Supplementary Information

Markers for obese and non-obese Type 2 diabetes identified using whole blood metabolomics

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This file includes **Supplementary Tables S1-S3** and **Figures S1-S3**.

Supplementary Table S1. Characteristics of subjects. Individual data from 5 non-obese, non-diabetic, 5 obese, non-diabetic, 4 non-obese Type 2 diabetic, and 4 obese Type 2 diabetic subjects are shown. BMI, body mass index; PG, fasting plasma glucose.

group	Subject No.	Age	Gender	BMI (kg/m^2)	HbA1c (%)	PG (mg/dL)
non-Ob ND	1	78	F	21.1	5.5	82
	2	63	F	20.9	5.8	93
	3	63	M	20.7	5.3	88
	4	42	F	20.6	5.2	87
	5	44	M	20.6	5.2	81
Ob ND	6	69	M	29.6	5.4	102
	7	42	F	31.9	5.5	102
	8	41	M	29.1	5.1	93
	9	79	F	34.2	5.2	88
	10	69	F	31.4	5.8	101
non-Ob T2D	11	59	F	20.8	8.7	153
	12	68	M	23.1	9.5	108
	13	54	F	19.3	12.6	264
	14	52	M	20.2	9.3	223
Ob T2D	15	51	M	28.4	9.8	151
	16	39	F	35.8	7.2	115
	17	72	F	34.1	8.8	146
	18	56	M	31.0	6.9	149

Supplementary Table S2. Chromatographic data and mass spectra of 125 compounds. Compounds were identified using either commercially available standards (STD) or by analysis of MS/MS spectra (MS/MS), if no standard was available.

Compounds	Status	Formula	Ionixation	Theoretical m/z	Detected m/z	m/z error (ppm)	RT (min)
1,5-Anhydroglucitol	STD	C6H12O5	[M-H]-	163.0612	163.0617	3.0	9.9
2-Hydroxybutyrate	STD	C4H8O3	[M-H]-	103.0401	103.0409	8.1	4.8
2-Oxoglutarate	STD	C5H6O5	[M-H]-	145.0142	145.0146	2.5	13.9
3-Hydroxybutyrate	STD	C4H8O3	[M-H]-	103.0401	103.0410	9.2	6.0
4-Aminobenzoate	STD	C7H7NO2	[M+H]+	138.0555	138.0545	-7.0	7.6
4-Guanidinobutanoate	STD	C5H11N3O2	[M+H]+	146.0930	146.0922	-5.1	14.7
6-Phosphogluconate	STD	C6H13O10P	[M-H]-	275.0174	275.0171	-0.8	17.3
Acetyl-carnitine	STD	C9H17NO4	[M+H]+	204.1236	204.1227	-4.6	9.1
Acetyl-carnosine	STD	C11H16N4O4	[M+H]+	269.1250	269.1238	-4.3	6.7
Adenine	STD	C5H5N5	[M+H]+	136.0623	136.0614	-6.7	7.0
Adenosine	STD	C10H13N5O4	[M+H]+	268.1046	268.1029	-6.2	6.7
ADP	STD	C10H15N5O10P2	[M+H]+	428.0372	428.0359	-3.2	14.8
Aminobutyrate	STD	C4H9NO2	[M-H]-	102.0561	102.0568	7.2	12.8
AMP	STD	C10H14N5O7P	[M+H]+	348.0709	348.0699	-2.9	12.8
Arginine	STD	C6H14N4O2	[M+H]+	175.1195	175.1185	-5.6	26.2
Asparagine	STD	C4H8N2O3	[M+H]+	133.0613	133.0601	-8.9	14.3
Aspartate	STD	C4H7NO4	[M+H]+	134.0453	134.0443	-7.9	13.9
ATP	STD	C10H16N5O13P3	[M+H]+	508.0036	508.0024	-2.3	16.1
Betaine	STD	C5H11NO2	[M+H]+	118.0868	118.0857	-9.5	9.3
Butyro-betaine	STD	C7H15NO2	[M+H]+	146.1181	146.1172	-5.9	12.5
(iso)Butyryl-carnitine	STD	C11H21NO4	[M+H]+	232.1549	232.1541	-3.4	6.4
Caffeine	STD	C8H10N4O2	[M+H]+	195.0882	195.0874	-3.9	4.1
Carnitine	STD	C7H15NO3	[M+H]+	162.1130	162.1119	-6.7	12.4
Carnosine	STD	C9H14N4O3	[M+H]+	227.1144	227.1136	-3.4	15.4
CDP-choline	STD	C14H26N4O11P2	[M+H]+	489.1152	489.1132	-3.9	15.1
CDP-ethanolamine	STD	C11H20N4O11P2	[M-H]-	445.0531	445.0536	1.0	16.1
Chenodeoxycholate	STD	C24H40O4	[M-H]-	391.2854	391.2850	-1.0	3.7
Citrate	STD	C6H8O7	[M-H]-	191.0197	191.0200	1.5	17.5
Citrulline	STD	C6H13N3O3	[M+H]+	176.1035	176.1026	-4.9	15.5
Creatine	STD	C4H9N3O2	[M-H]-	130.0622	130.0628	4.3	14.0
Creatinine	STD	C4H7N3O	[M-H]-	112.0516	112.0525	8.0	7.2
CTP	STD	C9H16N3O14P3	[M-H]-	481.9772	481.9778	1.2	17.7
Cytidine	STD	C9H13N3O5	[M+H]+	244.0933	244.0925	-3.5	10.1
Decanoyl-carnitine	STD	C17H33NO4	[M+H]+	316.2488	316.2478	-3.3	4.7
Dimethyl-arginine	STD	C8H18N4O2	[M+H]+	203.1508	203.1501	-3.4	22.2
Dimethyl-guanosine	STD	C12H17N5O5	[M+H]+	312.1308	312.1295	-4.1	6.3
Dimethyl-lysine	STD	C8H18N2O2	[M+H]+	175.1447	175.1438	-4.6	21.7
Dimethyl-proline	STD	C7H13NO2	[M+H]+	144.1025	144.1014	-7.0	8.4
Dimethyl-xanthine	STD	C7H8N4O2	[M+H]+	181.0726	181.0718	-4.4	4.8
Diphosphoglycerate	STD	C3H8O10P2	[M-H]-	264.9520	264.9516	-1.7	18.0
Dodecanoyl-carnitine	STD	C19H37NO4	[M+H]+	344.2801	344.2790	-3.1	4.5
Ergothioneine	STD	C9H15N3O2S	[M+H]+	230.0963	230.0953	-4.3	13.9
Fructose-1,6-diphosphate	STD	C6H14O12P2	[M-H]-	338.9888	338.9886	-0.5	17.8
Fructose-6-phosphate	STD	C6H13O9P	[M-H]-	259.0224	259.0225	0.1	15.4
GDP	STD	C10H15N5O11P2	[M-H]-	442.0171	442.0170	-0.2	17.6
GDP-glucose	STD	C16H25N5O16P2	[M-H]-	604.0699	604.0715	2.7	17.7
Gluconate	STD	C6H12O7	[M-H]-	195.0510	195.0510	0.0	12.4
Glucose-6-phosphate	STD	C6H13O9P	[M-H]-	259.0224	259.0226	0.7	16.5

Supplementary Table S2. (continued)

Compounds	Status	Formula	Ionixation	Theoretical m/z	Detected m/z	m/z error (ppm)	RT (min)
Glutamate	STD	C5H9NO4	[M+H]+	148.0610	148.0600	-6.6	13.5
Glutamine	STD	C5H10N2O3	[M-H]-	145.0619	145.0622	2.3	14.3
Glutathione disulfide	STD	C20H32N6O12S2	[M+H]+	613.1598	613.1587	-1.7	17.3
Glyceraldehyde-3-phosphate	STD	C3H7O6P	[M-H]-	168.9907	168.9908	0.3	14.4
Glycerol-phosphate	STD	C3H9O6P	[M-H]-	171.0064	171.0068	2.5	14.1
Glycerophosphocholine	STD	C8H20NO6P	[M+H]+	258.1106	258.1095	-4.6	14.3
Glycerophosphoethanolamine	MS/MS	C5H14NO6P	[M-H]-	214.0486	214.0489	1.6	15.3
Glycochenodeoxycholate	STD	C26H43NO5	[M-H]-	448.3068	448.3066	-0.5	3.6
GTP	STD	C10H16N5O14P3	[M-H]-	521.9834	521.9839	1.0	18.6
Hexanoyl-carnitine	STD	C13H25NO4	[M+H]+	260.1862	260.1852	-3.6	5.2
Hippurate	STD	C9H9NO3	[M+H]+	180.0661	180.0653	-4.2	4.4
Histidine	STD	C6H9N3O2	[M+H]+	156.0773	156.0764	-5.9	13.7
Hypoxanthine	STD	C5H4N4O	[M+H]+	137.0463	137.0455	-5.9	7.6
IMP	STD	C10H13N4O8P	[M-H]-	347.0398	347.0404	1.6	15.1
Indoxyl-sulfate	STD	C8H7NO4S	[M-H]-	212.0023	212.0022	-0.6	4.6
Isoleucine	STD	C6H13NO2	[M-H]-	130.0874	130.0881	6.1	9.4
Keto(iso)leucine	STD	C6H10O3	[M-H]-	129.0557	129.0564	4.9	3.6
Ketovaline	STD	C5H8O3	[M-H]-	115.0401	115.0408	6.7	3.9
Kynurenine	STD	C10H12N2O3	[M+H]+	209.0926	209.0918	-4.0	8.8
Leucine	STD	C6H13NO2	[M-H]-	130.0874	130.0881	6.1	8.7
Lysine	STD	C6H14N2O2	[M-H]-	145.0983	145.0989	4.6	25.3
Malate	STD	C4H6O5	[M-H]-	133.0142	133.0149	5.0	14.7
Methionine	STD	C5H11NO2S	[M+H]+	150.0589	150.0580	-5.7	9.6
myo-Inositol	STD	C6H12O6	[M-H]-	179.0561	179.0562	0.5	16.5
N-Acetyl-aspartate	STD	C6H9NO5	[M-H]-	174.0408	174.0412	2.3	13.1
N-Acetyl-glucosamine	STD	C8H15NO6	[M+H]+	222.0978	222.0970	-3.5	10.2
N-Methyl-guanosine	STD	C11H15N5O5	[M+H]+	298.1151	298.1141	-3.5	8.6
N-Methyl-adenosine	STD	C11H15N5O4	[M+H]+	282.1202	282.1181	-7.6	12.4
N1-Methyl-histidine	STD	C7H11N3O2	[M+H]+	170.0930	170.0921	-5.2	11.3
N2-Acetyl-arginine	STD	C8H16O3N4	[M+H]+	217.1301	217.1291	-4.6	14.5
N2-Acetyl-lysine	STD	C8H16O3N2	[M+H]+	189.1239	189.1230	-4.9	14.8
N3-Methyl-histidine	STD	C7H11N3O2	[M+H]+	170.0930	170.0921	-5.1	12.0
N6-Acetyl-lysine	STD	C8H16O3N2	[M+H]+	189.1239	189.1230	-4.6	12.2
N6-Methyl-lysine	STD	C7H16N2O2	[M+H]+	161.1290	161.1281	-5.6	24.2
NAD+	STD	C21H27N7O14P2	[M+H]+	664.1169	664.1149	-3.1	13.8
NADP+	STD	C21H28N7O17P3	[M+H]+	744.0833	744.0817	-2.1	16.7
Nicotinamide	STD	C6H6N2O	[M+H]+	123.0558	123.0548	-8.6	5.1
O-Methyl-guanosine	STD	C11H15N5O5	[M+H]+	298.1151	298.1142	-3.1	7.6
Octanoyl-carnitine	STD	C15H29NO4	[M+H]+	288.2175	288.2166	-3.0	4.7
Ophthalmic acid	STD	C11H19N3O6	[M+H]+	290.1352	290.1342	-3.5	12.4
Ornithine	STD	C5H12N2O2	[M-H]-	131.0826	131.0835	6.7	23.2
Pantothenate	STD	C9H17NO5	[M+H]+	220.1185	220.1176	-3.9	5.2
Pentose-phosphate	STD	C5H11O8P	[M-H]-	229.0119	229.0120	0.6	15.0
Phenylalanine	STD	C9H11NO2	[M+H]+	166.0868	166.0859	-5.6	7.6
Phosphocholine	STD	C5H14NO4P	[M+H]+	184.0739	184.0731	-4.1	14.7
Phosphocreatine	STD	C4H10N3O5P	[M-H]-	210.0285	210.0289	1.5	14.6
Phosphoenolpyruvate	STD	C3H5O6P	[M-H]-	166.9751	166.9753	1.3	17.1
Phosphoethanolamine	STD	C2H8NO4P	[M-H]-	140.0118	140.0125	4.6	15.6
Phosphoglycerate	STD	C3H7O7P	[M-H]-	184.9857	184.9861	2.4	16.5
Proline	STD	C5H9NO2	[M+H]+	116.0712	116.0700	-10.0	11.4
Propionyl-carnitine	STD	C10H19NO4	[M+H]+	218.1392	218.1384	-4.0	7.5
Pseudouridine	STD	C9H12N2O6	[M-H]-	243.0623	243.0625	1.1	10.1

Supplementary Table S2. (continued)

Compounds	Status	Formula	Ionixation	Theoretical m/z	Detected m/z	m/z error (ppm)	RT (min)
S-Adenosyl-homocysteine	STD	C14H20N6O5S	[M+H]+	385.1294	385.1282	-3.1	13.1
S-Adenosyl-methionine	STD	C15H22N6O5S	[M+H]+	399.1451	399.1442	-2.1	17.1
S-Methyl-ergothioneine	STD	C10H17N3O2S	[M+H]+	244.1120	244.1109	-4.5	8.6
Sedoheptulose-7-phosphate	STD	C7H15O10P	[M-H]-	289.0330	289.0334	1.2	15.8
Serine	STD	C3H7NO3	[M+H]+	106.0504	106.0494	-10.0	14.9
Succinate	STD	C4H6O4	[M-H]-	117.0193	117.0199	4.7	13.8
Taurine	STD	C2H7NO3S	[M-H]-	124.0074	124.0078	3.4	13.1
Tetradecanoyl-carnitine	STD	C21H41NO4	[M+H]+	372.3114	372.3110	-1.1	4.1
Threonine	STD	C4H9NO3	[M+H]+	120.0661	120.0650	-8.6	13.3
Trimethyl-histidine	STD	C9H15N3O2	[M+H]+	198.1243	198.1234	-4.5	11.1
Trimethyl-lysine	STD	C9H20N2O2	[M+H]+	189.1603	189.1595	-4.4	22.9
Trimethyl-tryptophan	STD	C14H18N2O2	[M+H]+	247.1447	247.1437	-3.9	6.3
Trimethyl-tyrosine	MS/MS	C12H17NO3	[M+H]+	224.1287	224.1276	-5.0	8.1
Tryptophan	STD	C11H12N2O2	[M+H]+	205.0977	205.0969	-3.8	9.8
Tyrosine	STD	C9H11NO3	[M+H]+	182.0817	182.0809	-4.3	11.9
UDP-glucose	STD	C15H24N2O17P2	[M-H]-	565.0477	565.0487	1.7	15.7
UDP-glucuronate	STD	C15H22N2O18P2	[M-H]-	579.0270	579.0279	1.6	18.3
UDP-N-acetylglucosamine	STD	C17H27N3O17P2	[M-H]-	606.0743	606.0756	2.1	14.4
UMP	STD	C9H13N2O9P	[M-H]-	323.0286	323.0289	0.8	14.3
Urate	STD	C5H4N4O3	[M-H]-	167.0211	167.0210	-0.3	12.2
Uridine	STD	C9H12N2O6	[M-H]-	243.0623	243.0626	1.2	7.3
UTP	STD	C9H15N2O15P3	[M-H]-	482.9613	482.9621	1.8	17.2
(iso)Valeryl-carnitine	STD	C12H23NO4	[M+H]+	246.1705	246.1697	-3.3	5.7
Valine	STD	C5H11NO2	[M-H]-	116.0717	116.0726	8.0	11.0
Xanthine	STD	C5H4N4O2	[M-H]-	151.0261	151.0268	4.4	8.4

Supplementary Table S3. A list of 125 blood metabolites in 14 categories. Abundances of compounds are semi-quantitatively separated into 3 groups, H (high), M (medium), and L (low), by their peak areas. P-values were calculated using the Mann−Whitney U-test. Peak ratios were calculated using the median of peak abundance in non-diabetic and Type 2 diabetic or non-obese and obese.

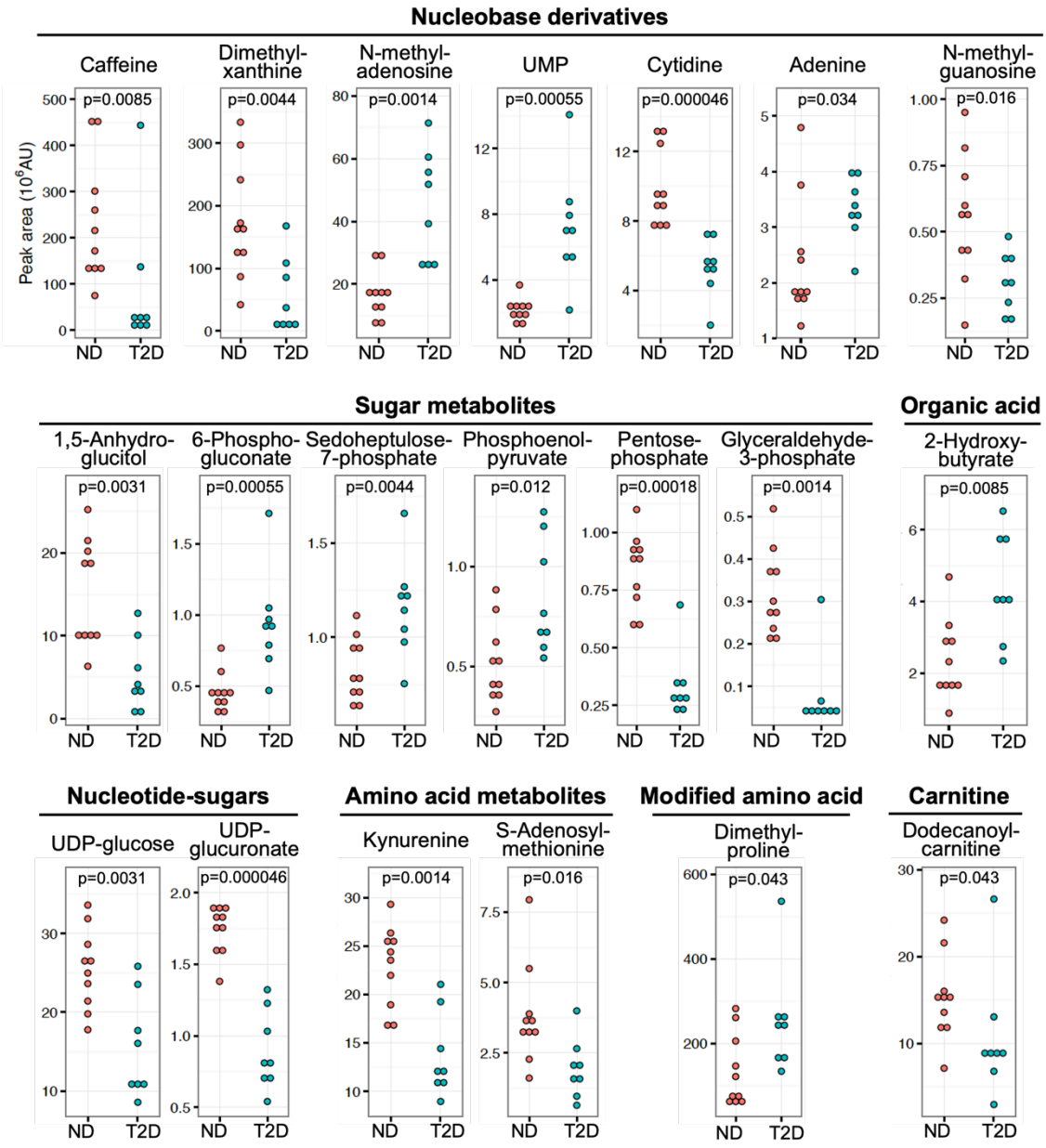
Compounds	RBC-enriched	Peak abundance	T2D/non-T2D		Ob/non-Ob	
			p-value	Peak ratio	p-value	Peak ratio
Nucleotides (9)						
ATP	●	H	0.41		0.063	
ADP	●	H-M	0.41		0.063	
AMP	●	M	0.46		0.19	
GTP	●	M	0.90		0.44	
UMP	●	M-L	0.00055	3.32	0.93	
CTP		L	0.32		0.86	
GDP	●	L	0.76		0.86	
IMP	●	L	0.15		0.39	
UTP		L	0.083		0.67	
Nucleosides, nucleobases, and derivatives (14)						
Caffeine		H-L	0.0085	0.14	0.30	
Dimethyl-xanthine		H-L	0.0044	0.16	0.67	
Urate	●	M	0.51		0.0040	1.26
N-Methyl-adenosine		M-L	0.0014	2.70	0.39	
Cytidine		M-L	0.000046	0.60	0.44	
Pseudouridine		M-L	0.12		0.014	1.11
Uridine		L	0.15		1.00	
Xanthine		L	0.36		0.040	1.42
Adenine	●	L	0.034	1.79	0.19	
Adenosine		L	0.24		0.93	
Dimethyl-guanosine		L	0.083		0.11	
N-Methyl-guanosine		L	0.016	0.55	0.30	
O-Methyl-guanosine		L	0.12		0.39	
Hypoxanthine		L	0.27		0.019	1.31
Nucleotide-sugar derivatives (4)						
UDP-glucose	●	M-L	0.0031	0.53	0.49	
UDP-N-acetylglucosamine	●	M-L	0.41		0.93	
UDP-glucuronate	●	L	0.000046	0.45	0.60	
GDP-glucose	●	L	0.20		0.22	
Sugar phosphates (11)						
Diphosphoglycerate	●	H-M	0.76		1.00	
Fructose-1,6-diphosphate	●	M	0.32		1.00	
Fructose-6-phosphate	●	L	0.00055	1.39	1.00	
6-Phosphogluconate	●	L	0.00055	2.10	0.86	
Glucose-6-phosphate	●	L	0.12		0.60	
Glyceraldehyde-3-phosphate	●	L	0.0014	0.14	0.93	
Glycerol-phosphate	●	L	0.27		1.00	
Pentose-phosphate	●	L	0.00018	0.33	0.44	
Phosphoenolpyruvate	●	L	0.012	1.57	0.19	
Phosphoglycerate	●	L	0.034	1.41	0.49	
Sedoheptulose-7-phosphate	●	L	0.0044	1.50	0.86	

Supplementary Table S3. (continued)

Compounds	RBC-enriched	Peak abundance	T2D/non-T2D		Ob/non-Ob	
			p-value	Peak ratio	p-value	Peak ratio
Sugar derivatives (4)						
N-Acetyl-glucosamine	●	M	0.0044	1.32	0.16	
1,5-Anhydroglucitol		M-L	0.0031	0.27	0.44	
Gluconate	●	M-L	0.76		0.80	
myo-Inositol		L	0.27		0.22	
Vitamins and coenzymes (5)						
NAD+	●	H-M	0.17		0.44	
Nicotinamide	●	H-M	0.12		0.80	
4-Aminobenzoate		M-L	0.69		0.42	
Pantothenate	●	M-L	0.76		0.077	
$NADP^+$	●	L	0.043	1.39	0.040	1.40
Organic acids (9)						
Glycochenodeoxycholate		H-L	0.17		0.19	
Chenodeoxycholate		M-L	0.15		0.39	
Aminobutyrate	●	L	0.10		0.040	1.30
2-Hydroxybutyrate		L	0.0085	2.01	0.30	
2-Oxoglutarate		L	0.27		0.031	1.81
3-Hydroxybutyrate		L	0.10		0.014	1.58
Citrate		L	0.32		0.80	
Malate	●	L	0.32		0.011	1.22
Succinate	●	L	0.016	1.48	0.49	
Antioxidants (2)						
Glutathione disulfide	●	H	0.068		0.050	
Ergothioneine	●	H	0.76		0.39	
Standard amino acids (17)						
Arginine		H	0.068		0.063	
Phenylalanine		H	0.055		0.014	1.33
Proline		H	0.76		0.0078	1.27
Glutamate		H	0.32		0.14	
Histidine		H	0.41		0.040	1.25
Tryptophan		H	0.10		0.0056	1.25
Threonine		H-M	0.0085	0.67	0.050	
Tyrosine		H-M	0.46		0.0056	1.37
Methionine		H-M	0.016	0.75	0.094	
Glutamine		M	0.24		0.73	
Leucine		M	0.12		0.11	
Serine		M	0.0014	0.70	0.050	
Lysine		M-L	1.00		0.86	
Asparagine		M-L	0.083		0.040	1.30
Aspartate		M-L	0.57		0.30	
Isoleucine		M-L	0.15		0.11	
Valine		L	0.32		0.11	
Acetylated amino acids (4)						
N-Acetyl-aspartate		L	0.027	0.71	0.73	
N2-Acetyl-arginine		L	0.32		0.019	1.76
N2-Acetyl-lysine		L	0.46		0.0019	1.61
N6-Acetyl-lysine		L	0.83		0.73	

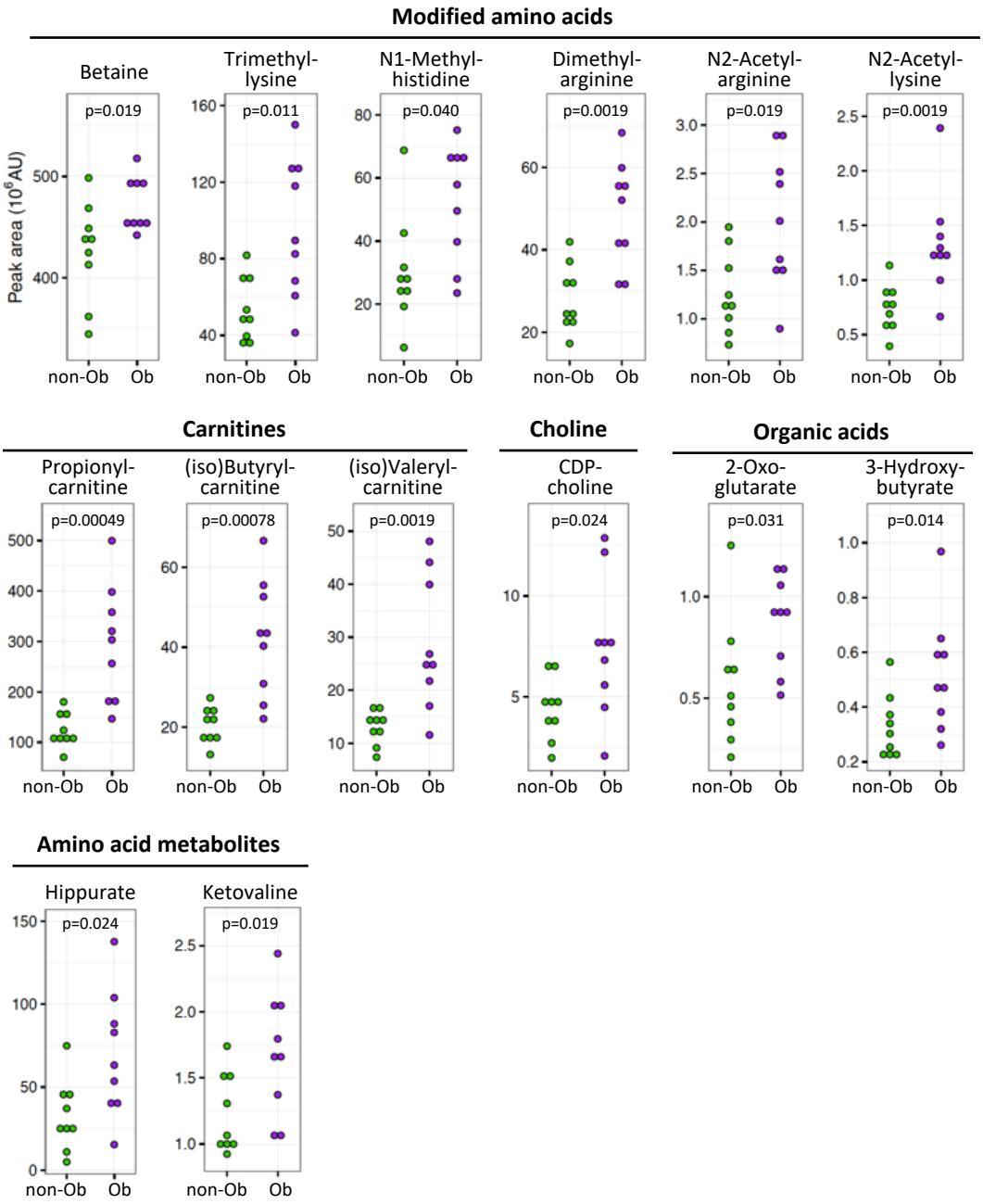
Supplementary Table S3. (continued)

Compounds	RBC-enriched	Peak abundance	T2D/non-T2D		Ob/non-Ob	
			p-value	Peak ratio	p-value	Peak ratio
Methylated amino acids (13)						
Betaine		H	0.90		0.019	1.05
Butyro-betaine	●	H-M	0.24		0.077	
Dimethyl-proline	●	H-M	0.043	2.42	0.86	
Trimethyl-lysine	●	H-M	0.46		0.011	1.80
Trimethyl-tryptophan	●	H-M	0.15		0.80	
Dimethyl-arginine		M	0.20		0.0019	1.48
N6-Methyl-lysine		M	0.32		0.67	
S-Methyl-ergothioneine	●	M	0.90		0.39	
Dimethyl-lysine		M-L	0.055		0.16	
N1-Methyl-histidine		M-L	0.27		0.040	2.08
N3-Methyl-histidine		M-L	0.055		0.86	
Trimethyl-tyrosine	●	M-L	0.32		0.60	
Trimethyl-histidine	●	L	0.97		0.094	
Other amino acids (17)						
Citrulline		H	0.016	0.75	0.040	1.20
Hippurate		H-L	0.17		0.024	2.41
Taurine		M	0.0044	0.79	0.80	
Acetyl-carnosine		M-L	0.083		0.11	
Creatine	●	M-L	0.63		0.49	
Creatinine		M-L	0.27		0.16	
Indoxyl-sulfate		M-L	0.055		0.80	
Keto(iso)leucine		M-L	0.083		0.077	
Kynurenine		M-L	0.0014	0.50	0.22	
Ophthalmic acid		M-L	0.41		0.60	
4-Guanidinobutanoate		L	0.51		0.14	
Carnosine	●	L	0.36		0.063	
Ketovaline		L	0.97		0.019	1.57
Ornithine		L	0.12		0.93	
Phosphocreatine	●	L	0.46		0.44	
S-Adenosyl-homocysteine	●	L	0.46		0.11	
S-Adenosyl-methionine	●	L	0.016	0.52	0.11	
Lipid metabolites (6)						
Glycerophosphocholine		H-M	0.46		0.86	
Phosphocholine		H-M	0.90		0.031	1.49
CDP-choline		M-L	0.46		0.024	1.66
Glycerophosphoethanolamine		L	0.012	0.82	0.44	
Phosphoethanolamine		L	0.57		0.49	
CDP-ethanolamine		L	0.17		0.094	
Carnitines (10)						
Carnitine		H	0.90		0.0056	1.24
Acetyl-carnitine	●	H	1.00		0.0012	1.29
Propionyl-carnitine	●	H-M	0.70		0.00049	2.64
(iso)Butyryl-carnitine		M	0.70		0.00078	2.04
Decanoyl-carnitine		M	0.083		0.30	
(iso)Valeryl-carnitine		M-L	0.90		0.0019	1.76
Hexanoyl-carnitine		M-L	0.63		0.11	
Octanoyl-carnitine		M-L	0.36		0.44	
Dodecanoyl-carnitine		M-L	0.043	0.58	0.26	
Tetradecanoyl-carnitine	●	L	0.27		0.19	

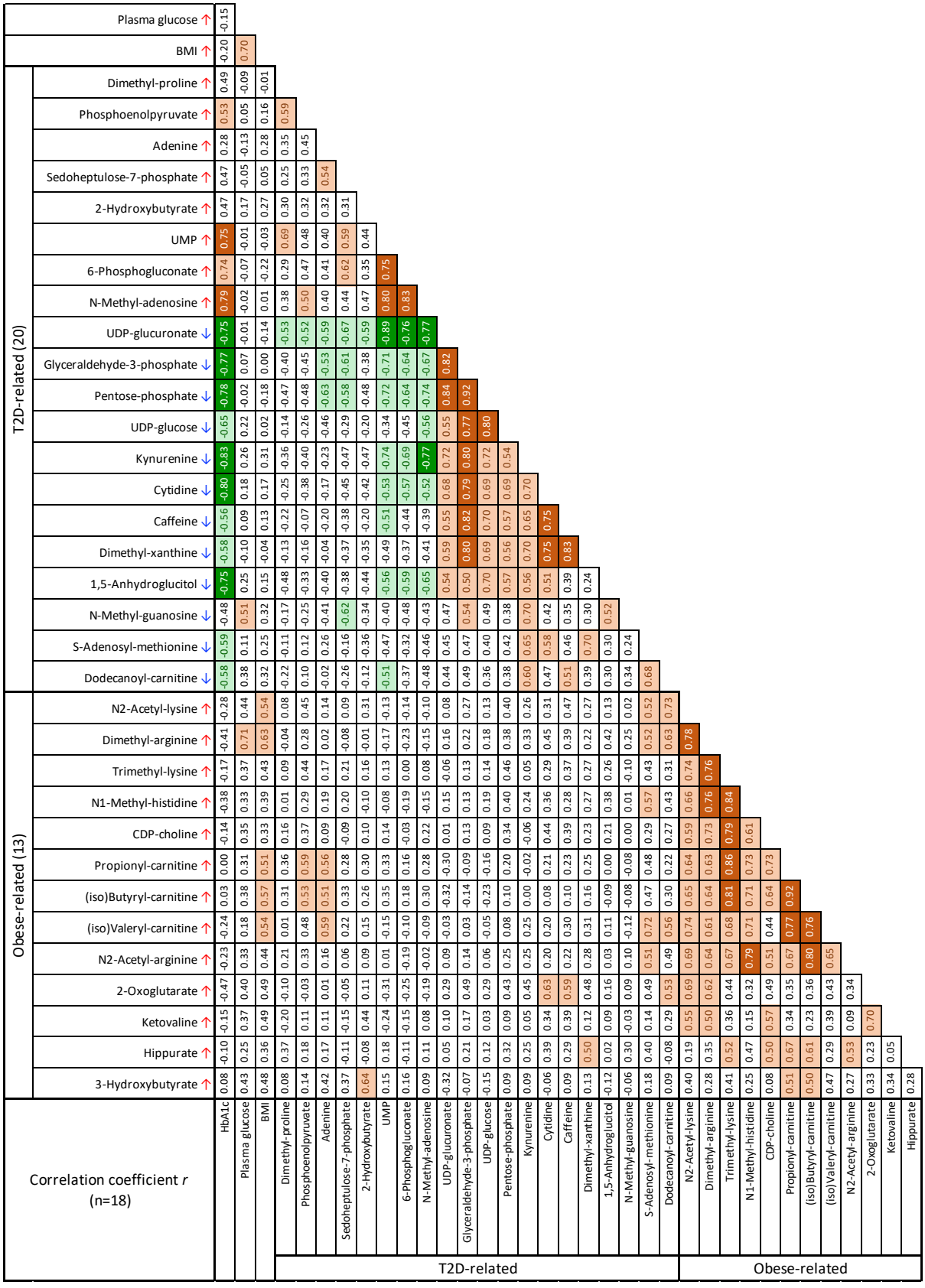


Supplementary Figure S1. Dot plot profiling of Type 2 diabetes marker abundances.

Peak areas of the non-diabetic and Type 2 diabetic groups are plotted. Eight of 20 compounds increased significantly and 12 compounds decreased. Distributions of cytidine and UDP-glucuronate were completely segregated between non-diabetic and Type 2 diabetic.



Supplementary Figure S2. Dot plot profiling of 13 obesity marker abundances. Peak areas of the non-obese group and obese group are plotted. All 13 compounds increased significantly in obesity. Of these, three carnitines showed the most significant differences.



Supplementary Figure S3. Correlation analysis of 20 Type 2 diabetes and 13 obesity markers. Pearson's correlation analysis for 18 subjects. Positive ($r > 0.5$) and negative ($r < -0.5$) correlations are shown in orange and green cells, respectively (see text). Arrows indicate either an increase↑ or a decrease↓ of metabolite levels in comparison with each control.