

Supplementary Material

Metabolic and lipidomic markers differentiate COVID-19 from non-hospitalized and other intensive care patients

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Table S1. Descriptive statistics for metabolites and lipoproteins in COVID-19, HC, and CS cohorts. For each cohort, mean and standard deviation are shown. P-Values show unadjusted p-values from unpaired t-tests.

							COVID-19 vs. HC		COVID-19 vs. CS		CS vs. HC	
	COVID-19		HC		CS		Change in %	P value	Change in %	P value	Change in %	P value
	mean	SD	mean	SD	mean	SD						
Metabolites												
Alanine (mmol/l)	0.43	0.14	0.53	0.10	0.38	0.23	-19.6	0.001207	13.9	0.59863	-29.4	0.000005
Creatine (mmol/l)	0.08	0.08	0.03	0.04	0.05	0.07	184.3	0.000672	68.4	0.134926	68.8	0.126552
Creatinine (mmol/l)	0.12	0.04	0.09	0.02	0.11	0.06	39.2	0.000003	3.5	0.798795	34.4	<0,000001
Glutamine (mmol/l)	0.55	0.12	0.71	0.11	0.61	0.24	-22.9	0.000006	-9.6	0.299422	-14.7	0.000557
Glycine (mmol/l)	0.40	0.15	0.35	0.08	0.29	0.12	12.1	0.112016	35.8	0.026379	-17.4	0.008796
Histidine (mmol/l)	0.06	0.01	0.10	0.02	0.07	0.03	-37.2	<0,000001	-9.7	0.278744	-30.4	<0,000001
Isoleucine (mmol/l)	0.09	0.03	0.07	0.02	0.09	0.05	24.8	0.017030	8.4	0.587356	15.1	0.038670
Leucine (mmol/l)	0.12	0.05	0.14	0.04	0.12	0.06	-13.8	0.147592	3.3	0.842568	-16.5	0.032872
Phenylalanine (mmol/l)	0.11	0.04	0.08	0.02	0.08	0.04	30.6	0.000148	33.7	0.029756	-2.3	0.779637
Tyrosine (mmol/l)	0.06	0.02	0.07	0.02	0.07	0.03	-16.1	0.061054	-20.8	0.118895	6.0	0.445455
Valine (mmol/l)	0.28	0.07	0.29	0.06	0.25	0.10	-5.8	0.307764	10.4	0.393469	-14.7	0.005767
Acetic acid (mmol/l)	0.02	0.04	0.01	0.02	0.06	0.28	98.5	0.107327	-65.8	0.274587	480.4	0.000139
Formic acid (mmol/l)	0.03	0.02	0.01	0.01	0.02	0.02	115.2	0.004080	25.4	0.501467	71.6	0.014801

Lactic acid (mmol/l)	1.99	0.72	4.43	1.48	1.79	1.59	-55.2	<0,000001	10.9	0.91487	-59.6	<0,000001
Glucose (mmol/l)	10.01	2.68	4.08	1.44	8.74	3.68	145.3	<0,000001	14.6	0.152078	114.1	<0,000001
Glutamine/Glutamate ratio	4.82	2.12	4.83	2.12	8.48	3.55	-0.2	0.987164	-43.2	0.000405	75.7	<0,000001
Lactic acid/Pyruvic Acid ratio	25.63	1.56	101.31	33.52	19.44	7.10	-74.7	<0,000001	31.8	0.247346	-80.8	<0,000001
Fischer's ratio	3.12	0.20	3.40	0.63	3.06	1.03	-8.1	0.134514	2.1	0.024105	-10.0	0.026230
Lipoproteins												
ApoB100 (mg/dl)	102.37	28.02	87.46	25.09	73.95	24.61	17.0	0.057028	38.4	0.002642	-15.4	0.021378
LDL/HDL	1.54	0.76	2.08	0.91	1.74	3.50	-26.1	0.049293	-11.7	0.702129	-16.3	0.096041
ApoB100/ApoA1	1.02	0.31	0.60	0.24	0.77	0.37	70.3	<0,000001	32.5	0.03618	28.5	0.004005
ApoB Particles (mmol/l)	1861.33	509.47	1590.24	456.15	1344.59	447.57	17.0	0.057051	38.4	0.002644	-15.4	0.021385
VLDL Particles (mmol/l)	309.35	79.95	159.96	92.08	187.18	70.85	93.4	<0,000001	65.3	0.000168	17.0	0.087113
IDL Particles (mmol/l)	195.04	77.35	103.49	49.75	102.00	64.37	88.5	<0,000001	91.2	0.001085	-1.4	0.716573
LDL Particles (mmol/l)	1399.94	564.82	1322.71	376.44	1042.19	396.53	5.8	0.527514	34.3	0.022561	-21.2	0.001045
LDL-1 Particles (mmol/l)	393.29	207.03	209.49	64.86	243.32	123.63	87.7	<0,000001	61.6	0.006626	16.1	0.021411
LDL-2 Particles (mmol/l)	192.71	62.84	195.37	63.51	218.54	74.20	-1.4	0.891056	-11.8	0.292636	11.9	0.207588
LDL-3 Particles (mmol/l)	184.23	117.09	182.45	74.02	143.23	74.83	1.0	0.941651	28.6	0.125851	-21.5	0.011993

LDL-4 Particles (mmol/l)	135.55	150.40	178.72	107.91	78.53	115.83	-24.2	0.212933	72.6	0.144626	-56.1	0.000081
LDL-5 Particles (mmol/l)	157.75	134.44	221.24	102.65	111.30	113.42	-28.7	0.052804	41.7	0.189765	-49.7	0.000008
LDL-6 Particles (mmol/l)	270.31	199.08	354.17	180.18	237.77	201.75	-23.7	0.134417	13.7	0.469488	-32.9	0.003500
Chol (mg/dl)	166.43	45.98	208.42	41.59	118.73	35.19	-20.1	0.001428	40.2	0.00168	-43.0	<0,000001
VLDL (mg/dl)	29.79	10.83	22.43	15.06	17.12	9.11	32.8	0.103585	74.0	0.001224	-23.7	0.232713
VLDL-1 Chol (mg/dl)	7.43	4.60	9.71	8.92	5.74	6.81	-23.5	0.386440	29.6	0.256175	-41.0	0.047072
VLDL-2 Chol (mg/dl)	4.43	1.52	3.41	2.72	2.29	1.79	30.0	0.205958	93.5	0.000115	-32.8	0.092050
VLDL-3 Chol (mg/dl)	5.67	3.02	3.68	2.78	2.21	2.15	54.2	0.021625	156.0	0.000636	-39.8	0.072188
VLDL-4 Chol (mg/dl)	8.90	2.98	4.19	2.50	4.14	3.30	112.5	<0,000001	115.3	0.000715	-1.3	0.407800
VLDL-5 Chol (mg/dl)	2.47	0.98	1.25	0.58	1.93	1.12	96.7	<0,000001	28.0	0.244815	53.7	0.000002
IDL (mg/dl)	20.73	8.45	12.98	7.94	9.53	9.24	59.7	0.001954	117.6	0.001995	-26.6	0.176692
LDL (mg/dl)	74.69	42.79	114.20	32.81	57.33	28.88	-34.6	0.000226	30.3	0.126116	-49.8	<0,000001
LDL-1 Chol (mg/dl)	29.78	18.46	22.03	7.12	17.59	10.20	35.2	0.005222	69.3	0.011104	-20.1	0.015293
LDL-2 Chol (mg/dl)	13.10	7.36	19.54	7.22	17.73	7.18	-33.0	0.004295	-26.1	0.07556	-9.3	0.173650
LDL-3 Chol (mg/dl)	10.20	9.37	17.08	7.68	8.64	6.04	-40.3	0.004988	18.1	0.402016	-49.4	0.000002
LDL-4 Chol (mg/dl)	6.68	10.13	15.58	9.51	4.08	8.15	-57.1	0.002915	63.7	0.285967	-73.8	<0,000001
LDL-5 Chol (mg/dl)	8.11	9.68	17.32	8.21	5.90	8.73	-53.2	0.000474	37.5	0.363769	-65.9	<0,000001
LDL-6 Chol (mg/dl)	16.37	13.16	22.80	10.95	13.07	12.24	-28.2	0.062560	25.3	0.307751	-42.7	0.000114
HDL (mg/dl)	44.96	11.51	59.47	15.65	38.43	15.66	-24.4	0.002407	17.0	0.126568	-35.4	<0,000001

HDL-1 Chol (mg/dl)	18.71	6.84	20.19	9.72	13.84	9.46	-7.3	0.609243	35.2	0.076123	-31.5	0.004703
HDL-2 Chol (mg/dl)	10.32	2.45	9.61	3.30	7.23	2.20	7.4	0.471804	42.6	0.000238	-24.7	0.002135
HDL-3 Chol (mg/dl)	8.28	2.36	10.40	2.70	6.75	2.16	-20.4	0.010468	22.5	0.034662	-35.1	<0,000001
HDL-4 Chol (mg/dl)	6.86	6.41	17.76	4.99	9.93	5.30	-61.3	<0,000001	-30.9	0.190377	-44.1	<0,000001
VLDL FC (mg/dl)	12.88	5.16	9.97	6.28	7.69	4.51	29.1	0.126588	67.4	0.003709	-22.9	0.206156
VLDL-1 FC (mg/dl)	2.35	1.92	4.02	3.72	1.21	2.13	-41.6	0.129537	94.0	0.044809	-69.9	0.001178
VLDL-2 FC (mg/dl)	2.59	0.99	1.57	1.35	1.39	0.92	65.3	0.012363	86.2	0.000738	-11.2	0.695323
VLDL-3 FC (mg/dl)	2.95	1.46	1.75	1.52	1.35	1.13	68.1	0.011125	117.7	0.001326	-22.8	0.412432
VLDL-4 FC (mg/dl)	4.63	1.78	1.90	1.26	2.14	1.75	144.1	<0,000001	116.4	0.00123	12.8	0.119650
VLDL-5 FC (mg/dl)	0.99	0.42	0.63	0.53	0.87	0.63	56.9	0.025738	13.7	0.623537	38.1	0.023975
IDL FC (mg/dl)	6.12	2.43	3.92	2.40	2.63	2.53	56.2	0.003369	132.4	0.000719	-32.8	0.076886
LDL FC (mg/dl)	27.24	12.93	32.41	8.76	22.18	8.90	-15.9	0.070340	22.8	0.113704	-31.6	<0,000001
LDL-1 FC (mg/dl)	8.70	4.68	6.36	2.03	5.88	3.06	36.9	0.001978	48.0	0.022739	-7.5	0.300410
LDL-2 FC (mg/dl)	4.74	2.19	5.79	2.25	5.94	2.46	-18.0	0.131886	-20.2	0.183143	2.7	0.858783
LDL-3 FC (mg/dl)	4.48	3.14	5.03	2.09	3.89	2.35	-10.9	0.417351	15.3	0.326756	-22.7	0.005479
LDL-4 FC (mg/dl)	2.83	2.96	4.48	2.24	1.82	3.03	-36.8	0.021793	55.8	0.199507	-59.4	<0,000001
LDL-5 FC (mg/dl)	2.64	2.67	4.46	1.91	2.25	3.03	-40.9	0.003359	17.4	0.531936	-49.7	0.000002
LDL-6 FC (mg/dl)	3.48	2.87	5.63	2.44	3.45	3.26	-38.2	0.005544	1.0	0.790193	-38.8	0.000087
HDL FC (mg/dl)	7.98	3.98	13.56	4.43	9.62	5.10	-41.1	0.000064	-17.0	0.44427	-29.0	0.000055
HDL-1 FC (mg/dl)	2.57	1.93	5.34	2.29	2.65	2.67	-51.8	0.000110	-3.1	0.903164	-50.3	<0,000001

HDL-2 FC (mg/dl)	1.98	0.71	2.14	0.91	1.47	0.86	-7.2	0.572573	34.6	0.031958	-31.1	0.001324
HDL-3 FC (mg/dl)	0.94	0.64	2.06	0.85	0.84	0.65	-54.5	0.000021	11.8	0.450484	-59.3	<0,000001
HDL-4 FC (mg/dl)	0.98	1.17	2.78	1.30	1.21	1.00	-64.6	0.000012	-19.0	0.580907	-56.4	<0,000001
TG (mg/dl)	187.92	46.97	157.16	105.95	124.18	58.05	19.6	0.323657	51.3	0.000789	-21.0	0.211051
VLDL TG (mg/dl)	114.95	48.34	100.25	76.49	63.52	48.18	14.7	0.517630	81.0	0.001348	-36.6	0.049472
VLDL-1 TG (mg/dl)	51.06	31.19	58.88	54.21	30.28	36.97	-13.3	0.625985	68.6	0.017696	-48.6	0.020399
VLDL-2 TG (mg/dl)	18.83	8.83	14.66	12.17	9.18	6.30	28.4	0.253410	105.1	0.000546	-37.4	0.073463
VLDL-3 TG (mg/dl)	18.80	8.94	11.75	8.68	8.68	6.26	60.0	0.009125	116.6	0.000644	-26.1	0.256869
VLDL-4 TG (mg/dl)	17.31	6.66	8.15	4.27	9.08	5.65	112.3	<0,000001	90.6	0.001783	11.4	0.077313
VLDL-5 TG (mg/dl)	4.88	1.11	2.57	0.83	3.94	1.29	89.9	<0,000001	23.8	0.057408	53.4	<0,000001
IDL TG (mg/dl)	17.01	6.61	17.95	17.82	7.91	6.15	-5.3	0.855813	115.1	0.000152	-56.0	0.018743
LDL TG (mg/dl)	47.47	19.38	19.75	7.63	32.49	15.02	140.4	<0,000001	46.1	0.011475	64.5	<0,000001
LDL-1 TG (mg/dl)	17.23	8.46	5.52	2.84	11.93	5.93	212.1	<0,000001	44.4	0.030652	116.1	<0,000001
LDL-2 TG (mg/dl)	6.73	3.50	2.59	0.87	4.23	2.22	160.3	<0,000001	59.2	0.009659	63.6	<0,000001
LDL-3 TG (mg/dl)	5.17	2.23	2.49	0.79	3.75	1.48	107.4	<0,000001	38.1	0.021338	50.2	<0,000001
LDL-4 TG (mg/dl)	6.97	4.42	2.27	1.46	4.03	2.84	207.2	<0,000001	72.8	0.019509	77.8	0.000007
LDL-5 TG (mg/dl)	5.28	2.62	2.65	1.47	3.34	2.01	99.0	<0,000001	58.1	0.014751	25.8	0.075399
LDL-6 TG (mg/dl)	6.78	1.83	4.43	2.27	4.77	2.55	52.9	0.000797	41.9	0.008616	7.7	0.590666
HDL TG (mg/dl)	19.15	7.74	12.67	5.15	11.64	7.04	51.2	0.000174	64.5	0.005374	-8.1	0.783238
HDL-1 TG (mg/dl)	8.06	3.98	4.57	2.49	4.45	3.52	76.5	0.000042	81.1	0.008929	-2.5	0.792152

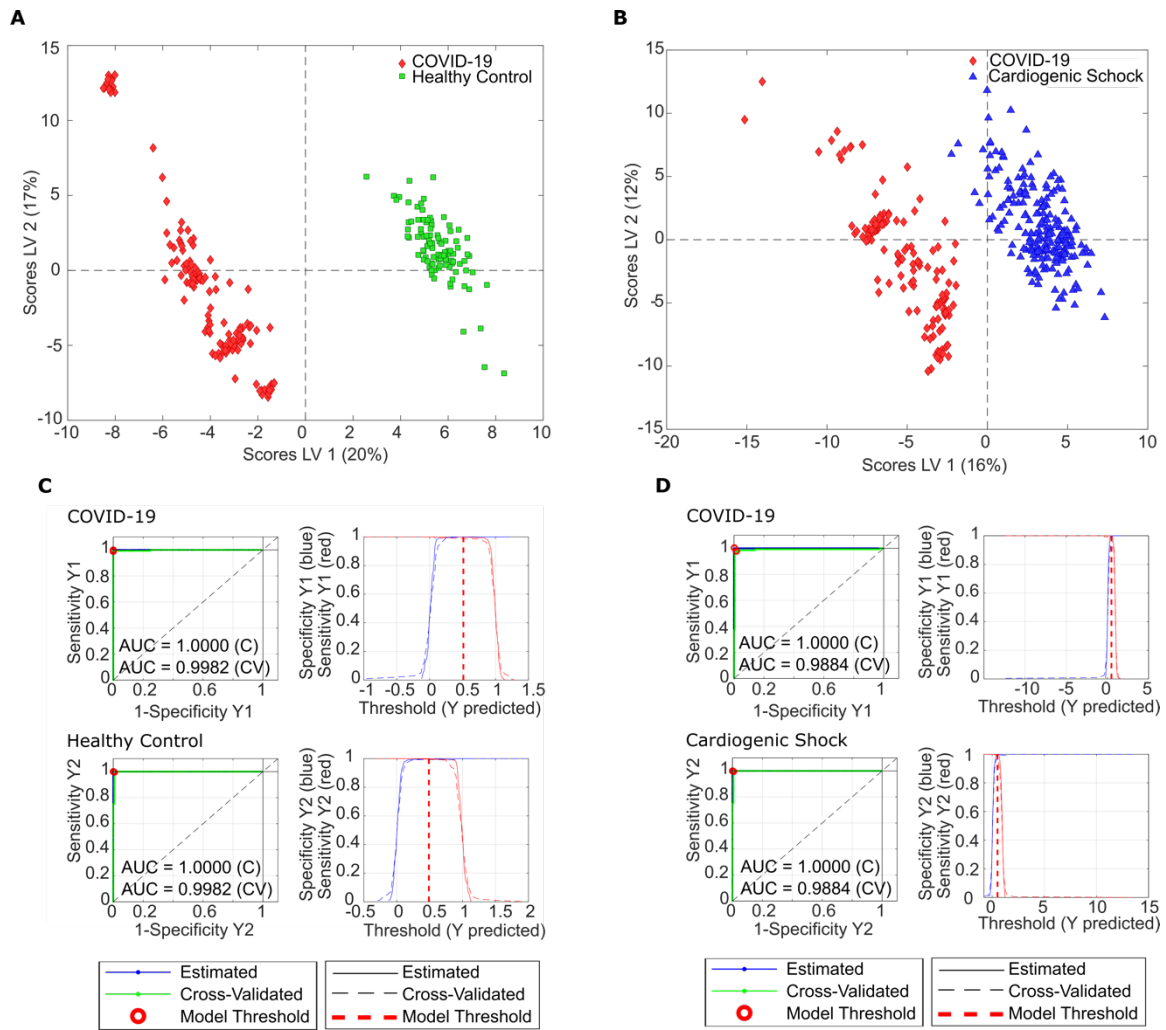
HDL-2 TG (mg/dl)	4.04	1.61	2.29	1.05	2.46	1.71	76.4	0.000001	64.4	0.006826	7.3	0.249182
HDL-3 TG (mg/dl)	3.60	1.15	2.42	1.02	2.48	1.63	48.6	0.000302	45.5	0.018555	2.1	0.570755
HDL-4 TG (mg/dl)	3.40	0.78	3.58	1.26	2.66	1.13	-4.9	0.644202	28.2	0.030169	-25.8	0.006940
VLDL PL (mg/dl)	26.95	11.49	23.44	14.02	14.33	8.67	15.0	0.406695	88.0	0.000883	-38.9	0.013540
VLDL-1 PL (mg/dl)	6.97	4.46	9.28	8.28	4.21	3.37	-24.9	0.344723	65.6	0.016536	-54.7	0.007273
VLDL-2 PL (mg/dl)	4.43	2.30	3.87	2.89	2.07	1.49	14.3	0.521768	114.2	0.000872	-46.6	0.012570
VLDL-3 PL (mg/dl)	6.05	3.09	4.24	2.63	2.57	2.00	42.7	0.029216	135.7	0.000778	-39.5	0.029777
VLDL-4 PL (mg/dl)	8.67	2.75	4.40	2.07	4.60	2.78	97.3	<0,000001	88.7	0.000881	4.6	0.172132
VLDL-5 PL (mg/dl)	2.49	1.28	1.62	0.65	2.03	1.23	53.3	0.000213	22.5	0.421991	25.1	0.002240
IDL PL (mg/dl)	8.19	2.64	9.15	5.41	2.59	2.47	-10.5	0.546953	216.2	0.000002	-71.7	0.000002
LDL PL (mg/dl)	54.94	24.69	64.46	16.01	41.48	16.86	-14.8	0.070372	32.4	0.04475	-35.6	<0,000001
LDL-1 PL (mg/dl)	19.73	11.19	12.62	3.66	12.40	6.39	56.3	0.000007	59.0	0.012279	-1.7	0.975649
LDL-2 PL (mg/dl)	9.22	3.38	10.85	3.54	10.72	3.89	-15.0	0.132558	-14.0	0.259271	-1.2	0.653038
LDL-3 PL (mg/dl)	7.38	5.46	9.62	3.84	6.26	3.39	-23.3	0.070911	17.8	0.326533	-34.9	0.000088
LDL-4 PL (mg/dl)	5.35	6.31	8.72	4.88	2.83	4.36	-38.7	0.030307	88.8	0.117985	-67.5	<0,000001
LDL-5 PL (mg/dl)	5.17	5.40	9.68	4.15	4.12	4.30	-46.6	0.000810	25.3	0.415115	-57.4	<0,000001
LDL-6 PL (mg/dl)	9.96	7.40	13.31	5.51	8.29	6.52	-25.2	0.057555	20.2	0.350257	-37.8	0.000083
HDL PL (mg/dl)	74.07	15.27	84.10	20.51	62.34	21.24	-11.9	0.104254	18.8	0.055888	-25.9	0.000014
HDL-1 PL (mg/dl)	26.47	8.60	25.32	12.42	19.59	10.68	4.6	0.755473	35.1	0.042246	-22.6	0.047582
HDL-2 PL (mg/dl)	18.69	3.72	15.24	5.07	13.42	3.57	22.7	0.024289	39.3	0.000117	-11.9	0.132553

HDL-3 PL (mg/dl)	15.94	3.61	16.95	4.25	13.17	4.00	-6.0	0.430053	21.0	0.022157	-22.3	0.000133
HDL-4 PL (mg/dl)	12.97	8.24	25.97	5.05	16.88	7.25	-50.0	<0,000001	-23.2	0.199888	-35.0	<0,000001
ApoA1 (mg/dl)	104.15	20.70	152.53	25.99	102.27	25.68	-31.7	<0,000001	1.8	0.629963	-33.0	<0,000001
HDL ApoA1 (mg/dl)	104.17	23.55	153.01	28.47	103.84	25.33	-31.9	<0,000001	0.3	0.799226	-32.1	<0,000001
HDL-1 ApoA1 (mg/dl)	28.86	11.51	33.12	17.80	25.80	17.22	-12.9	0.421547	11.9	0.457709	-22.1	0.068653
HDL-2 ApoA1 (mg/dl)	19.35	4.58	21.36	5.69	16.11	5.72	-9.4	0.242913	20.2	0.062705	-24.6	0.000146
HDL-3 ApoA1 (mg/dl)	24.41	5.01	27.98	6.51	21.21	4.57	-12.7	0.069745	15.1	0.030979	-24.2	0.000007
HDL-4 ApoA1 (mg/dl)	30.44	18.89	69.57	12.97	39.71	16.84	-56.3	<0,000001	-23.4	0.174768	-42.9	<0,000001
ApoA2 (mg/dl)	24.70	6.75	33.68	5.50	18.96	7.22	-26.6	<0,000001	30.3	0.014853	-43.7	<0,000001
HDL ApoA2 (mg/dl)	27.92	6.43	33.86	5.27	21.25	7.40	-17.5	0.000468	31.4	0.003966	-37.2	<0,000001
HDL-1 ApoA2 (mg/dl)	3.86	1.09	3.57	1.83	2.39	1.47	8.2	0.585283	61.8	0.003047	-33.1	0.009060
HDL-2 ApoA2 (mg/dl)	4.48	0.71	4.30	1.33	2.62	1.07	4.3	0.636109	71.2	0.000002	-39.1	<0,000001
HDL-3 ApoA2 (mg/dl)	6.78	1.53	7.06	1.61	4.43	1.68	-4.1	0.560885	53.0	0.00008	-37.3	<0,000001
HDL-4 ApoA2 (mg/dl)	8.22	5.92	17.99	4.35	9.12	4.56	-54.3	<0,000001	-9.9	0.692616	-49.3	<0,000001
VLDL ApoB (mg/dl)	17.01	4.40	8.80	5.06	10.29	3.90	93.4	<0,000001	65.3	0.000169	17.0	0.087014
IDL ApoB (mg/dl)	10.73	4.25	5.69	2.74	5.61	3.54	88.4	<0,000001	91.2	0.001082	-1.4	0.717293
LDL ApoB (mg/dl)	76.99	31.06	72.75	20.70	57.32	21.81	5.8	0.527487	34.3	0.022559	-21.2	0.001046
LDL-1 ApoB (mg/dl)	21.63	11.39	11.52	3.57	13.38	6.80	87.7	<0,000001	61.6	0.006628	16.1	0.025375
LDL-2 ApoB (mg/dl)	10.60	3.46	10.75	3.49	12.02	4.08	-1.4	0.892490	-11.8	0.292876	11.9	0.207721
LDL-3 ApoB (mg/dl)	10.13	6.44	10.03	4.07	7.88	4.12	1.0	0.940301	28.6	0.125808	-21.5	0.011995

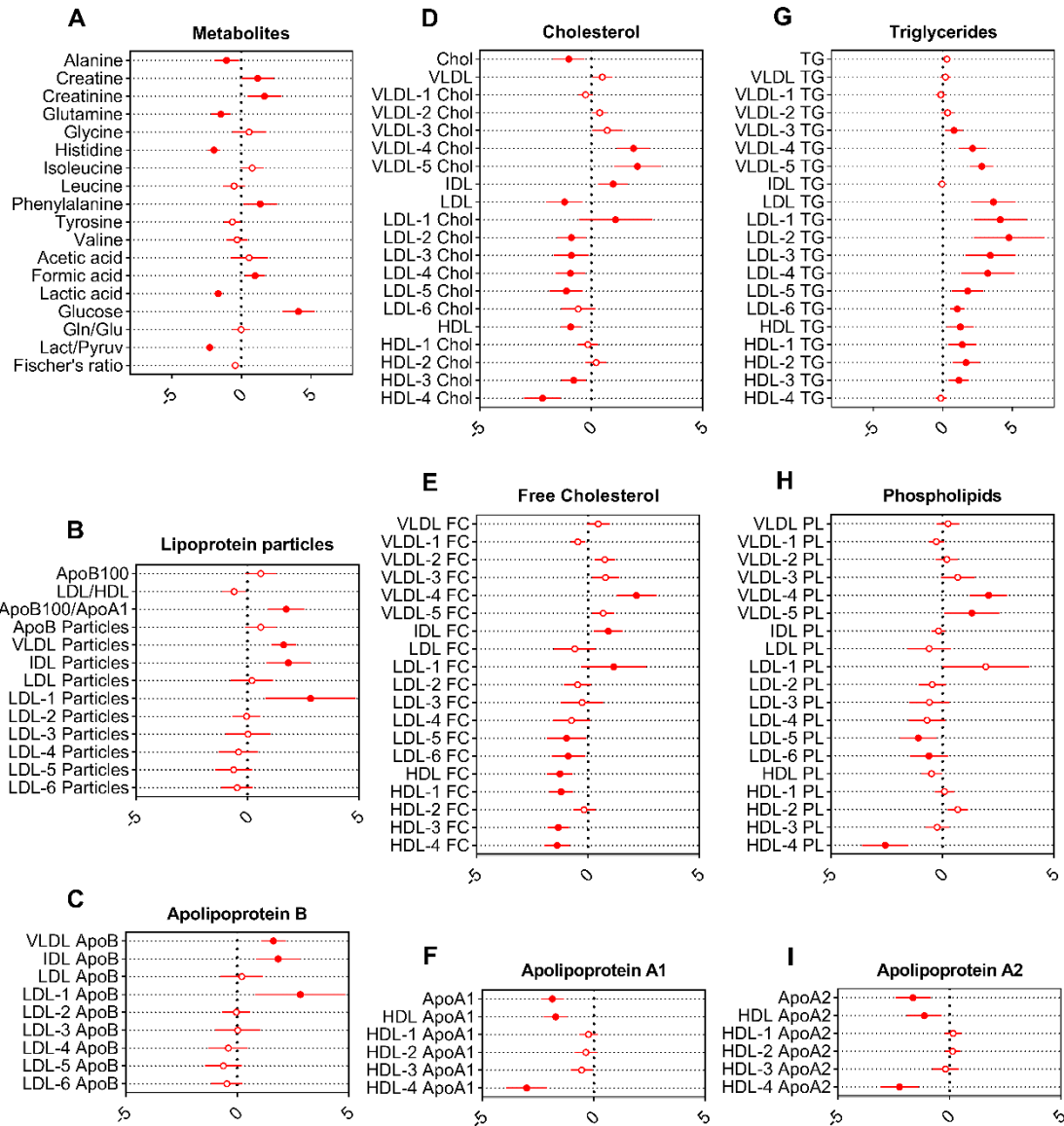
LDL-4 ApoB (mg/dl)	7.45	8.27	9.83	5.93	4.32	6.37	-24.2	0.213101	72.6	0.144721	-56.1	0.000082
LDL-5 ApoB (mg/dl)	8.68	7.39	12.17	5.65	6.12	6.24	-28.7	0.052775	41.7	0.190003	-49.7	0.000008
LDL-6 ApoB (mg/dl)	14.87	10.95	19.48	9.91	13.08	11.10	-23.7	0.134526	13.7	0.469536	-32.9	0.003502

Table S2. Spearman Correlation for metabolites and lipoproteins against the Anti-S1 IgG-titer in COVID-19, HC, and CS cohorts.

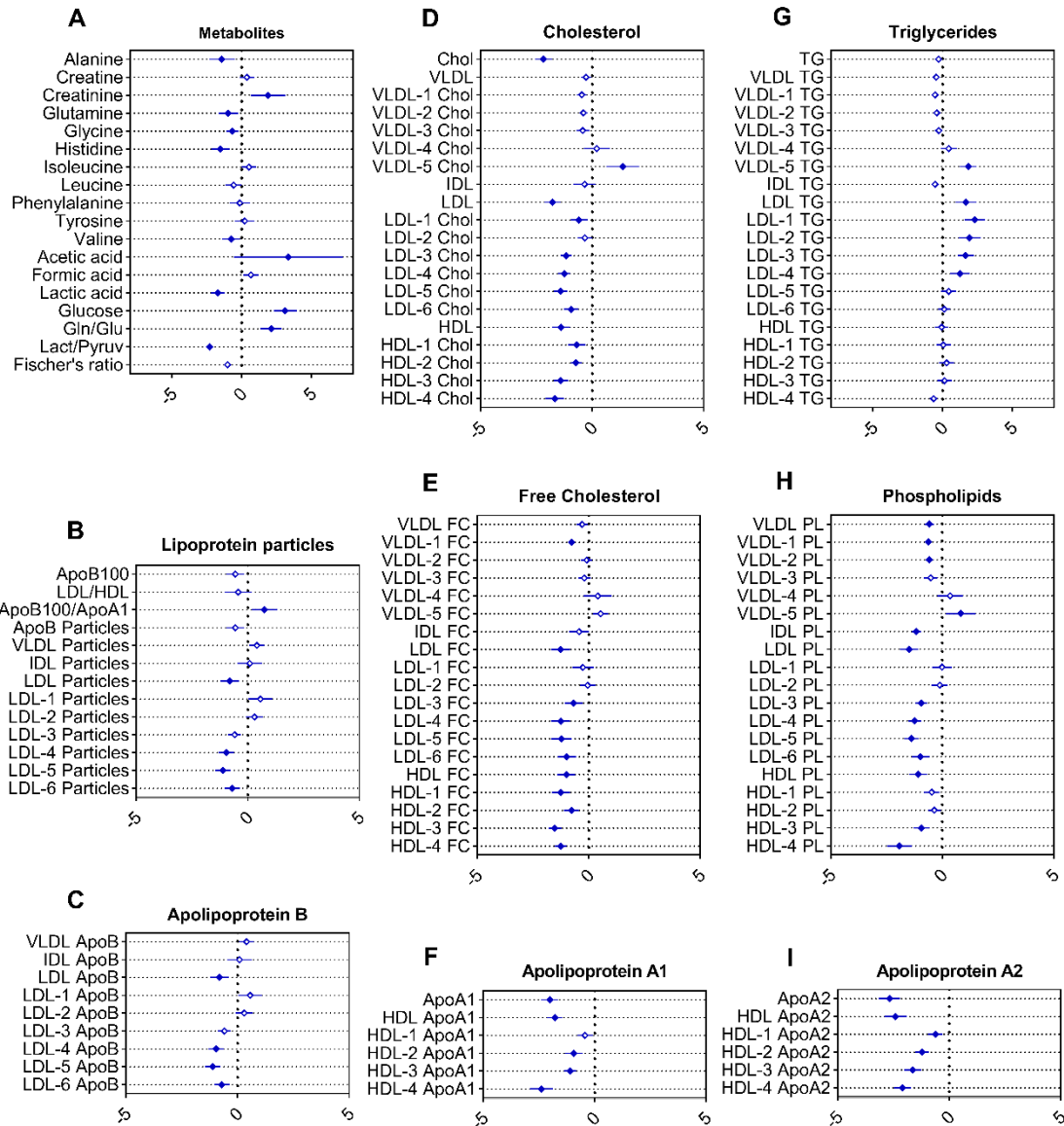
	Glycine	ApoA2	LDL-6 Particles	HDL- ApoA2	LDL-6 TG	LDL-6 Chol	LDL-5 FC	LDL-6 FC	LDL-6 PL	LDL-6 ApoB	HDL-4 Chol	HDL-4 FC	HDL-4 PL	ApoA1	ApoA2
Spearman r	0.5101	-0.4146	-0.5099	-0.4126	-0.3905	-0.5051	-0.4593	-0.5535	-0.4938	-0.5099	-0.4949	-0.4092	-0.4952	-0.5011	-0.5257
P value															
P (two-tailed)	0.0029	0.0183	0.0029	0.0189	0.0271	0.0032	0.0082	0.001	0.0041	0.0029	0.004	0.0201	0.004	0.0035	0.002



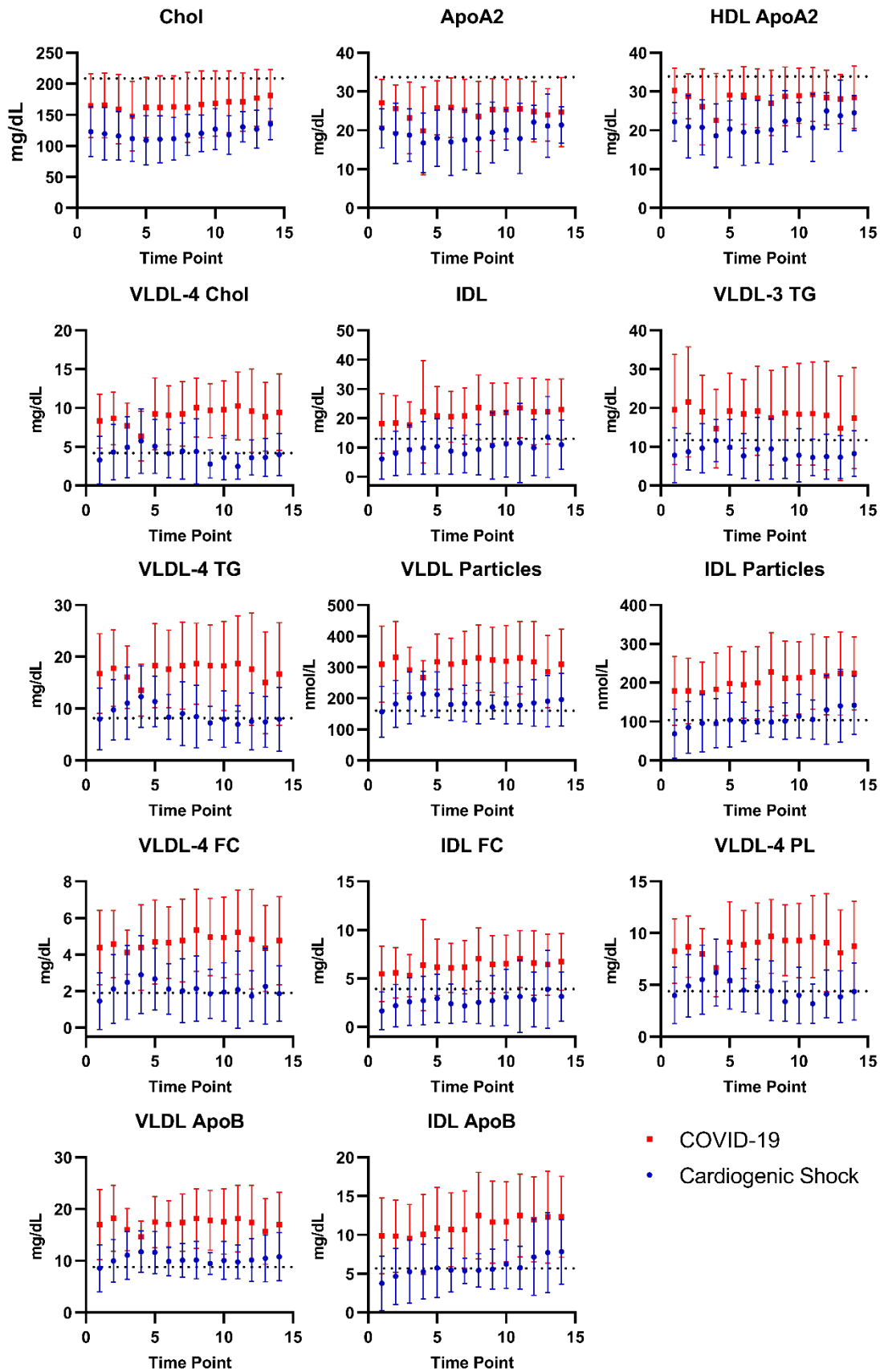
Supplementary Figure 1. A PLS-DA for COVID-19 vs. Healthy Controls. The ROC analysis in **C** indicates a significance for the separation of the two groups. **B** PLS-DA of COVID-19 vs. Cardiogenic Shock shows a good grouping for the two groups. A good separation model was validated by a ROC analysis (**D**).



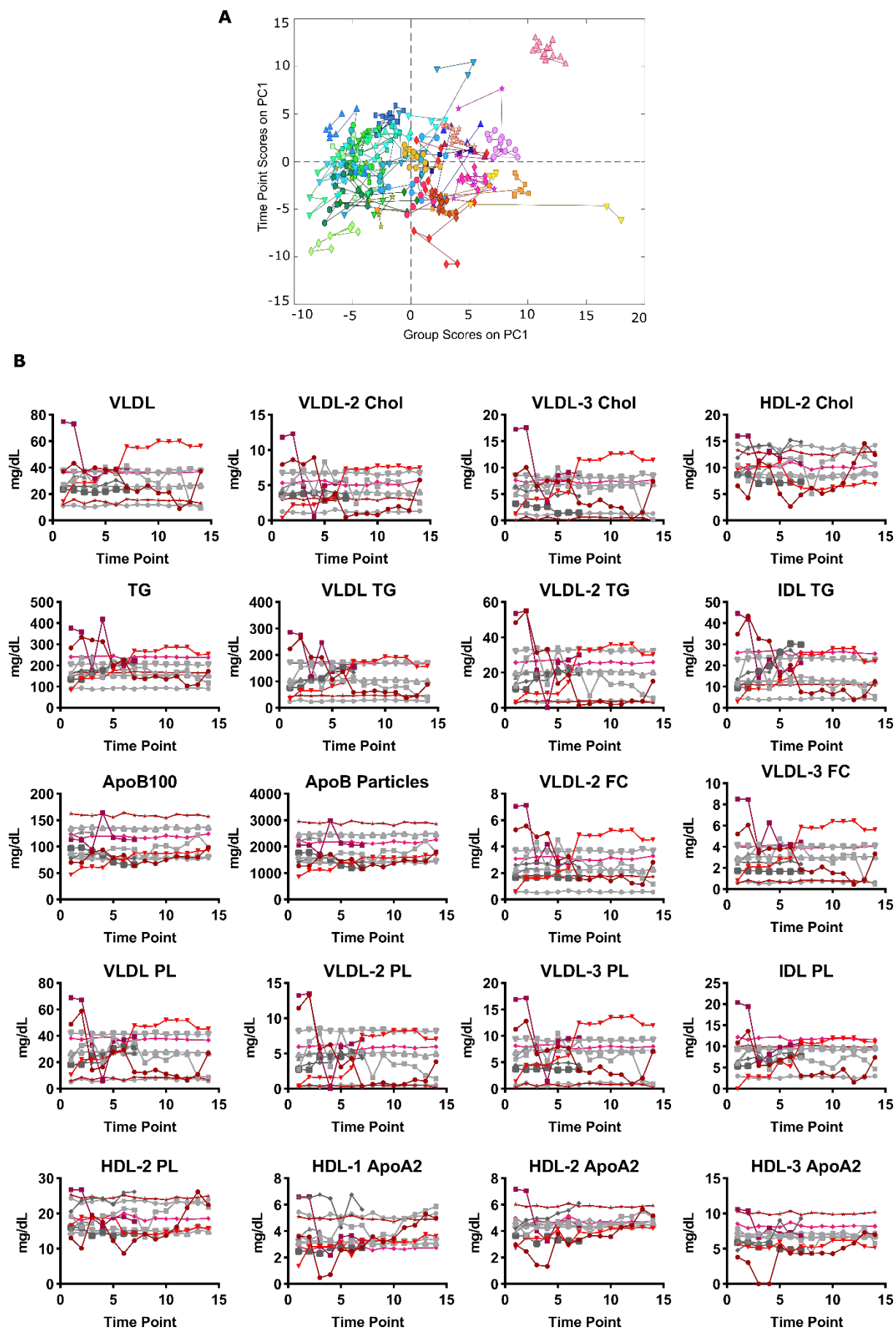
Supplementary Figure 2. Forest plots showing changes for groups of metabolites (A) and lipoprotein classes (B-I). The middle line indicates the reference average whereas circles on the horizontal axes show changes scaled by standard deviations. Red circles show changes for COVID-19 samples compared to healthy controls as the reference (vertical line). Statistically significant differences between COVID-19 to HC determined using the false discovery method of Benjamini, Krieger and Yekutieli ($Q = 1\%$) are indicated by filled circles.



Supplementary Figure 3. Forest plots showing changes for groups of metabolites (A) and lipoprotein classes (B-I). The middle line indicates the reference average whereas diamonds on the horizontal axes show changes scaled by standard deviations. Blue diamonds show changes for CS samples compared to healthy controls as the reference (vertical line). Statistically significant differences between CS to HC determined using the false discovery method of Benjamini, Krieger and Yekutieli ($Q = 1\%$) are indicated by filled diamonds.

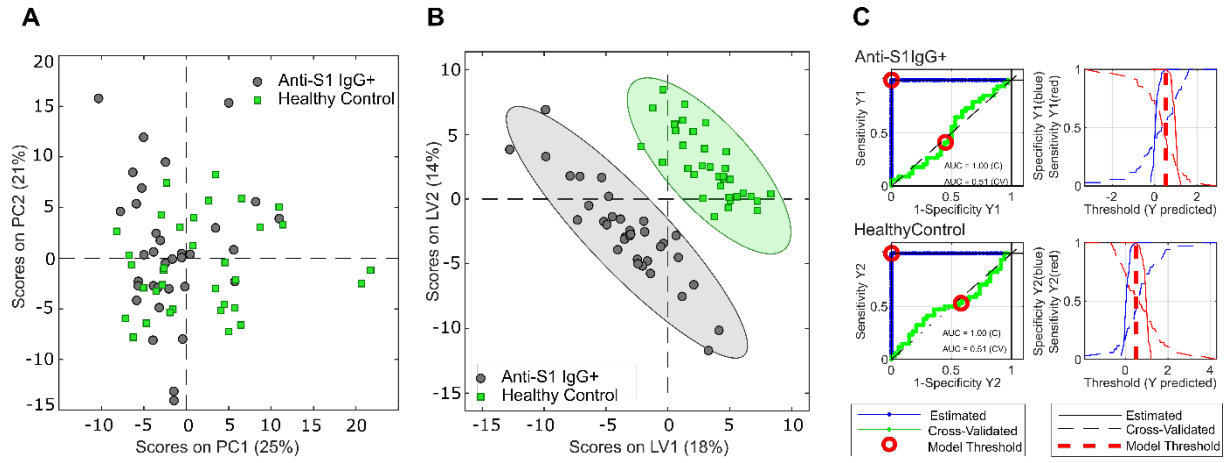


Supplementary Figure 4. Time courses of lipoproteins (mean and standard deviation) that are significant for the both comparison of COVID-19 to HC and CS allows to differentiate between COVID-19 (red) and cardiogenic shock (blue) showing a continuous progression for COVID-19; the dotted line represents the mean value for healthy controls.

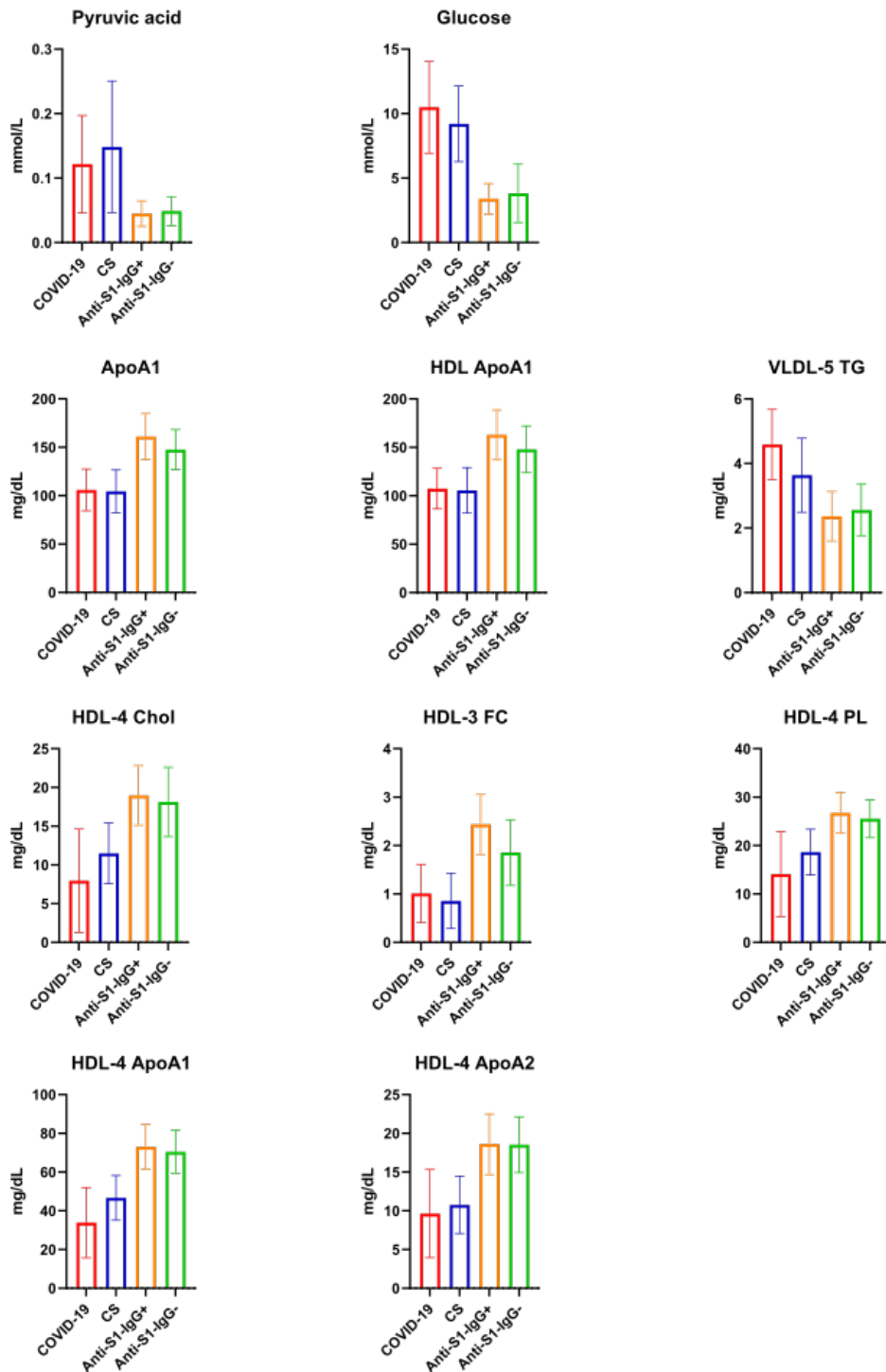


Supplementary Figure 5. A ASCA analysis of COVID-19 (warm colors in yellow and red) vs. cardiogenic shock (cold colors in blue and green) samples showing a separation between the groups in consideration of the

different groups and time points. **B** Time courses of lipoproteins for COVID-19 patients that are only significant for the comparison of COVID-19 vs. CS showing striking progressions over time for some patients (highlighted in red).



Supplementary Figure 6. **A** PCA and **B** PLS-DA for Anti-S1 IgG+ vs. age- and sex-matched Healthy Controls. The ROC analysis in **C** shows no significance for the separation of the two groups.



Supplementary Figure 7. Metabolites and lipoproteins significantly changed between (1) COVID-19 vs. Anti-SARS-CoV-2 IgG+ individuals (Anti-S1-IgG+), (2) COVID-19 vs. Anti-SARS-CoV-2 IgG-antibodies (Anti-S1-IgG-), (3) CS vs. Anti-S1-IgG+, (4) CS vs. Anti-S1-IgG determined using multiple unpaired t-test with the false discovery method of Benjamini, Krieger and Yekutieli (Q = 1%).

