Supplementary Table 1. Detail KEGG human pathway result

Pathway name	Total metabolites	Expected	Hits	Raw p	-LOG(p)	Holm adjust	FDR	Impact
1-hour only data								
Glycerophospholipid metabolism	39	0.23	4	5.2E-05	9.85	4.2E-03	4.2E-03	1.4E-01
Ascorbate and aldarate metabolism	45	0.26	3	1.9E-03	6.25	1.5E-01	7.7E-02	8.0E-03
Ether lipid metabolism	23	0.13	2	7.4E-03	4.90	5.8E-01	2.0E-01	0.0E+00
D-Glutamine and D-glutamate metabolism	11	0.06	1	6.2E-02	2.78	1.0E+00	1.0E+00	0.0E+00
Citrate cycle (TCA cycle)	20	0.12	1	1.1E-01	2.20	1.0E+00	1.0E+00	8.6E-02
Taurine and hypotaurine metabolism	20	0.12	1	1.1E-01	2.20	1.0E+00	1.0E+00	3.3E-01
Alanine, aspartate and glutamate metabolism	24	0.14	1	1.3E-01	2.03	1.0E+00	1.0E+00	0.0E+00
Sphingolipid metabolism	25	0.15	1	1.4E-01	1.99	1.0E+00	1.0E+00	1.3E-02
Lysine biosynthesis	32	0.19	1	1.7E-01	1.76	1.0E+00	1.0E+00	0.0E+00
Vitamin B6 metabolism	32	0.19	1	1.7E-01	1.76	1.0E+00	1.0E+00	1.9E-02
Nitrogen metabolism	39	0.23	1	2.0E-01	1.59	1.0E+00	1.0E+00	0.0E+00
Inositol phosphate metabolism	39	0.23	1	2.0E-01	1.59	1.0E+00	1.0E+00	1.4E-01
Butanoate metabolism	40	0.23	1	2.1E-01	1.56	1.0E+00	1.0E+00	0.0E+00
Galactose metabolism	41	0.24	1	2.1E-01	1.54	1.0E+00	1.0E+00	0.0E+00
Histidine metabolism	44	0.26	1	2.3E-01	1.48	1.0E+00	1.0E+00	0.0E+00
Phenylalanine metabolism	45	0.26	1	2.3E-01	1.46	1.0E+00	1.0E+00	0.0E+00
Primary bile acid biosynthesis	47	0.27	1	2.4E-01	1.42	1.0E+00	1.0E+00	8.2E-03
Glycine, serine and threonine metabolism	48	0.28	1	2.5E-01	1.40	1.0E+00	1.0E+00	7.1E-04
Glyoxylate and dicarboxylate metabolism	50	0.29	1	2.6E-01	1.37	1.0E+00	1.0E+00	0.0E+00
Arginine and proline metabolism	77	0.45	1	3.7E-01	1.00	1.0E+00	1.0E+00	3.2E-02
Drug metabolism - cytochrome P450	86	0.50	1	4.0E-01	0.92	1.0E+00	1.0E+00	2.1E-02
Purine metabolism	92	0.54	1	4.2E-01	0.86	1.0E+00	1.0E+00	9.7E-03
1- and 24- hour data								
Aminoacyl-tRNA biosynthesis	75	0.41	8	6.9E-10	21.09	5.5E-08	5.5E-08	1.1E-01
Arginine and proline metabolism	77	0.42	6	1.3E-06	13.58	1.0E-04	5.1E-05	2.7E-01
Alanine, aspartate and glutamate metabolism	24	0.13	4	5.1E-06	12.18	4.0E-04	1.4E-04	7.1E-01
Nitrogen metabolism	39	0.21	4	3.8E-05	10.18	2.9E-03	7.6E-04	6.7E-04
D-Arginine and D-ornithine metabolism	8	0.04	2	7.4E-04	7.21	5.6E-02	1.2E-02	5.0E-01
D-Glutamine and D-glutamate metabolism	11	0.06	2	1.4E-03	6.54	1.1E-01	1.9E-02	1.4E-01
Histidine metabolism	44	0.24	2	2.2E-02	3.80	1.0E+00	2.6E-01	5.1E-04
Glycine, serine and threonine metabolism	48	0.26	2	2.6E-02	3.63	1.0E+00	2.6E-01	9.7E-02
Cysteine and methionine metabolism	56	0.30	2	3.5E-02	3.35	1.0E+00	3.1E-01	0.0E+00
Cyanoamino acid metabolism	16	0.09	1	8.3E-02	2.49	1.0E+00	6.4E-01	0.0E+00
Taurine and hypotaurine metabolism	20	0.11	1	1.0E-01	2.27	1.0E+00	6.4E-01	3.2E-02
Porphyrin and chlorophyll metabolism	104	0.56	2	1.1E-01	2.25	1.0E+00	6.4E-01	0.0E+00
Selenoamino acid metabolism	22	0.12	1	1.1E-01	2.18	1.0E+00	6.4E-01	0.0E+00
Valine, leucine and isoleucine biosynthesis	27	0.15	1	1.4E-01	1.99	1.0E+00	6.4E-01	0.0E+00
Pantothenate and CoA biosynthesis	27	0.15	1	1.4E-01	1.99	1.0E+00	6.4E-01	0.0E+00
Phenylalanine, tyrosine and tryptophan biosynthesis	27	0.15	1	1.4E-01	1.99	1.0E+00	6.4E-01	6.2E-04
beta-Alanine metabolism	28	0.15	1	1.4E-01	1.96	1.0E+00	6.4E-01	0.0E+00
Glycolysis or Gluconeogenesis	31	0.17	1	1.6E-01	1.86	1.0E+00	6.4E-01	0.0E+00
Pentose phosphate pathway	32	0.17	1	1.6E-01	1.83	1.0E+00	6.4E-01	0.0E+00
Lysine biosynthesis	32	0.17	1	1.6E-01	1.83	1.0E+00	6.4E-01	0.0E+00
Glutathione metabolism	38	0.21	1	1.9E-01	1.68	1.0E+00	6.7E-01	1.1E-02
Glycerophospholipid metabolism	39	0.21	1	1.9E-01	1.65	1.0E+00	6.7E-01	3.2E-03
Butanoate metabolism	40	0.22	1	2.0E-01	1.63	1.0E+00	6.7E-01	0.0E+00
Galactose metabolism	41	0.22	1	2.0E-01	1.61	1.0E+00	6.7E-01	2.8E-03
Nicotinate and nicotinamide metabolism	44	0.24	1	2.1E-01	1.54	1.0E+00	6.7E-01	0.0E+00
Phenylalanine metabolism	45	0.24	1	2.2E-01	1.52	1.0E+00	6.7E-01	1.2E-01
Starch and sucrose metabolism	50	0.27	1	2.4E-01	1.43	1.0E+00	7.1E-01	1.7E-02
Pyrimidine metabolism	60	0.32	1	2.8E-01	1.27	1.0E+00	8.0E-01	0.0E+00
Amino sugar and nucleotide sugar metabolism	88	0.48	1	3.8E-01	0.96	1.0E+00	1.0E+00	0.0E+00
Purine metabolism	92	0.50	1	4.0E-01	0.92	1.0E+00	1.0E+00	0.0E+00
24-hour only data								
Aminoacyl-tRNA biosynthesis	75	0.47	9	7.3E-11	23.33	5.9E-09	5.9E-09	1.1E-01
Nitrogen metabolism	39	0.24	5	2.3E-06	12.99	1.8E-04	9.2E-05	7.6E-03
Cyanoamino acid metabolism	16	0.10	3	1.0E-04	9.17	8.2E-03	2.8E-03	0.0E+00
Glycine, serine and threonine metabolism	48	0.30	4	1.6E-04	8.73	1.2E-02	3.2E-03	3.2E-01
Glycerophospholipid metabolism	39	0.24	3	1.6E-03	6.46	1.2E-01	2.5E-02	2.3E-01
Thiamine metabolism	24	0.15	2	9.2E-03	4.68	6.9E-01	1.0E-01	0.0E+00
Sphingolipid metabolism	25	0.16	2	1.0E-02	4.60	7.4E-01	1.0E-01	9.5E-03
Phenylalanine, tyrosine and tryptophan biosynthesis	27	0.17	2	1.2E-02	4.43	8.5E-01	1.0E-01	7.4E-03
Valine, leucine and isoleucine biosynthesis	27	0.17	2	1.2E-02	4.43	8.5E-01	1.0E-01	2.7E-02
Methane metabolism	34	0.21	2	1.8E-02	4.01	1.0E+00	1.5E-01	1.8E-02
Valine, leucine and isoleucine degradation	40	0.25	2	2.5E-02	3.70	1.0E+00	1.8E-01	2.2E-02
Lysine degradation	47	0.29	2	3.3E-02	3.40	1.0E+00	2.2E-01	1.5E-01
Biotin metabolism	11	0.07	1	6.7E-02	2.71	1.0E+00	4.1E-01	0.0E+00
Glycosylphosphatidylinositol(GPI)-anchor biosynthesis	14	0.09	1	8.4E-02	2.48	1.0E+00	4.8E-01	4.4E-02
Linoleic acid metabolism	15	0.09	1	9.0E-02	2.41	1.0E+00	4.8E-01	0.0E+00
Sulfur metabolism	18	0.11	1	1.1E-01	2.24	1.0E+00	5.3E-01	0.0E+00
Alanine, aspartate and glutamate metabolism	24	0.15	1	1.4E-01	1.97	1.0E+00	6.1E-01	4.6E-02
beta-Alanine metabolism	28	0.17	1	1.6E-01	1.82	1.0E+00	6.1E-01	0.0E+00
alpha-Linolenic acid metabolism	29	0.18	1	1.7E-01	1.79	1.0E+00	6.1E-01	0.0E+00
Glycolysis or Gluconeogenesis	31	0.19	1	1.8E-01	1.73	1.0E+00	6.1E-01	0.0E+00
Glycerolipid metabolism	32	0.20	1	1.8E-01	1.70	1.0E+00	6.1E-01	2.1E-02
Pentose phosphate pathway	32	0.20	1	1.8E-01	1.70	1.0E+00	6.1E-01	2.2E-02
Lysine biosynthesis	32	0.20	1	1.8E-01	1.70	1.0E+00	6.1E-01	1.0E-01
Pyruvate metabolism	32	0.20	1	1.8E-01	1.70	1.0E+00	6.1E-01	1.4E-01
Propanoate metabolism	35	0.22	1	2.0E-01	1.62	1.0E+00	6.2E-01	0.0E+00
Ubiquinone and other terpenoid-quinone biosynthesis	36	0.22	1	2.0E-01	1.60	1.0E+00	6.2E-01	0.0E+00
Glutathione metabolism	38	0.24	1	2.1E-01	1.55	1.0E+00	6.3E-01	0.0E+00
Histidine metabolism	44	0.27	1	2.4E-01	1.42	1.0E+00	6.8E-01	1.4E-01
Phenylalanine metabolism	45	0.28	1	2.5E-01	1.40	1.0E+00	6.8E-01	0.0E+00
Primary bile acid biosynthesis	47	0.29	1	2.6E-01	1.36	1.0E+00	6.8E-01	8.2E-03
Glyoxylate and dicarboxylate metabolism	50	0.31	1	2.7E-01	1.31	1.0E+00	7.0E-01	3.3E-02
Cysteine and methionine metabolism	56	0.35	1	3.0E-01	1.21	1.0E+00	7.5E-01	1.2E-02
Arachidonic acid metabolism	62	0.39	1	3.2E-01	1.12	1.0E+00	7.9E-01	0.0E+00
Tyrosine metabolism	76	0.47	1	3.8E-01	0.96	1.0E+00	9.0E-01	4.7E-02
Tryptophan metabolism	79	0.49	1	3.9E-01	0.93	1.0E+00	9.0E-01	1.1E-01
Purine metabolism	92	0.57	1	4.4E-01	0.81	1.0E+00	9.9E-01	0.0E+00
Porphyrin and chlorophyll metabolism	104	0.65	1	4.9E-01	0.72	1.0E+00	1.0E+00	0.0E+00

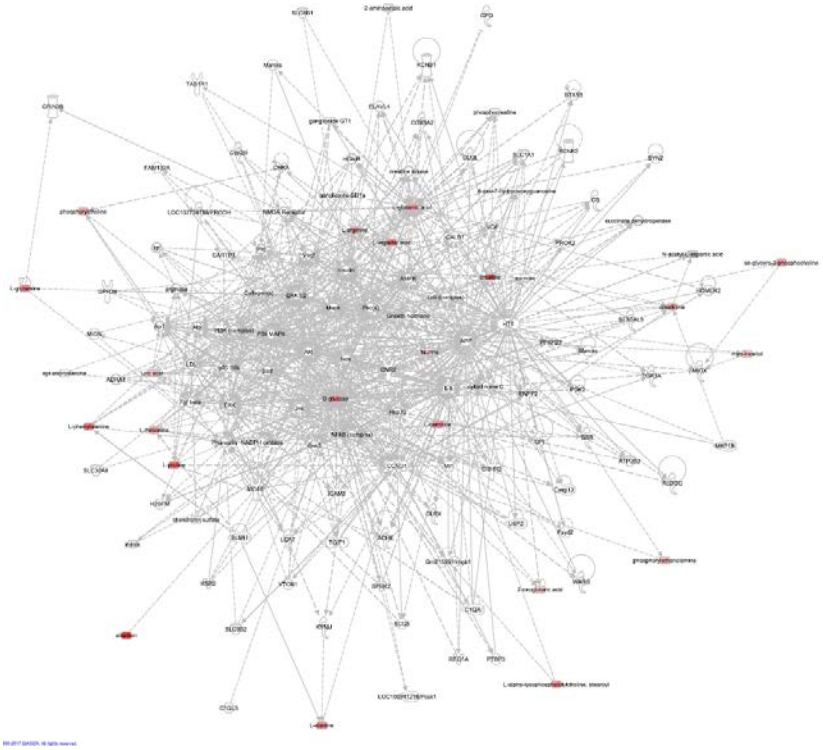
Supplementary Table 2. Significantly altered metabolites in BALF samples. Metabolites that are significantly altered between ozone and air ($p < 0.05$) are shown with fold change and highlighted in color (yellow for up-regulation and blue for down-regulation) for the 1 hour and 24 hour data. Three subgroups are presented for each time point: all subjects, GSTM1 + and GSTM1 – subjects. The metabolites are categorized into super- and sub-pathways based on Metabolon's classification.

			1 hr All	1 hr G+	1 hr G-	24 hr All	24 hr G+	24 hr G-
Amino Acid	Glycine, Serine and Threonine Metabolism	glycine	1.37	0.86	2.47	1.39	1.64	1.19
		serine	1.39	1.29	1.53	1.69	1.63	1.74
		N-acetylserine	0.98	0.86	1.14	1.20	1.11	1.29
		threonine	1.73	1.40	2.26	1.35	1.21	1.50
	Alanine and Aspartate Metabolism	alanine	1.92	1.40	2.83	1.64	1.38	1.92
		aspartate	2.32	2.31	2.34	1.50	1.49	1.50
		asparagine	2.17	1.95	2.48	1.84	1.94	1.75
	Glutamate Metabolism	glutamate	1.75	1.68	1.83	1.40	1.46	1.34
		glutamine	1.92	1.44	2.74	1.37	1.22	1.52
	Histidine Metabolism	histidine	1.67	1.36	2.14	1.78	1.90	1.68
	Lysine Metabolism	lysine	1.64	1.22	2.38	1.49	1.24	1.77
	Phenylalanine and Tyrosine Metabolism	phenylalanine	2.05	1.49	3.03	1.68	1.47	1.91
		tyrosine	1.68	0.91	3.63	1.66	1.35	2.00
		phenol sulfate	1.32	1.43	1.19	1.36	1.20	1.53
		p-cresol sulfate	2.14	2.63	1.65	1.32	1.10	1.55
	Tryptophan Metabolism	tryptophan	1.95	1.42	2.89	1.46	1.31	1.62
	Leucine, Isoleucine and Valine Metabolism	leucine	1.51	1.28	1.86	1.51	1.49	1.53
		isoleucine	1.10	0.84	1.53	1.40	1.32	1.47
	Methionine, Cysteine, SAM and Taurine Metabolism	taurine	1.23	1.12	1.38	1.16	1.12	1.19
	Urea cycle; Arginine and Proline Metabolism	arginine	1.72	1.55	1.97	1.48	1.34	1.62
		ornithine	1.95	1.98	1.92	1.45	1.19	1.74
		proline	2.22	1.62	3.28	1.48	1.10	1.95
	Creatine Metabolism	creatine	2.25	1.32	4.37	1.17	0.87	1.53
		creatinine	1.57	1.43	1.75	1.33	1.18	1.48
Carbohydrate	Glycolysis, Gluconeogenesis, and Pyruvate Metabolism	glucose	1.93	1.24	3.36	1.47	1.30	1.64
		lactate	0.78	0.44	1.56	1.52	1.28	1.79
		glycerate	1.19	1.05	1.37	1.54	1.71	1.39
	Aminosugar Metabolism	erythronate*	1.19	1.01	1.46	1.09	1.09	1.09
Energy	TCA Cycle	alpha-ketoglutarate	1.29	1.11	1.57	1.11	0.93	1.30
Lipid	Carnitine Metabolism	carnitine	1.86	1.39	2.69	1.35	1.29	1.40
	Inositol Metabolism	myo-inositol	1.37	1.31	1.45	1.09	1.13	1.06
	Phospholipid Metabolism	choline phosphate	1.57	1.72	1.39	1.09	1.25	0.96
		glycerophosphorylcholine (GPC)	1.67	1.51	1.90	1.17	1.41	0.99
		phosphoethanolamine	1.38	1.27	1.52	1.10	1.13	1.08
		glycerophosphoethanolamine	2.57	1.87	3.83	1.07	0.92	1.23
		1-palmitoyl-2-oleoyl-GPC (16:0/18:1)	0.92	0.88	0.97	1.13	1.07	1.20
		1-stearoyl-2-arachidonoyl-GPC (18:0/20:4)	0.96	0.93	1.00	1.21	1.12	1.29
		1-stearoyl-2-oleoyl-GPC (18:0/18:1)	0.93	0.86	1.04	1.20	1.13	1.28
		1-stearoyl-2-arachidonoyl-GPI (18:0/20:4)	1.36	1.42	1.29	1.27	1.37	1.18
		1-palmitoyl-2-oleoyl-GPG (16:0/18:1)	0.89	0.84	0.97	1.05	1.02	1.08
		1,2-dilinoleoyl-GPC (18:2/18:2)	1.01	1.00	1.03	1.17	1.14	1.21
		1-palmitoyl-2-oleoyl-GPS (16:0/18:1)	0.90	0.81	1.01	1.17	1.07	1.26
	Lysolipid	1-palmitoyl-GPC (16:0)	1.23	1.16	1.33	1.23	1.14	1.32
		1-stearoyl-GPC (18:0)	1.79	1.79	1.79	1.61	1.60	1.62
	Plasmalogen	1-(1-enyl-stearoyl)-2-linoleoyl-GPE (P-18:0/18:2)*	0.93	0.83	1.07	1.26	1.17	1.34
		1-(1-enyl-stearoyl)-2-arachidonoyl-GPE (P-18:0/20:4)*	1.07	0.94	1.25	1.14	1.17	1.12
	Sphingolipid Metabolism	palmitoyl dihydrosphingomyelin (d18:0/16:0)*	0.90	0.77	1.09	1.36	1.56	1.20
		palmitoyl sphingomyelin (d18:1/16:0)	0.99	0.90	1.11	1.16	1.23	1.10
		stearoyl sphingomyelin (d18:1/18:0)	1.25	1.60	0.93	1.25	1.27	1.24
		tricosanoyl sphingomyelin (d18:1/23:0)*	1.43	1.47	1.37	1.36	1.45	1.27
		sphingomyelin (d18:1/20:0, d16:1/22:0)*	1.04	1.00	1.10	1.17	1.12	1.20
		sphingomyelin (d18:1/22:1, d18:2/22:0, d16:1/24:1)*	1.47	1.64	1.27	1.39	1.82	1.09
		sphingomyelin (d18:2/24:1, d18:1/24:2)*	1.10	1.03	1.18	1.19	1.21	1.17
Nucleotide	Purine Metabolism, (Hypo)Xanthine/Inosine containing	hypoxanthine	0.93	0.52	1.91	1.24	1.26	1.23
		urate	1.40	1.15	1.80	1.23	1.03	1.45
		allantoin	2.92	2.50	3.56	1.08	1.20	0.98
	Pyrimidine Metabolism, Uracil containing	uridine	1.48	1.31	1.72	1.25	0.97	1.59
Cofactors and Vitamins	Ascorbate and Aldarate Metabolism	threonate	2.08	1.50	3.13	1.06	1.09	1.04
Xenobiotics	Xanthine Metabolism	caffeine	0.96	0.59	1.78	0.75	0.62	0.89
	Food Component/Plant	stachydrine	1.26	1.15	1.40	1.14	0.85	1.51
	Drug	N-ethylglycinexylidide	0.36	0.52	0.23	0.70	0.71	0.70
		salicylate	1.15	1.10	1.22	1.10	1.09	1.12
	Chemical	sulfate*	1.06	0.98	1.16	1.04	1.08	1.01

(A)

Supplementary Figure 1. IPA Network Analysis result. A detailed network analysis result for the 1-hour (A) and 24-hour (B) data are plotted where the measured metabolites are denoted with orange circle.

(A)



(B)