2, d18:2/20:1, d16:1/22:2)*	-0,3594	0
estrone 3-sulfate	-0,364	0,01641
stearoylcholine*	-0,3769	0
hydroxy-CMPF*	-0,4001	0,00307
dihomo-linolenoyl-choline	-0,4248	0
linoleoylcholine*	-0,4302	0
5alpha-pregnan-3beta-ol,20-one sulfate	-0,4997	0,02831
cysteine-glutathione disulfide	-0,5088	0
taurocholenate sulfate*	-0,5279	0
tryptophan betaine	-0,5388	0,00007
N-methylproline	-0,6043	0,00467
N,N-dimethylalanine	-0,6853	0
1,5-anhydroglucitol (1,5-AG)	-0,726	0
pregnanolone/allopregnanolone sulfate	-0,9053	0,00766
pregnanediol-3-glucuronide	-0,9979	0,0022
5alpha-pregnan-3beta,20alpha-diol disulfate	-1,2436	0,00027
5alpha-pregnan-diol disulfate	-1,3543	0,00003
5alpha-pregnan-3beta,20beta-diol monosulfate (1)	-1,4083	0,00052
5alpha-pregnan-3beta,20alpha-diol monosulfate (2)	-1,4689	0,00241

Cluster liver specific vs Cluster Control(F)		
METABOLITE_NAME	**logFC**	**adj.P.Val**
5alpha-androstan-3alpha,17beta-diol monosulfate (2)	1,44418	0,01061

glycoursodeoxycholic acid sulfate (1)	1,25432	0,00011
5alpha-androstan-3alpha,17beta-diol disulfate	0,81785	0,00005
taurochenodeoxycholic acid 3-sulfate	0,80603	0,00327
ursodeoxycholate	0,75216	0,01382
glycochenodeoxycholate glucuronide (1)	0,71616	0,01952
formiminoglutamate	0,65741	0
glycochenodeoxycholate 3-sulfate	0,61835	0,0009
deoxycholic acid glucuronide	0,53847	0,02732
tauroursodeoxycholic acid sulfate (1)	0,52661	0,01061
diacylglycerol (12:0/18:1, 14:0/16:1, 16:0/14:1) [2]*	0,46551	0,00361
GlcNAc sulfate conjugate of C21H34O2 steroid**	0,41607	0,00403
heneicosapentaenoate (21:5n3)	0,41479	0,03322
1-carboxyethylisoleucine	0,39559	0,00193
palmitoyl-oleoyl-glycerol (16:0/18:1) [1]*	0,38874	0,00484
palmitoyl-docosahexaenoyl-glycerol (16:0/22:6) [1]*	0,38772	0,01061
1-carboxyethylleucine	0,37986	0,00005
1-stearoyl-2-oleoyl-GPI (18:0/18:1)*	0,37323	0
2-oxoarginine*	0,37279	0,00043
diacylglycerol (14:0/18:1, 16:0/16:1) [2]*	0,36051	0,03741
palmitoyl-oleoyl-glycerol (16:0/18:1) [2]*	0,35926	0,00592
hexadecanedioate (C16-DC)	0,34721	0,00037
1-carboxyethylphenylalanine	0,34223	0,00142
2-hydroxy-3-methylvalerate	0,33938	0,00245
xanthine	0,32709	0,00064
diacylglycerol (14:0/18:1, 16:0/16:1) [1]*	0,3246	0,02462
1-carboxyethylvaline	0,32419	0,0052
behenoyl dihydrosphingomyelin (d18:0/22:0)*	0,31784	0
picolinate	0,31071	0,00003
myristoyl-linoleoyl-glycerol (14:0/18:2) [1]*	0,30623	0,04156
octadecanedioylcarnitine (C18-DC)*	0,30016	0,00056
palmitoyl-linoleoyl-glycerol (16:0/18:2) [2]*	0,28879	0,01739
glycocholenate sulfate*	0,2834	0,00002
sedoheptulose	0,28264	0,01473
4-hydroxyglutamate	0,27966	0,0011
1-stearoyl-2-oleoyl-GPE (18:0/18:1)	0,2665	0,01709
2-aminoadipate	0,26056	0
N-acetylmethionine	-0,2625	0
cysteine-glutathione disulfide	-0,3057	0,03

Molecular features that were differentially expressed between type 2 diabetes and non-T2D groups, and between cardiometabolic and control cluster (G)		
Liver Gene	T2D group vs nonT2D group	Cardiometa-bolic cluster vs Control cluster
A1CF	X	X
AADAT	X	X
AASS	X	
ABCC4		X
ABCG5		X
ABLIM1		X
ACADSB	X	X
ACAT2	X	X
ACLY	X	X
ACOX2	X	X
ACP5		X
ACSS3	X	X
ADAMTSL3		X
AGMO		X
AGXT		X
AGXT2		X
AKR1B10	X	X
AKR1B15	X	X
AKR1C3		X
ALAS1		X
ALDH1L1		X
ALDH3A1		X
ALDOC	X	X
ALPL	X	X
ANG		X
ANKRD18A	X	X
ANKRD18B	X	X
ANKRD18CP	X	
ANKRD29		X
ANKS1B	X	
ANKUB1	X	
ANTXR1		X
ANXA2P1		X

ANXA2P2	X	X
AOC4P	X	X
APOF	X	X
APOM		X
ARHGAP10	X	X
ARPC5L	X	X
ARRDC3		X
ARSD	X	X
ASPN		X
ATP6V1F	X	
ATP9A	X	X
AZGP1		X
BPIFB1		X
C1orf198		X
C3orf85		X
C3P1	X	X
C4B		X
C6		X
C8A		X
C8B		X
CA14	X	
CACTIN-AS1		X
CAP2		X
CAPN12	X	X
CAPN2		X
CASTOR2		X
CCDC71L	X	
CCL15-CCL14		X
CCL20	X	X
CCND1	X	X
CCR1		X
CD163L1		X
CD3E	X	
CD4	X	X
CD82	X	X
CDH1	X	
CDKN1A		X
CEP170B	X	
CEP89		X
CES1	X	X
CETN2		X

CETP	X	X
CFAP298		X
CFHR5	X	X
CHI3L1	X	X
CKS2	X	X
CLEC4M	X	X
CLPTM1L		X
CNPPD1		X
COLEC10		X
COX10-AS1	X	
CPA3		X
CPEB4		X
CPN1	X	X
CPNE6	X	
CPS1-IT1	X	X
CPT1B	X	X
CPVL		X
CSTA	X	X
CSTB		X
CUTC	X	
CXADR	X	X
CXCL10		X
CXCL9	X	X
CXCR2P1	X	X
CYP1A2	X	
CYP2C19	X	X
CYP2C8	X	X
CYP3A43	X	
CYP51A1	X	X
DAZ4	X	
DBX1		X
DCBLD2		X
DCPS	X	X
DDB2	X	X
DDX3Y	X	
DEFB1	X	X
DHCR7	X	X
DLAT		X
DLGAP1-AS3		X
DNAJC12	X	X
DNAJC6	X	

DOK6	X	X
DPYD	X	X
DPYSL2		X
DTNA	X	X
DYNLT1	X	
EBP	X	X
EEF1A2		X
EFNA1		X
EHD4		X
EIF1AY	X	X
ENO3	X	
ENPEP	X	X
EPCAM	X	
EPHA3		X
ERG28	X	X
ERVK-7		X
ESPN		X
ESR1		X
ESRRG	X	
ETFA		X
EXT1	X	X
FABP4		X
FABP5	X	X
FAM151A	X	X
FASN		X
FBXO32		X
FBXW11		X
FCN2	X	X
FDFT1	X	X
FDXR	X	X
FGB		X
FGF2		X
FGF21	X	
FNDC1	X	
FNDC3A		X
FRMD4B	X	X
FST	X	
GABRE	X	
GALK1		X
GAS6	X	X
GAS6-AS1	X	X

GCH1		X
GDF5	X	X
GGH		X
GIMAP7	X	
GNL2		X
GNMT	X	X
GPBP1L1		X
GPR82		X
GPX2	X	
GRTP1		X
GSTA7P		X
GUCA2B	X	X
HAAO		X
HAO2		X
HERC5	X	
HKDC1	X	X
HLA-E		X
HMGCS1	X	X
HNRNPA1		X
HNRNPH3		X
HOMER2		X
HS3ST3A1	X	
HSD11B1		X
HSD17B7P2		X
HSPA4L	X	X
HULC	X	
HYDIN		X
IDH2	X	X
IDNK		X
IDO2		X
IKBKE		X
IL32	X	X
IL7R	X	
INHBE	X	
INMT-MINDY4	X	X
INSIG1	X	X
ITGBL1	X	X
JUNB	X	
JUND		X
KCNE3	X	X
KDELR3	X	X

KDM5D	X	X
KDM6A		X
KLF3		X
KRT6A	X	X
KRT6C	X	X
KRT75	X	X
KRT79	X	X
KRT84	X	
LAPTM4B		X
LDLR	X	X
LGALS2	X	
LGALS4	X	X
LIN28B		X
LINC01554	X	X
LINC01588	X	
LINC02291		X
LINC02396		X
LINC02432	X	
LOC100422781		X
LOC101927136	X	X
LOC105369360	X	
LOC730101	X	
LPL	X	X
LRP6		X
LRRCC1	X	
LSS	X	X
LUM	X	X
MACO1		X
MAP2K1		X
MAP4	X	X
MAP4K4	X	X
MAPKAPK3	X	X
MARC2	X	X
MARCH1		X
MBNL3		X
MCL1	X	
MET	X	X
MIR101-2	X	
MIR505		X
MIR622	X	X
MIR644A		X

MMAB	X	
MMP14		X
MOGAT3	X	
MPC2		X
MPV17L		X
MS4A14		X
MSN	X	X
MT1A	X	X
MT1B		X
MT1DP		X
MT1E		X
MT1F	X	X
MT1G	X	X
MT1H		X
MT1IP		X
MT1JP		X
MT1M	X	X
MT3		X
MTFP1		X
MVD	X	X
MYH11	X	
MYL12B		X
MYO9A		X
NAAA	X	X
NAP1L1		X
NAT8L		X
NCAM2		X
NEK8		X
NHSL1		X
NID2	X	X
NLRP9		X
NME1	X	
NOS2		X
NPC1L1		X
NPM2	X	X
NPR3	X	
NR1I3		X
NRN1	X	X
NSDHL	X	X
NT5E	X	X
NTN4	X	X

OAT	X	X
ODC1	X	X
OLFM2	X	X
OSBPL2	X	
P2RX5		X
P2RY13	X	
P4HA1	X	
PADI1		X
PAFAH2		X
PAIP2B	X	X
PCCB	X	X
PCDH12		X
PCNT		X
PCOLCE		X
PDIA5	X	
PDP2		X
PEPD	X	X
PER2		X
PGLYRP2		X
PHPT1		X
PIEZO1	X	X
PINK1	X	X
PLCB1	X	X
PLIN1	X	
PLK2		X
PLN	X	X
PLXNA4		X
PNPLA4		X
PODN	X	X
PON1	X	X
POSTN	X	X
PPA1		X
PPP1R1A	X	X
PRDX5		X
PRKAA2	X	X
PRKAG1		X
PRRG4		X
PRXL2A		X
PTGDS	X	X
PTPN11		X
PTPRD	X	X

PURPL	X	X
PYGB	X	X
PZP	X	X
RAI14		X
RALGDS	X	X
RBM24		X
RBP5		X
RELN		X
RETREG1		X
RGCC		X
RGMA		X
RGS5	X	X
RPS27L	X	X
RPS4Y1	X	X
RRM2B		X
RSBN1L		X
RSU1		X
RXYLT1		X
SARDH		X
SC5D	X	X
SCARNA17		X
SCARNA4	X	
SCARNA9L		X
SCCPDH		X
SCD	X	X
SCPEP1	X	
SDC2		X
SERPINA1	X	X
SERPINE1	X	
SERTM2	X	
SGCE	X	X
SGO2		X
SH3BP5L	X	X
SHISA4		X
SIPA1L2		X
SIRT5		X
SKAP2		X
SKP2		X
SLC16A13	X	
SLC22A1	X	
SLC22A10	X	X

SLC22A3		X
SLC27A2		X
SLC6A13	X	X
SLC9A9		X
SLCO1B7	X	X
SLCO4C1	X	X
SNORA14A	X	X
SNORA14B	X	
SNORA28	X	
SNORD62A	X	
SNORD62B	X	
SNORD70	X	X
SNTB1		X
SNX10	X	X
SORD		X
SPATA18	X	X
SPICE1		X
SPINK1	X	X
SPINK4		X
SPP1	X	X
SPP2		X
SREBF2	X	X
SRPX2		X
STAT3	X	
STMN2	X	X
STOM	X	X
STX3		X
SULF2	X	X
SULT1C2	X	X
SULT1E1	X	
SUSD2		X
TANGO6		X
TCP10L2	X	X
TEF		X
TESK2		X
TFF3	X	
TFPI2	X	X
THBS1	X	
TIMD4	X	X
TIMP1	X	X
TMED6	X	X

TMEM132C		X
TMEM154	X	
TMEM45B	X	
TMEM92	X	X
TMTC1	X	X
TNFAIP3	X	X
TNFRSF10A		X
TNFRSF10D		X
TNIP1		X
TNNC1		X
TOB1	X	
TP53I3	X	X
TRIM35		X
TTTY14	X	X
TUBE1		X
TWSG1		X
TXNRD1		X
TYMS	X	X
UGT2A2		X
USP22	X	X
USP9Y	X	X
UTY	X	X
VAMP5		X
VCAM1	X	X
VCAN	X	X
VIL1	X	X
VTRNA1-1		X
WDPCP		X
WDR72	X	
WNK3	X	X
XIST	X	X
XRCC5		X
ZBTB32		X
ZFP1		X
ZFP36		X
ZG16	X	X
ZKSCAN1		X
ZMAT3	X	X
ZNF16		X
ZNF329		X

liver gene pathways	T2D group vs nonT2D group	Cardiometa-bolic cluster vs Control cluster
acetyl_coa_metabolic_process	X	X
activation_of_immune_response		X
activation_of_protein_kinase_activity		X
acylglycerol_homeostasis	X	X
adaptive_immune_response	X	
adaptive_immune_response_based_on_somatic_recom-bination_of_immune_receptors_built_from_immunoglobu-lin_superfamily_domains	X	X
adp_metabolic_process	X	X
alcohol_biosynthetic_process	X	X
alcohol_catabolic_process		X
alcohol_metabolic_process	X	X
alpha_amino_acid_catabolic_process	X	X
alpha_amino_acid_metabolic_process	X	X
amide_transport	X	
antimicrobial_humoral_immune_response_mediated_by_antimicro-bial_peptide		X
antimicrobial_humoral_response		X
arachidonic_acid_metabolic_process		X
aspartate_family_amino_acid_metabolic_process	X	X
atp_metabolic_process		X
b_cell_mediated_immunity	X	X
biological_process_involved_in_interaction_with_host		X
carbohydrate_catabolic_process	X	X
carbohydrate_derivative_transport	X	
carbohydrate_homeostasis	X	
carbohydrate_transmembrane_transport	X	
carbohydrate_transport	X	
carboxylic_acid_transport	X	
cell_chemotaxis	X	X
cell_matrix_adhesion	X	
cell_substrate_adhesion	X	
cell_substrate_junction_organization	X	
cellular_amino_acid_biosynthetic_process	X	X
cellular_amino_acid_catabolic_process	X	X
cellular_amino_acid_metabolic_process	X	X
cellular_carbohydrate_catabolic_process	X	X

cellular_carbohydrate_metabolic_process	X	X
cellular_glucan_metabolic_process		X
cellular_hormone_metabolic_process	X	X
cellular_ketone_metabolic_process	X	
cellular_lipid_catabolic_process	X	X
cellular_nitrogen_compound_catabolic_process	X	
cellular_oxidant_detoxification		X
cellular_response_to_alcohol	X	
cellular_response_to_cadmium_ion	X	X
cellular_response_to_calcium_ion	X	X
cellular_response_to_carbohydrate_stimulus	X	
cellular_response_to_chemical_stress	X	X
cellular_response_to_corticosteroid_stimulus	X	
cellular_response_to_fatty_acid	X	X
cellular_response_to_inorganic_substance	X	X
cellular_response_to_ketone	X	X
cellular_response_to_lipoprotein_particle_stimulus	X	X
cellular_response_to_nutrient		X
cellular_response_to_reactive_oxygen_species	X	X
cellular_response_to_toxic_substance	X	X
cellular_response_to_xenobiotic_stimulus	X	X
cellular_transition_metal_ion_homeostasis		X
cholesterol_efflux		X
complement_activation	X	X
demethylation	X	
detoxification	X	X
dicarboxylic_acid_metabolic_process	X	X
diol_metabolic_process	X	
dna_biosynthetic_process	X	
endothelial_cell_apoptotic_process		X
endothelial_cell_development	X	
energy_derivation_by_oxidation_of_organic_compounds	X	X
energy_homeostasis	X	
energy_reserve_metabolic_process		X
estrogen_metabolic_process	X	X
fatty_acid_biosynthetic_process	X	X
fatty_acid_metabolic_process	X	X
foam_cell_differentiation		X
focal_adhesion_assembly	X	
generation_of_precursor_metabolites_and_energy	X	X

glucose_import	X	
glutamate_metabolic_process	X	
glycerolipid_biosynthetic_process	X	X
glycerolipid_metabolic_process	X	X
glycerophospholipid_metabolic_process		X
granulocyte_chemotaxis	X	X
hemostasis	X	X
hormone_metabolic_process	X	X
humoral_immune_response	X	X
humoral_immune_response_mediated_by_circulating_immunoglobulin	X	X
hydrogen_peroxide_metabolic_process	X	
intermembrane_lipid_transfer		X
intestinal_absorption		X
intracellular_lipid_transport	X	
intracellular_receptor_signaling_pathway		X
intracellular_sterol_transport	X	
isoprenoid_biosynthetic_process	X	X
isoprenoid_metabolic_process	X	X
leukocyte_chemotaxis	X	X
leukocyte_mediated_immunity	X	X
leukocyte_migration	X	
lipid_catabolic_process	X	X
lipid_homeostasis	X	X
lipid_localization	X	X
lipid_modification	X	X
long_chain_fatty_acid_metabolic_process		X
lymphocyte_migration	X	
mitotic_g1_s_transition_checkpoint_signaling	X	
monocarboxylic_acid_biosynthetic_process	X	X
monocarboxylic_acid_catabolic_process	X	X
mononuclear_cell_migration	X	
monosaccharide_biosynthetic_process	X	
monosaccharide_metabolic_process	X	X
multicellular_organism_growth	X	X
myeloid_leukocyte_migration	X	X
negative_regulation_of_catabolic_process	X	
negative_regulation_of_cellular_amide_metabolic_process	X	
negative_regulation_of_cellular_catabolic_process	X	

negative_regulation_of_cellular_macromolecule_biosynthetic_process	X	
negative_regulation_of_endothelial_cell_apoptotic_process	X	
negative_regulation_of_growth		X
negative_regulation_of_lipid_biosynthetic_process	X	
negative_regulation_of_oxidative_stress_induced_cell_death	X	
negative_regulation_of_peptidase_activity	X	
negative_regulation_of_proteolysis	X	
negative_regulation_of_response_to_wounding		X
neurotransmitter_uptake	X	
neutral_lipid_biosynthetic_process	X	X
neutral_lipid_metabolic_process	X	X
neutrophil_chemotaxis	X	X
neutrophil_migration	X	
nuclear_transcribed_mrna_catabolic_process	X	
nucleobase_metabolic_process		X
nucleoside_bisphosphate_metabolic_process	X	X
nucleoside_diphosphate_metabolic_process	X	X
nucleoside_phosphate_biosynthetic_process		X
nucleotide_phosphorylation	X	X
olefinic_compound_metabolic_process		X
organic_acid_biosynthetic_process	X	X
organic_acid_catabolic_process	X	X
organic_anion_transport	X	
organic_cyclic_compound_catabolic_process	X	X
organic_hydroxy_compound_biosynthetic_process	X	X
organic_hydroxy_compound_catabolic_process	X	X
organic_hydroxy_compound_transport	X	X
peptide_transport	X	
phosphatidylcholine_metabolic_process	X	X
phospholipid_biosynthetic_process	X	X
phospholipid_metabolic_process	X	X
plasma_lipoprotein_particle_clearance		X
polyol_metabolic_process	X	
polysaccharide_metabolic_process		X
positive_regulation_of_calcium_mediated_signaling	X	
positive_regulation_of_catabolic_process	X	
positive_regulation_of_chemotaxis	X	
positive_regulation_of_dna_biosynthetic_process	X	X

positive_regulation_of_epithelial_cell_migration	X	
positive_regulation_of_glucose_import	X	
positive_regulation_of_glucose_transmembrane_transport	X	
positive_regulation_of_immune_response		X
positive_regulation_of_kinase_activity	X	X
positive_regulation_of_leukocyte_chemotaxis	X	
positive_regulation_of_leukocyte_migration	X	
positive_regulation_of_lipid_biosynthetic_process	X	
positive_regulation_of_lipid_localization		X
positive_regulation_of_lipid_metabolic_process	X	
positive_regulation_of_mapk_cascade	X	
positive_regulation_of_posttranscriptional_gene_silencing	X	
positive_regulation_of_protein_kinase_activity		X
positive_regulation_of_protein_kinase_b_signaling		X
positive_regulation_of_reactive_oxygen_species_metabolic_process		X
positive_regulation_of_response_to_external_stimulus	X	X
positive_regulation_of_steroid_metabolic_process		X
positive_regulation_of_sterol_transport		X
primary_alcohol_metabolic_process	X	X
protein_containing_complex_remodeling	X	X
protein_lipid_complex_subunit_organization	X	X
protein_localization_to_plasma_membrane	X	
purine_containing_compound_biosynthetic_process		X
purine_containing_compound_metabolic_process	X	X
pyruvate_metabolic_process	X	X
reactive_oxygen_species_metabolic_process	X	X
receptor_recycling	X	
regulation_of_alcohol_biosynthetic_process	X	
regulation_of_atp_metabolic_process		X
regulation_of_cell_matrix_adhesion	X	
regulation_of_cell_substrate_junction_organization	X	
regulation_of_cellular_amide_metabolic_process	X	
regulation_of_cholesterol_efflux		X
regulation_of_cholesterol_metabolic_process	X	X
regulation_of_dna_biosynthetic_process	X	X
regulation_of_epithelial_cell_apoptotic_process		X
regulation_of_gene_silencing_by_rna	X	

regulation_of_generation_of_precursor_metabolites_and_energy		X
regulation_of_glucose_import	X	
regulation_of_glucose_transmembrane_transport	X	
regulation_of_hormone_levels	X	X
regulation_of_intracellular_transport		X
regulation_of_leukocyte_chemotaxis	X	
regulation_of_lipid_biosynthetic_process	X	X
regulation_of_lipid_localization		X
regulation_of_lipid_metabolic_process	X	X
regulation_of_lipid_transport		X
regulation_of_mononuclear_cell_migration	X	
regulation_of_nucleotide_biosynthetic_process		X
regulation_of_nucleotide_metabolic_process		X
regulation_of_oxidative_stress_induced_cell_death	X	
regulation_of_peptidase_activity	X	
regulation_of_plasma_lipoprotein_particle_levels	X	X
regulation_of_protein_catabolic_process	X	
regulation_of_protein_localization_to_plasma_membrane	X	
regulation_of_reactive_oxygen_species_metabolic_process		X
regulation_of_response_to_oxidative_stress	X	
regulation_of_small_molecule_metabolic_process	X	X
regulation_of_steroid_biosynthetic_process	X	X
regulation_of_steroid_metabolic_process	X	X
regulation_of_sterol_transport		X
regulation_of_triglyceride_metabolic_process	X	
regulation_of_viral_process		X
response_to_alcohol	X	
response_to_cadmium_ion	X	X
response_to_calcium_ion	X	X
response_to_carbohydrate	X	
response_to_chemokine		X
response_to_copper_ion	X	X
response_to_dexamethasone		X
response_to_estrogen	X	
response_to_ethanol	X	
response_to_extracellular_stimulus	X	X
response_to_fatty_acid	X	X
response_to_fluid_shear_stress	X	

response_to_ketone	X	X
response_to_metal_ion	X	X
response_to_molecule_of_bacterial_origin	X	
response_to_monosaccharide	X	
response_to_nutrient	X	X
response_to_oxidative_stress	X	
response_to_peptide	X	
response_to_reactive_oxygen_species	X	
response_to_sterol	X	X
response_to_toxic_substance	X	X
response_to_uv	X	
response_to_vitamin	X	X
response_to_x_ray		X
response_to_xenobiotic_stimulus	X	
response_to_zinc_ion	X	X
retinol_metabolic_process		X
rhythmic_process	X	
ribonucleoside_diphosphate_metabolic_process	X	X
ribose_phosphate_biosynthetic_process		X
ribose_phosphate_metabolic_process	X	X
rna_catabolic_process	X	
secondary_alcohol_metabolic_process	X	X
secondary_metabolic_process	X	
small_molecule_catabolic_process	X	X
steroid_biosynthetic_process	X	X
steroid_metabolic_process	X	X
sterol_biosynthetic_process	X	X
sterol_homeostasis	X	X
sterol_metabolic_process	X	X
sterol_transport	X	X
sulfur_amino_acid_metabolic_process	X	
sulfur_compound_biosynthetic_process	X	X
sulfur_compound_metabolic_process	X	X
terpenoid_metabolic_process	X	X
thioester_biosynthetic_process		X
thioester_metabolic_process	X	X
transcription_by_rna_polymerase_iii		X
transition_metal_ion_homeostasis	X	X
triglyceride_biosynthetic_process	X	X
triglyceride_metabolic_process	X	X
vascular_process_in_circulatory_system		X

vasodilation		X
vesicle_budding_from_membrane	X	
viral_genome_replication		X
viral_life_cycle		X
wound_healing	X	
xenobiotic_metabolic_process	X	
zinc_ion_homeostasis	X	X

Metabolites	**T2D group vs nonT2D group**	**Cardiometa-bolic cluster vs Control cluster**
(S)-3-hydroxybutyrylcarnitine	X	X
1-(1-enyl-palmitoyl)-2-palmitoleoyl-GPC (P-16:0/16:1)*		X
1-carboxyethylisoleucine	X	X
1-carboxyethylleucine	X	X
1-carboxyethylphenylalanine	X	X
1-carboxyethyltyrosine	X	X
1-carboxyethylvaline	X	X
1-methyl-4-imidazoleacetate		X
1-methyl-5-imidazoleacetate		X
1-methyl-5-imidazolelactate		X
1-myristoyl-2-palmitoyl-GPC (14:0/16:0)		X
1-myristoylglycerol (14:0)		X
1-oleoyl-2-linoleoyl-GPE (18:1/18:2)*	X	X
1-oleoyl-GPE (18:1)		X
1-palmitoyl-2-arachidonoyl-GPE (16:0/20:4)*	X	X
1-palmitoyl-2-docosahexaenoyl-GPE (16:0/22:6)*	X	X
1-palmitoyl-2-linoleoyl-GPE (16:0/18:2)	X	X
1-palmitoyl-2-oleoyl-GPE (16:0/18:1)	X	X
1-palmitoyl-2-palmitoleoyl-GPC (16:0/16:1)*		X
1-palmitoyl-GPG (16:0)*		X
1-ribosyl-imidazoleacetate*	X	X
1-stearoyl-2-arachidonoyl-GPE (18:0/20:4)	X	X
1-stearoyl-2-docosahexaenoyl-GPE (18:0/22:6)*	X	X
1-stearoyl-2-linoleoyl-GPE (18:0/18:2)*	X	X
1-stearoyl-2-oleoyl-GPE (18:0/18:1)	X	X
1-stearoyl-GPG (18:0)	X	X
1,5-anhydroglucitol (1,5-AG)	X	X
11-ketoetiocholanolone glucuronide		X
11beta-hydroxyandrosterone glucuronide	X	X

11beta-hydroxyetiocholanolone glucuronide*		X
2-aminoadipate		X
2-aminoheptanoate		X
2-hydroxy-3-methylvalerate	X	X
2-hydroxy-4-(methylthio)butanoic acid		X
2-hydroxybutyrate/2-hydroxyisobutyrate	X	X
2-oxoarginine*		X
2-stearoyl-GPE (18:0)*		X
2,3-dihydroxy-2-methylbutyrate	X	X
2,3-dihydroxy-5-methylthio-4-pentenoate (DMTPA)*		X
3-carboxy-4-methyl-5-propyl-2-furanpropanoate (CMPF)	X	
3-hydroxyadipate		X
3-hydroxydodecanedioate*	X	
3-hydroxyhexanoylcarnitine (1)	X	
3-hydroxymyristate	X	X
3-hydroxysebacate		X
3-indoxyl sulfate		X
3-methyladipate		X
3-methylglutaconate		X
3-methylglutarylcarnitine (2)	X	X
3,4-dihydroxybutyrate		X
4-acetamidobutanoate		X
4-hydroxyphenylacetate	X	X
4-hydroxyphenylacetoylcarnitine	X	X
4-hydroxyphenylacetylglutamine	X	X
5alpha-androstan-3alpha,17beta-diol disulfate		X
5alpha-androstan-3alpha,17beta-diol monosulfate (2)		X
5alpha-androstan-3beta,17beta-diol disulfate		X
5alpha-pregnan-3beta-ol,20-one sulfate		X
5alpha-pregnan-3beta,20alpha-diol disulfate	X	X
5alpha-pregnan-3beta,20alpha-diol monosulfate (2)	X	X
5alpha-pregnan-3beta,20beta-diol monosulfate (1)	X	X
5alpha-pregnan-diol disulfate	X	X
7-ketodeoxycholate	X	X
8-methoxykynurenate		X
acisoga	X	X
adrenate (22:4n6)	X	X
alpha-hydroxycaproate		X
alpha-hydroxyisovalerate	X	X
alpha-ketobutyrate	X	X

androstenediol (3alpha, 17alpha) monosulfate (2)	X	X
androstenediol (3beta,17beta) disulfate (1)		X
androsterone glucuronide	X	X
arabitol/xylitol		X
arabonate/xylonate	X	X
arachidonoylcholine	X	X
ascorbic acid 3-sulfate*	X	X
beta-citrylglutamate	X	X
beta-cryptoxanthin	X	X
branched-chain, straight-chain, or cyclopropyl 10:1 fatty acid (1)*		X
campesterol	X	
carnitine of C10H14O2 (5)*	X	X
ceramide (d16:1/24:1, d18:1/22:1)*		X
chenodeoxycholate	X	X
chenodeoxycholic acid 24-glucuronide		X
chenodeoxycholic acid sulfate (1)	X	X
cholate	X	X
cholic acid glucuronide	X	X
cyclo(leu-pro)	X	X
cystathionine	X	X
cysteine-glutathione disulfide	X	X
cytosine		X
deoxycholate	X	X
deoxycholic acid 12-sulfate*	X	X
deoxycholic acid glucuronide	X	X
diacylglycerol (12:0/18:1, 14:0/16:1, 16:0/14:1) [2]*	X	X
diacylglycerol (14:0/18:1, 16:0/16:1) [1]*	X	X
diacylglycerol (14:0/18:1, 16:0/16:1) [2]*	X	X
diacylglycerol (16:1/18:2 [2], 16:0/18:3 [1])*	X	X
dihomo-linolenoyl-choline	X	X
docosahexaenoylcholine	X	X
docosapentaenoate (n3 DPA; 22:5n3)	X	X
docosatrienoate (22:3n6)*	X	X
dopamine 3-O-sulfate		X
dopamine 4-sulfate	X	X
eicosapentaenoylcholine		X
eicosenedioate (C20:1-DC)*		X
erucate (22:1n9)		X
erythronate*		X
estrone 3-sulfate		X

formiminoglutamate	X	X
fructose	X	X
fructosyllysine	X	X
galactonate		X
gamma-CEHC glucuronide*		X
gamma-glutamylglutamate		X
gamma-glutamylisoleucine*		X
gamma-glutamylvaline		X
gamma-tocopherol/beta-tocopherol	X	X
gentisate		X
glucose	X	X
glucuronate		X
glucuronide of C14H22O4 (2)*	X	X
glutamate		X
glutamine conjugate of C6H10O2 (1)*	X	X
glutamine conjugate of C6H10O2 (2)*	X	X
glutamine conjugate of C7H12O2*	X	X
glutarate (C5-DC)	X	X
glycodeoxycholate	X	
glycolithocholate sulfate*		X
glycosyl ceramide (d18:1/23:1, d17:1/24:1)*		X
glycosyl ceramide (d18:2/24:1, d18:1/24:2)*		X
glycoursodeoxycholic acid sulfate (1)	X	X
guanidinosuccinate	X	X
gulonate*	X	X
heneicosapentaenoate (21:5n3)	X	X
hexanoylglutamine	X	X
homocitrulline	X	X
hydantoin-5-propionate	X	X
hydroxy-CMPF*	X	X
hydroxy-N6,N6,N6-trimethyllysine*		X
I-urobilinogen	X	X
imidazole propionate	X	X
indoleacetylglutamine	X	X
indolepropionate	X	
isoursodeoxycholate	X	X
isoursodeoxycholate sulfate (1)	X	X
L-urobilin		X
lactate		X
lactose	X	X
lanthionine		X

linoleoyl-arachidonoyl-glycerol (18:2/20:4) [1]*	X	X
linoleoyl-arachidonoyl-glycerol (18:2/20:4) [2]*	X	X
linoleoyl-docosahexaenoyl-glycerol (18:2/22:6) [1]*	X	X
linoleoyl-linolenoyl-glycerol (18:2/18:3) [1]*	X	X
linoleoyl-linoleoyl-glycerol (18:2/18:2) [1]*	X	X
linoleoyl-linoleoyl-glycerol (18:2/18:2) [2]*		X
linoleoylcholine*	X	X
lithocholate sulfate (1)	X	X
lyxonate	X	X
maleate		X
maltose	X	X
mannose	X	X
margarate (17:0)	X	X
methionine sulfone	X	X
methylsuccinoylcarnitine		X
myristoyl-linoleoyl-glycerol (14:0/18:2) [1]*	X	X
myristoyl-linoleoyl-glycerol (14:0/18:2) [2]*	X	X
N-acetyl-1-methylhistidine*		X
N-acetyl-cadaverine	X	X
N-acetylcitrulline		X
N-acetylhomocitrulline		X
N-acetylleucine	X	
N-acetylneuraminate		X
N-acetyltaurine		X
N-carbamoylalanine		X
N-carbamoylvaline		X
N-methylproline	X	X
N-stearoyl-sphinganine (d18:0/18:0)*	X	X
N-stearoyl-sphingosine (d18:1/18:0)*		X
N-stearoylserine*	X	X
N,N-dimethylalanine	X	X
N,N,N-trimethyl-5-aminovalerate	X	X
N2-acetyl,N6,N6-dimethyllysine		X
N2,N5-diacetylornithine	X	X
N6-succinyladenosine		X
nisinate (24:6n3)		X
oleoyl-arachidonoyl-glycerol (18:1/20:4) [1]*	X	X
oleoyl-arachidonoyl-glycerol (18:1/20:4) [2]*	X	X
oleoyl-linoleoyl-glycerol (18:1/18:2) [1]	X	X
oleoyl-linoleoyl-glycerol (18:1/18:2) [2]	X	X
oleoyl-oleoyl-glycerol (18:1/18:1) [1]*	X	X

oleoyl-oleoyl-glycerol (18:1/18:1) [2]*	X	X
oleoylcholine	X	X
orotidine	X	X
p-cresol glucuronide*	X	X
palmitoleoyl-arachidonoyl-glycerol (16:1/20:4) [2]*	X	X
palmitoleoyl-linoleoyl-glycerol (16:1/18:2) [1]*	X	X
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [1]*		X
palmitoleoyl-oleoyl-glycerol (16:1/18:1) [2]*	X	X
palmitoloelycholine	X	X
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [1]*	X	X
palmitoyl-arachidonoyl-glycerol (16:0/20:4) [2]*	X	X
palmitoyl-docosahexaenoyl-glycerol (16:0/22:6) [1]*	X	X
palmitoyl-linoleoyl-glycerol (16:0/18:2) [1]*	X	X
palmitoyl-linoleoyl-glycerol (16:0/18:2) [2]*	X	X
palmitoyl-oleoyl-glycerol (16:0/18:1) [1]*	X	X
palmitoyl-oleoyl-glycerol (16:0/18:1) [2]*	X	X
palmitoylcholine	X	X
pentose acid*		X
phenol glucuronide	X	X
phenol sulfate	X	X
phenylacetylcarnitine		X
phenylacetylglutamate	X	X
phenylacetylglutamine		X
picolinoylglycine	X	X
pipecolate		X
pregnanediol-3-glucuronide	X	X
pregnanolone/allopregnanolone sulfate	X	X
pregnenediol sulfate (C21H34O5S)*	X	X
pregnenolone sulfate	X	X
prolylglycine	X	X
pyridoxate		X
pyruvate	X	X
ribitol	X	
ribonate	X	X
sphingomyelin (d18:1/20:2, d18:2/20:1, d16:1/22:2)*		X
sphingomyelin (d18:1/22:2, d18:2/22:1, d16:1/24:2)*		X
sphingomyelin (d18:2/14:0, d18:1/14:1)*		X
sphingomyelin (d18:2/18:1)*		X
sphingomyelin (d18:2/24:2)*		X
stearoyl-arachidonoyl-glycerol (18:0/20:4) [1]*		X
stearoylcholine*	X	X

succinylcarnitine (C4-DC)		X
sucrose	X	X
taurocholenate sulfate*	X	X
taurodeoxycholic acid 3-sulfate	X	
taurolithocholate 3-sulfate	X	X
tetrahydrocortisol glucuronide	X	X
tetrahydrocortisol sulfate (1)		X
tetrahydrocortisone glucuronide (5)		X
trigonelline (N'-methylnicotinate)	X	X
trimethylamine N-oxide	X	X
tryptophan betaine	X	X
tyramine O-sulfate	X	X
ursodeoxycholate	X	X
vanillactate		X
xanthosine		X
xylose	X	X

The liver gene expression with significant differences between the cardiometabolic and liver-specific clusters (A), cardiometabolic and control clusters (B), and liver-specific and control clusters (C). Gene expression differential analysis across clusters was conducted using two-sided moderated t-tests. Statistical significance was assigned to differences where p-values, adjusted for multiple comparisons using the Benjamini-Hochberg method to control the False Discovery Rate, were below 0.05 and the absolute value of log2 fold change was greater than 0.26.

Metabolites with significant differences between the cardiometabolic and liver-specific clusters (D), cardiometabolic and control clusters (E), and liver-specific and control clusters (F). Metabolite differential analysis across clusters was conducted using moderated t-tests, excluding xenobiotics. Statistical significance was assigned to differences where p-values, adjusted for multiple comparisons using the Benjamini-Hochberg method to control the False Discovery Rate, were below 0.05 and the absolute value of log2 fold change was greater than 0.26.

Supplementary Table 2: Definition of self-reported history of liver disease, cardiovascular disease, and type 2 diabetes (UK Biobank data-field 20002) and ICD-10 codes used to define liver disease, cardiovascular disease, and type 2 diabetes.

Liver disease			
Self reported history		ICD-10 codes	
Description	Code	Diagnosis	Code
liver/biliary/pancreas problem	1136	Chronic viral hepatitis	B18
oesophageal varices	1141	Unspecified viral hepatitis	B19
hepatitis	1155	Liver cell carcinoma	C22.0
infective/viral hepatitis	1156	Disorders of copper metabolism	E83.0
non-infective hepatitis	1157	Disorders of iron metabolism	E83.1
liver failure/cirrhosis	1158	Disorders of plasma-protein metabolism, not elsewhere classified	E88.0
bile duct disease	1159	Budd-Chiari syndrome	I82.0
alcohol dependency	1408	Oesophageal varices with bleeding	I85.0
primary biliary cirrhosis	1506	Oesophageal varices without bleeding	I85.9
haemochromatosis	1507	Alcoholic liver disease	K70
hepatitis a	1578	Toxic liver disease	K71
hepatitis b	1579	Chronic hepatic failure	K72.1
hepatitis c	1580	Hepatic failure, unspecified	K72.9
hepatitis d	1581	Chronic hepatitis, not elsewhere classified	K73
hepatitis e	1582	Hepatic fibrosis	K74.0
alcoholic liver disease / alcoholic cirrhosis	1604	Hepatic sclerosis	K74.1
alpha-1 antitrypsin deficiency	1496	Hepatic fibrosis with hepatic sclerosis	K74.2
sclerosing cholangitis	1475	Primary biliary cirrhosis	K74.3
		Secondary biliary cirrhosis	K74.4
		Biliary cirrhosis, unspecified	K74.5
		Other and unspecified cirrhosis of liver	K74.6
		Nonspecific reactive hepatitis	K75.2
		Granulomatous hepatitis, not elsewhere classified	K75.3
		Autoimmune hepatitis	K75.4
		Other specified inflammatory liver diseases	K75.8
		Inflammatory liver disease, unspecified	K75.9

		Fatty (change of) liver, not elsewhere classified	K76.0
		Hepatic veno-occlusive disease	K76.5
		Portal hypertension	K76.6
		Hepatorenal syndrome	K76.7
		Other specified diseases of liver	K76.8
		Liver disease, unspecified	K76.9
		Cholangitis	K83.0
		Ascites	R18
		Liver transplant status	Z94.4
Cardio-vascular disease			
Self reported history		ICD-10 codes	
Description	Code	Diagnosis	ICD-10
angina	1074	Angina pectoris	I20
heart attack/myocardial infarction	1075	Acute myocardial infarction	I21
stroke	1081	Subsequent myocardial infarction	I22
transient ischaemic attack (tia)	1082	Certain current complications following acute myocardial infarction	I23
ischaemic stroke	1583	Other acute ischaemic heart diseases	I24
		Chronic ischaemic heart disease	I25
		Subarachnoid haemorrhage	I60
		Intracerebral haemorrhage	I61
		Other nontraumatic intracranial haemorrhage	I62
		Cerebral infarction	I63
		Stroke, not specified as haemorrhage or infarction	I64
		Sequelae of cerebrovascular disease	I69
		Transient cerebral ischaemic attacks and related syndromes	G45
Type 2 diabetes			
Self reported history		ICD-10 codes	
Description	Code	Diagnosis	ICD-10
diabetes	1220	Non-insulin-dependent diabetes mellitus	E11
type 2 diabetes	1223	Unspecified diabetes mellitus	E14