Supplemental Material

Lipidomics reveals associations of phospholipids with obesity and insulin resistance in young adults

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Tables

Supplemental Table 1. Significant analytes of the multiple linear regression model with HOMA-IR as outcome and metabolite concentrations as predictor, adjusted for sex, LDL-C, HDL-C, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour at 20yrs, without BMI adjustment. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported.

Analyte	**Estimate**	**CI**	**p**
SMa C32:2	0.15	0.05,0.26	<0.001
SMa C33:2	0.1	0.003,0.21	0.03
SMa C36:0	0.16	0.003,0.2	0.03
Pcaa C33:3	0.1	0.003,0.2	0.003

Supplemental Table 2. Results of the multiple linear regression model with WC as outcome and NEFA 16:1 to NEFA 16:0 and NEFA 18:1 to 18:0 ratios as predictor, adjusted for sex, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported. Analysis without BMI adjustment.

	Standardized Estimate	**CI**	**p**
NEFA C16:1/C16:0	1.86	0.35,3.37	0.001
NEFA C18:1/C18:0	0.72	-0.69,2.14	1

Supplemental Table 3. Results of multiple linear regression models between metabolite concentrations as predictor and sex, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. Bonferroni corrected p-values reported.

Analytes	HDL-C	LDL-C	Sex	Ethnicity	Western Dietary Pattern	Healthy Dietary Pattern	Dietary misreporting	Physical Activity	Sedentary Behaviour	Smoking	Drinking
SMa C30:1	<0.001	<0.001	0.021	1	0.28	1	1	1	1	1	1
SMa C32:0	1	<0.001	1	1	1	1	1	1	1	1	1
SMa C32:1	<0.001	<0.001	1	1	0.145	1	1	0.319	1	1	1
SMa C32:2	0.009	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C33:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C33:2	0.121	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C34:0	1	<0.001	0.02	1	1	1	1	1	1	1	1
SMa C34:1	<0.001	<0.001	0.511	1	1	1	1	1	1	1	1
SMa C34:2	<0.001	<0.001	<0.001	1	1	1	0.031	1	1	1	1
SMa C34:3	0.001	<0.001	0.002	1	1	1	1	1	1	1	1
SMa C35:0	1	<0.001	1	1	1	1	1	1	1	1	1
SMa C35:1	1	<0.001	1	1	1	1	1	1	1	1	1
SMa C36:0	1	<0.001	0.002	1	1	1	1	1	1	1	1
SMa C36:1	1	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C36:2	1	<0.001	<0.001	1	1	1	0.802	1	1	1	1
SMa C36:3	0.954	<0.001	<0.001	1	1	1	0.449	1	0.518	1	1
SMa C37:1	1	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C38:1	<0.001	<0.001	1	1	1	1	1	1	1	0.816	1

SMa C38:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C39:1	<0.001	<0.001	1	1	1	1	1	0.907	1	1	1
SMa C39:2	0.012	<0.001	0.002	1	1	1	1	1	1	1	1
SMa C40:1	0.903	<0.001	1	1	1	1	1	1	1	1	1
SMa C40:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C40:3	<0.001	<0.001	0.593	1	1	1	1	1	1	1	1
SMa C40:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C40:5	<0.001	<0.001	1	1	1	0.311	1	1	1	1	1
SMa C41:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C41:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C42:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C42:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C42:3	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
SMa C42:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C42:5	<0.001	<0.001	1	1	1	1	1	1	1	1	1
SMa C42:6	<0.001	<0.001	0.005	1	0.041	0.253	1	1	1	1	1
SMa C43:1	0.686	<0.001	1	1	1	1	0.738	1	1	1	1
SMa C43:2	1	<0.001	1	1	1	1	1	1	1	1	1
SMa C44:2	1	<0.001	1	1	1	1	1	1	1	1	1
SMa C44:6	0.002	<0.001	1	0.638	1	1	1	1	1	1	1
SMe C32:1	<0.001	<0.001	1	1	0.044	1	1	0.318	1	1	1
SMe C34:3	0.398	<0.001	1	1	1	1	1	1	1	1	1
SMe C36:2	1	<0.001	0.113	1	1	1	1	1	1	1	0.146
SMe C38:3	<0.001	<0.001	1	0.145	0.375	1	1	1	1	1	1
SMe C40:5	<0.001	<0.001	0.047	1	1	1	1	1	1	1	1
SMe C42:0	0.002	<0.001	0.51	1	1	1	1	1	1	1	1
SMe C42:3	0.406	<0.001	0	1	1	1	1	1	1	1	1
SMe C44:0	0.008	<0.001	0.044	1	1	1	1	1	1	1	1
SMe C44:3	1	<0.001	<0.001	1	1	1	1	1	1	1	1

PCaa C30:0	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C30:1	<0.001	<0.001	0.884	1	1	1	1	1	1	1	1
PCaa C30:2	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C32:0	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C32:1	<0.001	0.18	0.044	1	1	1	1	1	1	1	1
PCaa C32:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
PCaa C32:3	<0.001	<0.001	1	1	1	1	1	0.235	1	1	1
PCaa C34:0	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C34:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C34:2	<0.001	<0.001	0.001	0.046	1	1	1	1	1	1	1
PCaa C34:3	<0.001	0.002	0.004	1	1	1	1	1	1	1	1
PCaa C34:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C34:5	<0.001	<0.001	1	0.786	1	1	1	1	1	1	1
PCaa C36:0	<0.001	<0.001	1	0.349	1	0.043	1	1	1	1	1
PCaa C36:1	<0.001	<0.001	1	1	1	1	0.597	1	1	1	1
PCaa C36:2	<0.001	<0.001	1	0.291	1	1	1	1	1	1	1
PCaa C36:3	<0.001	<0.001	0.449	1	1	1	1	1	1	1	1
PCaa C36:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C36:5	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C36:6	<0.001	<0.001	1	1	1	0.041	1	1	1	1	1
PCaa C38:0	<0.001	<0.001	1	0.042	1	0.005	1	1	1	0.032	1
PCaa C38:1	<0.001	<0.001	1	0.251	1	1	1	1	1	1	1
PCaa C38:2	<0.001	<0.001	0.034	1	1	1	1	1	1	1	1
PCaa C38:3	0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C38:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C38:5	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C38:6	<0.001	<0.001	0.037	1	0.003	0.005	1	1	1	1	1
PCaa C40:0	0.009	<0.001	1	1	1	0.402	1	1	1	1	1
PCaa C40:1	0.001	<0.001	1	1	1	0.466	1	1	1	1	1

PCaa C40:3	<0.001	0.347	1	1	1	1	1	1	1	1	1
PCaa C40:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C40:5	0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C40:6	0.032	<0.001	1	1	0.133	0.047	1	1	1	1	1
PCaa C42:0	0.004	0.009	1	1	1	1	1	1	1	1	1
PCaa C42:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C42:2	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C42:4	0.002	<0.001	1	1	1	1	1	1	1	1	1
PCaa C42:5	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
PC.aaC42:6	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCaa C43.4	0.001	1	1	1	1	1	1	1	1	1	1
PCaa C43:6	<0.001	0.338	1	1	1	0.527	1	1	1	1	1
PCaa C44:12	0.002	0.85	1	1	1	1	1	1	1	1	1
PCae C30:0	<0.001	0.008	1	1	1	1	1	1	1	1	1
PCae C30:1	0.012	<0.001	1	1	1	0.009	1	1	1	1	1
PCae C32:0	<0.001	<0.001	1	1	1	1	1	1	1	0.582	1
PCae C32:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C32:2	<0.001	0.002	1	0.679	1	1	1	1	0.072	1	1
PCae C34:0	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C34:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C34:2	<0.001	<0.001	1	0.012	1	1	1	1	1	1	1
PCae C34:3	<0.001	0.007	1	0.001	1	1	1	1	0.33	1	1
PCae C34:4	<0.001	0.064	1	0	1	1	1	1	1	1	1
PCae C36:0	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C36:1	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C36:2	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C36:3	<0.001	<0.001	1	0.081	0.196	1	1	1	1	1	1
PCae C36:4	<0.001	<0.001	0.113	1	1	1	1	1	1	1	1
PCae C36:5	<0.001	<0.001	0	0.84	1	1	1	1	1	1	1

PCae C36:6	<0.001	<0.001	0	0.006	1	1	1	1	1	1	1
PCae C38:0	<0.001	<0.001	1	1	1	0.141	1	1	1	1	1
PCae C38:2	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C38:3	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C38:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C38:5	<0.001	<0.001	0.002	1	1	1	1	1	1	1	1
PCae C38:6	<0.001	<0.001	1	0.478	1	0.334	1	1	1	0.961	1
PCae C40:0	<0.001	<0.001	1	1	0.013	0.018	1	1	1	1	1
PCae C40:1	<0.001	<0.001	0.068	1	1	1	1	1	1	1	1
PCae C40:2	<0.001	<0.001	<0.001	1	1	1	1	1	1	1	1
PCae C40:3	<0.001	0.004	0.093	1	1	1	1	1	1	1	1
PCae C40:4	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C40:5	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C40:6	<0.001	<0.001	1	1	0.052	0.102	1	1	1	1	1
PCae C42:0	0.001	0.002	<0.001	1	0.181	1	1	1	1	1	1
PCae C42:1	<0.001	<0.001	1	1	1	1	1	1	0.091	1	1
PCae C42:2	<0.001	<0.001	1	1	1	1	1	1	1	1	1
PCae C42:3	<0.001	<0.001	1	1	1	1	1	1	0.778	1	1
PCae C42:4	<0.001	0.163	0.61	1	1	1	1	1	1	1	1
PCae C42:5	0.006	0.006	1	1	1	1	1	1	1	1	1
PCae C42:6	<0.001	<0.001	1	1	1	1	1	1	1	1	1
LPCa C14:0	1	1	1	1	1	1	1	1	1	1	1
LPCa C16:0	1	0.031	<0.001	1	1	1	1	1	1	1	1
LPCa C16:1	1	1	0.001	1	1	1	1	1	1	1	1
LPCa C18:0	1	0.003	<0.001	1	1	1	1	1	1	1	1
LPCa C18:1	<0.001	1	<0.001	1	1	1	1	1	1	1	1
LPCa C18:2	<0.001	0.739	<0.001	1	1	1	1	1	1	1	1
LPCa C18:3	0.006	1	<0.001	1	1	1	1	1	1	1	1
LPCa C18:6	1	1	1	1	1	1	1	1	1	1	1

LPCa C20:2	<0.001	1	<0.001	1	1	1	1	1	1	1	1
LPCa C20:3	<0.001	1	<0.001	1	1	1	1	1	1	1	1
LPCa C20:4	0.004	1	<0.001	1	1	1	1	1	1	1	1
LPCa C20:5	1	1	<0.001	1	1	1	1	1	1	1	1
LPCa C22:5	0.003	1	<0.001	1	1	1	1	1	1	0.056	1
LPCa C22:6	1	1	<0.001	1	1	0.318	1	1	1	1	1
LPCe C16:0	1	0.001	<0.001	1	1	1	1	1	1	1	1
LPCe C18:0	1	0.363	<0.001	1	1	1	1	1	1	1	1
LPCe C18:1	1	1	<0.001	1	1	1	1	1	1	1	1
NEFA C12:0	1	1	1	1	0.79	1	1	1	1	1	1
NEFA C14:0	1	0.645	1	1	1	1	1	1	1	1	1
NEFA C14:1	1	1	0.144	1	1	1	1	1	1	1	1
NEFA C15:0	1	1	1	1	0.808	1	1	1	1	1	1
NEFA C15:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C16:0	1	1	1	1	1	1	1	1	1	1	1
NEFA C16:1	1	1	0.242	1	1	1	1	1	1	1	1
NEFA C17:0	1	0.63	1	1	1	1	1	1	1	1	1
NEFA C17:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C18:0	1	1	1	1	1	1	1	1	1	1	1
NEFA C18:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C18:2	1	1	1	1	1	1	1	1	1	1	1
NEFA C18:3	1	1	1	1	1	1	1	1	1	1	1
NEFA C20:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C20:2	1	1	1	1	1	1	1	1	1	1	1
NEFA C20:3	1	1	1	1	1	1	1	1	1	1	1
NEFA C20:4	1	0.02	1	1	1	1	1	1	1	1	1
NEFA C22:6	1	0.029	1	0.131	0.054	1	0.637	1	1	1	1
NEFA C24:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C12:1	1	1	1	1	1	1	1	1	1	1	1

NEFA C13:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C14:2	1	1	1	1	1	1	1	0.199	1	1	1
NEFA C16:2	1	0.083	1	1	1	1	1	1	1	1	1
NEFA C18:4	1	1	1	1	1	1	1	1	1	1	1
NEFA C19:0	1	1	1	1	1	1	1	1	1	1	1
NEFA C19:1	1	1	1	1	1	1	1	1	1	1	1
NEFA C20:5	1	0.029	1	1	1	1	1	1	1	1	1
NEFA C22:4	1	0.023	1	1	1	1	1	1	1	1	1
NEFA C22:5	1	0.005	1	1	1	1	1	1	1	1	1
NEFA C24:4	0.074	1	1	1	1	1	1	1	1	1	1
NEFA C24:5	1	1	<0.001	1	1	1	0.848	1	1	1	1
NEFA C26:1	1	1	1	1	1	0.144	1	1	1	1	1

Supplemental Table 4. Distribution of different ethnicities.

Ethnicity	N
Caucasian	839
Chinese	21
Indian	14
Aboriginal	3
Vietnamese	3
Polynesian	2
Parents different ethnicity	129

Supplemental Table 5. Results of the multiple linear regression model with WC as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour, in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. All standardized estimates, Bonferroni corrected confidence intervals, p-values and Bonferoni corrected p-values reported. Sorted by decreasing significance.

Analytes	B Coefficient	Bonferroni CI	p	pcorr
SM.a.C32.2	4.04	2.45, 5.62	<0.001	<0.001
SM.a.C33.2	2.37	0.76, 3.99	<0.001	<0.001
SM.a.C34.2	3.32	1.68, 4.95	<0.001	<0.001
SM.a.C34.3	2.52	0.73, 4.31	<0.001	<0.001
SM.a.C36.0	2.54	0.61, 4.47	<0.001	<0.001
SM.a.C36.2	2.22	0.7, 3.73	<0.001	<0.001
SM.a.C36.3	2.26	0.8, 3.71	<0.001	<0.001
SM.a.C40.2	1.99	0.24, 3.74	<0.001	<0.001
SM.a.C42.3	1.84	0.21, 3.47	<0.001	<0.001
SM.a.C42.4	1.71	0.15, 3.27	<0.001	<0.001
SM.a.C35.2	1.44	-0.05, 2.93	<0.001	<0.001
SM.e.C44.3	1.66	0.03, 3.28	<0.001	<0.001
PC.aa.C38.3	2.51	1.02, 4	<0.001	<0.001
PC.aa.C38.4	2.13	0.6, 3.65	<0.001	<0.001
PC.aa.C38.5	1.76	0.21, 3.31	<0.001	<0.001
PC.aa.C40.5	2.26	0.77, 3.75	<0.001	<0.001
PC.aa.C40.6	2.08	0.56, 3.6	<0.001	<0.001
lyso.PC.a.C18.1	-1.65	-3.13, -0.16	<0.001	<0.001
lyso.PC.a.C18.2	-1.57	-3.06, -0.08	<0.001	<0.001
NEFA.17.1	1.51	0.08, 2.93	<0.001	<0.001
SM.a.C36.1	1.56	-0.09, 3.21	0.001	0.175
SM.a.C42.1	1.48	-0.14, 3.09	0.001	0.175
NEFA.16.2	1.29	-0.11, 2.68	0.001	0.175
NEFA.18.4	1.49	-0.07, 3.04	0.001	0.175
NEFA.22.4	1.44	-0.08, 2.96	0.001	0.175
NEFA.22.5	1.27	-0.15, 2.7	0.001	0.175
SM.a.C40.5	1.24	-0.21, 2.69	0.002	0.35
SM.a.C42.2	1.37	-0.26, 3.01	0.002	0.35
SM.a.C43.2	1.26	-0.2, 2.73	0.002	0.35
NEFA.14.2	1.2	-0.24, 2.64	0.002	0.35
SM.a.C43.1	1.24	-0.27, 2.75	0.003	0.525
SM.a.C41.3	1.41	-0.33, 3.15	0.003	0.525
PC.aa.C32.1	1.2	-0.27, 2.68	0.003	0.525
SM.a.C32.0	1.55	-0.38, 3.47	0.004	0.7
lyso.PC.a.C16.0	-1.16	-2.61, 0.29	0.004	0.7

lyso.PC.a.C18.3	-1.27	-2.88, 0.34	0.004	0.7
NEFA.16.1	1.06	-0.28, 2.4	0.004	0.7
SM.a.C41.1	1.28	-0.38, 2.95	0.005	0.875
lyso.PC.e.C16.0	-1.07	-2.44, 0.3	0.005	0.875
lyso.PC.e.C18.0	-1.07	-2.52, 0.38	0.007	1
PC.aa.C43.4	1.29	-0.49, 3.07	0.008	1
SM.a.C44.6	1.16	-0.45, 2.76	0.009	1
PC.aa.C40.4	1.03	-0.4, 2.47	0.009	1
NEFA.20.5	1.03	-0.43, 2.48	0.01	1
SM.a.C40.4	1	-0.44, 2.44	0.012	1
NEFA.17.0	0.96	-0.45, 2.37	0.013	1
NEFA.18.2	0.97	-0.46, 2.4	0.013	1
NEFA.19.1	1	-0.46, 2.45	0.013	1
PC.ae.C38.5	1.03	-0.5, 2.57	0.014	1
NEFA.14.1	0.94	-0.46, 2.33	0.014	1
PC.aa.C34.3	1.03	-0.51, 2.56	0.015	1
SM.a.C41.2	1.12	-0.56, 2.79	0.016	1
NEFA.18.3	0.87	-0.46, 2.21	0.017	1
PC.ae.C38.3	0.94	-0.51, 2.4	0.018	1
PC.aa.C42.2	1.17	-0.65, 2.99	0.019	1
PC.aa.C34.5	0.92	-0.52, 2.36	0.02	1
lyso.PC.a.C18.0	-0.89	-2.29, 0.51	0.021	1
SM.a.C32.1	1.04	-0.63, 2.71	0.023	1
PC.aa.C32.3	0.97	-0.58, 2.53	0.023	1
lyso.PC.a.C20.4	-0.91	-2.45, 0.62	0.031	1
NEFA.16.0	0.85	-0.61, 2.31	0.033	1
PC.aa.C44.12	0.83	-0.61, 2.27	0.035	1
PC.ae.C36.5	0.92	-0.67, 2.5	0.035	1
PC.aa.C36.5	0.87	-0.65, 2.38	0.037	1
NEFA.20.3	0.79	-0.61, 2.2	0.04	1
NEFA.12.1	0.8	-0.62, 2.23	0.04	1
PC.ae.C38.6	0.86	-0.69, 2.4	0.044	1
SM.a.C35.0	0.91	-0.75, 2.58	0.046	1
NEFA.20.2	0.77	-0.63, 2.17	0.046	1
SM.a.C35.1	0.83	-0.7, 2.35	0.048	1
NEFA.18.1	0.75	-0.63, 2.14	0.048	1
PC.ae.C34.2	-0.86	-2.48, 0.75	0.051	1
NEFA.20.4	0.76	-0.69, 2.21	0.056	1
PC.aa.C38.1	-0.84	-2.47, 0.78	0.058	1
SM.a.C39.1	0.85	-0.81, 2.52	0.062	1
PC.ae.C32.2	0.75	-0.72, 2.22	0.062	1
PC.ae.C36.4	0.76	-0.76, 2.28	0.069	1
PC.aa.C36.2	0.71	-0.78, 2.21	0.082	1
PC.aa.C36.4	0.75	-0.81, 2.3	0.082	1
SM.a.C44.2	0.82	-0.9, 2.54	0.083	1
SM.a.C40.1	0.77	-0.86, 2.4	0.085	1

PC.ae.C36.6	0.81	-0.91, 2.53	0.088	1
PC.aa.C42.1	0.84	-1, 2.67	0.096	1
SM.a.C42.5	0.84	-1.03, 2.71	0.101	1
lyso.PC.a.C16.1	0.63	-0.77, 2.02	0.102	1
lyso.PC.a.C20.3	-0.73	-2.35, 0.89	0.102	1
SM.a.C39.2	0.67	-0.83, 2.16	0.104	1
PC.ae.C40.3	0.66	-0.82, 2.14	0.106	1
PC.aa.C43.6	0.64	-0.81, 2.08	0.109	1
NEFA.20.1	0.6	-0.76, 1.96	0.109	1
SM.a.C30.1	0.75	-0.98, 2.49	0.113	1
PC.ae.C42.4	0.63	-0.81, 2.06	0.113	1
PC.aa.C38.6	0.72	-0.96, 2.39	0.12	1
PC.ae.C42.2	0.65	-0.89, 2.2	0.123	1
PC.aa.C36.6	0.61	-0.84, 2.06	0.126	1
PC.ae.C42.6	0.58	-0.83, 1.99	0.135	1
lyso.PC.a.C22.5	-0.68	-2.34, 0.99	0.138	1
lyso.PC.e.C18.1	-0.67	-2.35, 1.01	0.145	1
PC.aa.C40.1	0.75	-1.16, 2.66	0.15	1
PC.ae.C38.4	0.6	-0.92, 2.11	0.151	1
lyso.PC.a.C14.0	-0.54	-1.91, 0.84	0.155	1
NEFA.15.0	0.53	-0.84, 1.9	0.159	1
SM.a.C38.2	0.58	-0.94, 2.1	0.166	1
SM.a.C40.3	0.66	-1.1, 2.43	0.171	1
PC.aa.C42.4	-0.73	-2.7, 1.24	0.174	1
PC.aa.C42.0	0.6	-1.04, 2.24	0.182	1
PC.ae.C42.5	0.53	-0.92, 1.99	0.182	1
PC.aa.C36.3	0.53	-0.95, 2.02	0.192	1
NEFA.18.0	0.47	-0.93, 1.87	0.223	1
PC.ae.C30.0	-0.52	-2.07, 1.04	0.225	1
NEFA.22.6	0.49	-0.98, 1.96	0.225	1
PC.ae.C40.1	-0.51	-2.04, 1.03	0.227	1
PC.ae.C34.3	-0.52	-2.11, 1.08	0.236	1
NEFA.19.0	0.49	-1.03, 2.01	0.24	1
PC.ae.C38.0	0.49	-1.08, 2.05	0.255	1
NEFA.15.1	0.53	-1.26, 2.32	0.28	1
PC.ae.C32.1	0.45	-1.07, 1.98	0.281	1
PC.ae.C40.4	0.41	-1.01, 1.84	0.289	1
lyso.PC.a.C22.6	-0.42	-1.85, 1.01	0.289	1
PC.aa.C32.2	0.46	-1.14, 2.06	0.296	1
PC.aa.C36.0	0.44	-1.11, 1.98	0.303	1
SM.a.C37.1	0.42	-1.08, 1.91	0.309	1
PC.aa.C40.0	0.45	-1.18, 2.08	0.317	1
PC.ae.C40.6	0.44	-1.18, 2.07	0.319	1
SM.a.C34.0	-0.46	-2.26, 1.34	0.348	1
PC.ae.C36.2	-0.37	-1.85, 1.11	0.364	1
SM.a.C41.0	0.37	-1.17, 1.91	0.38	1

PC.ae.C40.5	0.34	-1.13, 1.81	0.405	1
PC.ae.C36.0	-0.33	-1.8, 1.14	0.412	1
SM.a.C34.1	-0.39	-2.15, 1.37	0.414	1
SM.a.C31.1	0.36	-1.26, 1.97	0.42	1
PC.ae.C42.0	-0.34	-1.9, 1.23	0.433	1
PC.aa.C36.1	0.32	-1.17, 1.81	0.435	1
PC.aa.C34.4	0.31	-1.22, 1.84	0.458	1
PC.aa.C34.1	0.28	-1.12, 1.69	0.467	1
SM.a.C33.1	0.31	-1.29, 1.91	0.479	1
SM.a.C42.6	0.31	-1.29, 1.91	0.48	1
NEFA.13.1	0.35	-1.51, 2.22	0.49	1
SM.a.C37.3	-0.28	-1.78, 1.22	0.496	1
PC.aa.C32.0	-0.27	-1.8, 1.26	0.52	1
PC.ae.C34.4	0.28	-1.32, 1.89	0.52	1
SM.a.C33.3	0.27	-1.28, 1.82	0.521	1
lyso.PC.a.C20.2	-0.33	-2.18, 1.53	0.521	1
PC.aa.C40.3	-0.31	-2.16, 1.55	0.545	1
SM.a.C39.5	0.27	-1.4, 1.95	0.551	1
PC.aa.C38.0	0.25	-1.34, 1.85	0.565	1
PC.aa.C42.5	-0.26	-2.02, 1.5	0.588	1
lyso.PC.a.C18.6	-0.25	-2, 1.49	0.594	1
PC.aa.C30.0	-0.19	-1.58, 1.2	0.623	1
NEFA.24.1	-0.18	-1.54, 1.18	0.632	1
PC.aa.C30.2	-0.23	-2.07, 1.61	0.652	1
PC.aa.C30.1	-0.22	-2, 1.57	0.659	1
NEFA.14.0	0.16	-1.19, 1.51	0.662	1
NEFA.26.1	0.19	-1.41, 1.79	0.663	1
PC.ae.C32.0	-0.17	-1.6, 1.27	0.675	1
NEFA.24.5	-0.19	-1.94, 1.56	0.692	1
PC.ae.C38.2	0.14	-1.36, 1.63	0.74	1
PC.aa.C34.0	-0.15	-1.81, 1.51	0.743	1
PC.ae.C42.1	-0.15	-1.81, 1.52	0.748	1
PC.ae.C30.1	0.14	-1.5, 1.78	0.76	1
PC.ae.C40.0	0.13	-1.43, 1.69	0.769	1
SM.a.C38.1	-0.12	-1.65, 1.41	0.781	1
lyso.PC.a.C20.5	-0.1	-1.55, 1.35	0.807	1
NEFA.24.4	0.11	-1.65, 1.88	0.815	1
PC.aa.C42.6	-0.11	-1.92, 1.69	0.817	1
PC.ae.C42.3	-0.09	-1.58, 1.4	0.828	1
PC.ae.C34.1	-0.08	-1.6, 1.43	0.841	1
PC.aa.C34.2	0.08	-1.5, 1.67	0.849	1
NEFA.12.0	0.06	-1.58, 1.71	0.888	1
PC.aa.C38.2	-0.05	-1.56, 1.46	0.899	1
PC.ae.C36.3	-0.04	-1.57, 1.5	0.932	1
SM.a.C43.0	-0.04	-1.83, 1.76	0.942	1
PC.ae.C34.0	0.02	-1.45, 1.5	0.953	1

PC.ae.C36.1	0.01	-1.44, 1.47	0.974	1
PC.ae.C40.2	0.01	-1.55, 1.57	0.982	1

Supplemental Table 6. Results of the multiple linear regression model with HOMA-IR as outcome and metabolite concentrations as predictor, adjusted for sex, BMI, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour, in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. All standardized estimates, Bonferroni corrected confidence intervals, p-values and Bonferoni corrected p-values reported. Sorted by decreasing significance.

Analytes	β Coefficient	Bonferroni CI	p	pcorr
PC.aa.C30.0	0.04	0, 0.08	<0.001	<0.001
PC.aa.C32.3	0.54	0.02, 1.06	<0.001	<0.001
PC.aa.C43.6	-0.26	-0.51, -0.02	<0.001	<0.001
PC.aa.C44.12	-0.21	-0.42, -0.01	<0.001	<0.001
lyso.PC.a.C14.0	0.1	0.03, 0.18	<0.001	<0.001
PC.aa.C32.2	0.05	-0.01, 0.11	0.001	0.175
SM.a.C31.1	0.81	-0.13, 1.75	0.002	0.35
PC.aa.C34.4	0.09	-0.01, 0.2	0.002	0.35
PC.ae.C42.4	-0.26	-0.57, 0.04	0.002	0.35
lyso.PC.a.C18.3	0.15	-0.04, 0.34	0.004	0.7
SM.a.C36.0	0.14	-0.04, 0.33	0.005	0.875
lyso.PC.e.C16.0	0.18	-0.05, 0.42	0.005	0.875
PC.ae.C38.5	-0.02	-0.04, 0.01	0.006	1
PC.ae.C42.6	-0.16	-0.38, 0.06	0.007	1
PC.aa.C34.3	0.01	-0.01, 0.03	0.009	1
PC.ae.C36.5	-0.02	-0.04, 0.01	0.013	1
PC.ae.C38.6	-0.03	-0.06, 0.01	0.013	1
PC.aa.C43.4	-1.09	-2.72, 0.54	0.015	1
NEFA.20.1	-0.12	-0.3, 0.06	0.017	1
PC.ae.C40.4	-0.12	-0.29, 0.06	0.018	1
NEFA.24.1	-0.42	-1.1, 0.26	0.023	1
SM.a.C32.2	0.24	-0.15, 0.63	0.024	1
NEFA.16.1	-0.01	-0.02, 0	0.025	1
SM.a.C38.1	0.01	0, 0.01	0.026	1
PC.aa.C42.0	-0.37	-0.98, 0.24	0.027	1
PC.ae.C30.0	0.38	-0.26, 1.03	0.03	1
NEFA.24.5	-3.08	-8.25, 2.09	0.03	1
PC.ae.C42.3	-0.23	-0.62, 0.16	0.032	1
lyso.PC.a.C22.5	-0.21	-0.58, 0.15	0.032	1
PC.ae.C40.5	-0.05	-0.15, 0.04	0.036	1
PC.aa.C38.4	0	-0.01, 0	0.041	1
SM.a.C30.1	0.32	-0.26, 0.91	0.044	1
NEFA.22.5	-0.21	-0.58, 0.17	0.045	1
PC.ae.C42.5	-0.07	-0.19, 0.06	0.047	1
NEFA.20.2	-0.17	-0.49, 0.15	0.047	1

SM.a.C42.4	-0.03	-0.07, 0.02	0.057	1
PC.ae.C34.3	-0.02	-0.04, 0.01	0.062	1
PC.ae.C34.0	0.09	-0.09, 0.26	0.07	1
PC.aa.C38.5	0	-0.01, 0	0.071	1
lyso.PC.a.C22.6	-0.06	-0.17, 0.06	0.074	1
NEFA.24.4	-5.21	-15.91, 5.5	0.076	1
PC.ae.C40.6	-0.04	-0.11, 0.04	0.08	1
NEFA.18.1	0	0, 0	0.082	1
PC.aa.C40.4	-0.04	-0.12, 0.04	0.083	1
PC.aa.C36.6	0.1	-0.11, 0.31	0.085	1
PC.aa.C38.0	-0.07	-0.21, 0.07	0.085	1
NEFA.19.1	-0.24	-0.75, 0.27	0.087	1
PC.aa.C42.2	-1.54	-4.91, 1.82	0.094	1
lyso.PC.a.C20.4	-0.01	-0.05, 0.02	0.104	1
NEFA.17.1	-0.07	-0.24, 0.09	0.115	1
PC.ae.C32.2	-0.11	-0.37, 0.15	0.117	1
NEFA.22.4	-0.32	-1.08, 0.43	0.117	1
PC.ae.C32.0	0.04	-0.06, 0.15	0.118	1
SM.a.C32.1	0.02	-0.02, 0.06	0.122	1
SM.a.C37.1	0.06	-0.08, 0.2	0.122	1
SM.a.C42.3	-0.01	-0.02, 0.01	0.124	1
lyso.PC.a.C16.0	0	0, 0.01	0.131	1
PC.aa.C38.2	0.02	-0.03, 0.08	0.135	1
SM.a.C43.0	-0.15	-0.53, 0.23	0.153	1
PC.aa.C30.2	0.25	-0.39, 0.89	0.154	1
PC.aa.C30.1	0.05	-0.07, 0.17	0.155	1
PC.aa.C32.1	0	-0.01, 0.01	0.156	1
SM.a.C33.2	0.61	-1.01, 2.24	0.167	1
SM.a.C37.3	-0.25	-0.91, 0.41	0.168	1
SM.a.C35.0	-0.23	-0.84, 0.38	0.169	1
PC.ae.C36.4	-0.01	-0.03, 0.01	0.173	1
SM.a.C40.3	0.01	-0.02, 0.04	0.174	1
PC.aa.C40.5	-0.01	-0.04, 0.02	0.19	1
NEFA.20.5	-0.18	-0.68, 0.32	0.192	1
SM.a.C36.3	-0.13	-0.5, 0.24	0.204	1
PC.ae.C36.2	0.01	-0.02, 0.04	0.217	1
SM.a.C33.3	-0.74	-3.01, 1.53	0.235	1
PC.ae.C36.6	-0.08	-0.31, 0.16	0.235	1
PC.aa.C42.1	-0.59	-2.42, 1.23	0.237	1
PC.ae.C34.1	0.01	-0.02, 0.04	0.237	1
PC.aa.C36.1	0	0, 0.01	0.24	1
PC.aa.C36.3	0	0, 0	0.244	1
NEFA.14.2	0.19	-0.4, 0.77	0.245	1
PC.aa.C36.0	-0.05	-0.2, 0.1	0.247	1
PC.ae.C40.1	0.07	-0.16, 0.3	0.252	1
PC.ae.C38.0	0.04	-0.1, 0.18	0.257	1

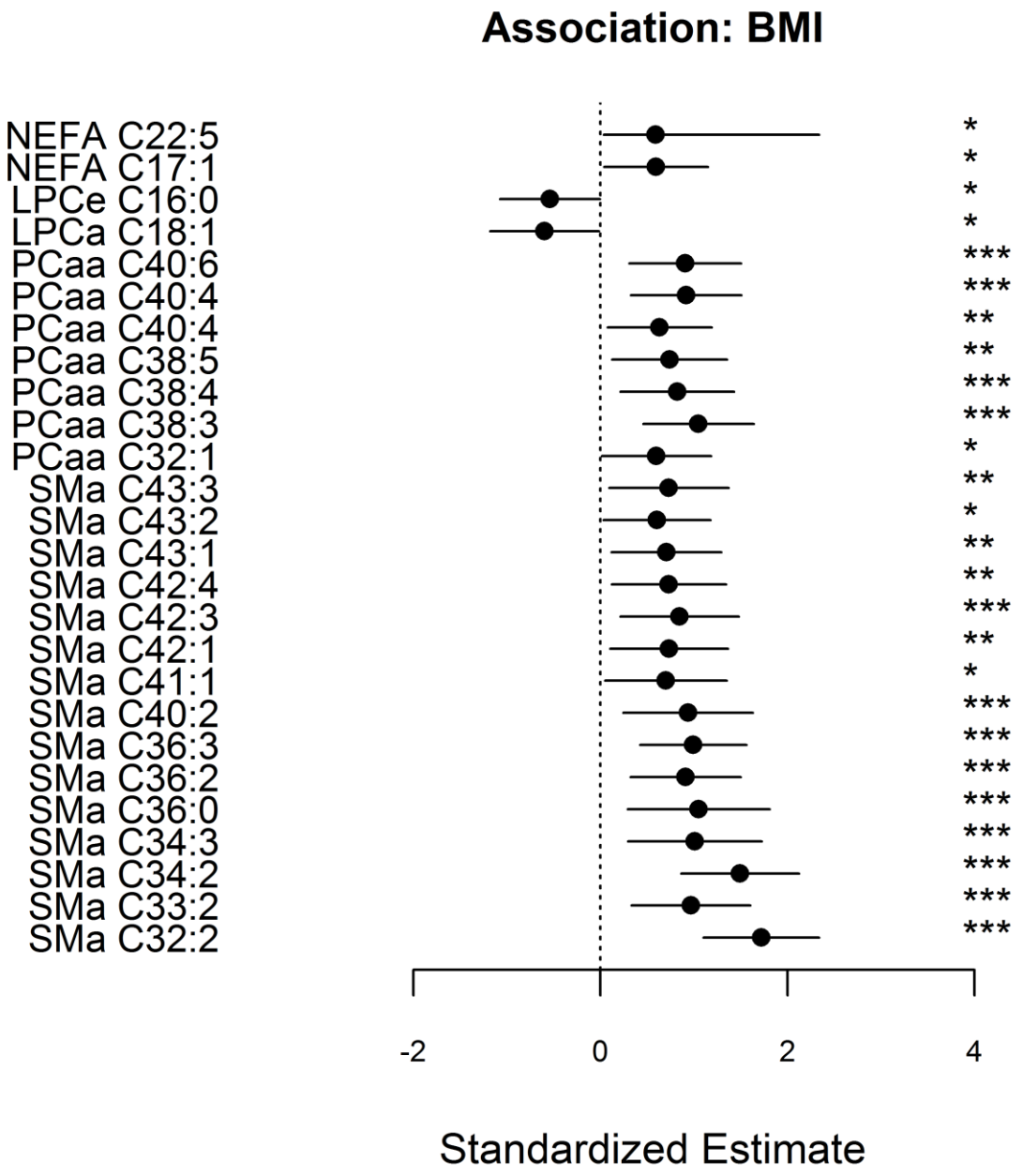
PC.aa.C40.1	-0.43	-1.83, 0.97	0.259	1
PC.ae.C32.1	-0.03	-0.15, 0.08	0.27	1
NEFA.18.2	0	-0.01, 0	0.27	1
PC.aa.C42.6	-0.14	-0.59, 0.32	0.274	1
PC.aa.C40.6	0	-0.01, 0.01	0.278	1
SM.a.C39.2	-0.05	-0.23, 0.13	0.283	1
SM.a.C34.1	0	-0.01, 0	0.285	1
PC.ae.C36.1	0.02	-0.05, 0.09	0.287	1
PC.ae.C38.4	-0.01	-0.04, 0.02	0.296	1
NEFA.18.0	0	0, 0.01	0.299	1
PC.aa.C40.0	-0.17	-0.77, 0.43	0.302	1
PC.aa.C34.5	0.18	-0.47, 0.83	0.311	1
lyso.PC.a.C20.5	-0.05	-0.22, 0.13	0.311	1
lyso.PC.a.C16.1	0.02	-0.05, 0.08	0.317	1
SM.a.C32.0	0.16	-0.42, 0.73	0.32	1
SM.a.C44.6	-0.05	-0.24, 0.14	0.323	1
SM.a.C39.1	-0.02	-0.09, 0.05	0.328	1
PC.aa.C32.0	0.01	-0.02, 0.03	0.357	1
SM.a.C41.2	-0.01	-0.06, 0.03	0.361	1
SM.a.C42.2	0	-0.01, 0.01	0.361	1
PC.aa.C34.2	0	0, 0	0.363	1
SM.a.C43.1	-0.06	-0.33, 0.2	0.386	1
NEFA.26.1	-0.21	-1.11, 0.69	0.394	1
SM.a.C40.1	0	-0.02, 0.01	0.405	1
PC.ae.C40.2	0.06	-0.22, 0.35	0.41	1
SM.a.C41.3	0.05	-0.17, 0.27	0.411	1
PC.aa.C34.1	0	0, 0	0.416	1
SM.a.C43.2	0.02	-0.08, 0.13	0.417	1
lyso.PC.a.C18.6	0.18	-0.65, 1.01	0.419	1
PC.aa.C38.1	0.09	-0.32, 0.5	0.428	1
NEFA.14.0	0	-0.01, 0.02	0.428	1
NEFA.14.1	-0.02	-0.12, 0.08	0.429	1
SM.a.C42.1	0	-0.02, 0.02	0.436	1
PC.ae.C36.3	-0.01	-0.05, 0.03	0.439	1
PC.aa.C38.6	0	0, 0	0.453	1
PC.aa.C36.5	0	-0.01, 0.01	0.458	1
NEFA.19.0	0.2	-0.84, 1.24	0.477	1
PC.ae.C34.4	-0.16	-0.96, 0.65	0.479	1
NEFA.18.3	-0.01	-0.05, 0.03	0.482	1
lyso.PC.a.C18.0	0	-0.01, 0.01	0.486	1
PC.aa.C34.0	0.02	-0.07, 0.1	0.504	1
SM.a.C35.2	0.13	-0.58, 0.83	0.514	1
NEFA.12.1	-0.06	-0.39, 0.27	0.516	1
PC.ae.C34.2	0.01	-0.03, 0.04	0.531	1
SM.a.C41.0	0.07	-0.33, 0.47	0.538	1
PC.ae.C42.2	-0.12	-0.85, 0.6	0.538	1

SM.e.C44.3	0.08	-0.43, 0.59	0.554	1
SM.a.C38.2	0	-0.02, 0.02	0.562	1
PC.ae.C40.0	0	-0.03, 0.02	0.573	1
PC.ae.C40.3	-0.07	-0.54, 0.39	0.573	1
PC.ae.C38.2	0.04	-0.22, 0.3	0.595	1
NEFA.12.0	0.01	-0.05, 0.07	0.595	1
SM.a.C40.4	-0.01	-0.11, 0.08	0.606	1
PC.ae.C36.0	-0.09	-0.73, 0.56	0.628	1
SM.a.C33.1	0.01	-0.06, 0.07	0.642	1
PC.aa.C38.3	0	-0.01, 0.01	0.65	1
PC.ae.C42.0	-0.07	-0.64, 0.5	0.666	1
SM.a.C40.5	0.02	-0.18, 0.22	0.672	1
NEFA.18.4	0.29	-2.23, 2.81	0.672	1
lyso.PC.e.C18.1	0.07	-0.57, 0.71	0.691	1
lyso.PC.a.C20.3	-0.01	-0.1, 0.08	0.699	1
lyso.PC.a.C18.1	0	-0.01, 0.01	0.707	1
PC.ae.C38.3	-0.01	-0.09, 0.08	0.718	1
SM.a.C42.5	0.01	-0.09, 0.1	0.738	1
SM.a.C34.3	-0.3	-3.59, 2.99	0.739	1
NEFA.20.4	0.01	-0.12, 0.15	0.749	1
lyso.PC.a.C18.2	0	0, 0.01	0.764	1
SM.a.C42.6	-0.01	-0.09, 0.07	0.765	1
SM.a.C40.2	0	-0.02, 0.01	0.77	1
lyso.PC.a.C20.2	-0.07	-1.1, 0.96	0.792	1
SM.a.C34.0	0.01	-0.12, 0.14	0.793	1
SM.a.C41.1	0	-0.04, 0.03	0.808	1
NEFA.16.2	0.05	-0.8, 0.9	0.825	1
SM.a.C39.5	-0.03	-0.53, 0.47	0.829	1
PC.aa.C42.4	-0.16	-3, 2.68	0.836	1
NEFA.16.0	0	0, 0	0.84	1
PC.aa.C36.2	0	0, 0	0.844	1
NEFA.22.6	-0.01	-0.15, 0.13	0.849	1
PC.aa.C42.5	-0.06	-1.19, 1.07	0.851	1
SM.a.C34.2	0	-0.03, 0.03	0.858	1
SM.a.C44.2	0.05	-0.99, 1.09	0.871	1
NEFA.20.3	0.01	-0.31, 0.34	0.873	1
NEFA.17.0	0	-0.1, 0.11	0.881	1
lyso.PC.e.C18.0	-0.01	-0.14, 0.13	0.894	1
PC.aa.C36.4	0	0, 0	0.903	1
SM.a.C36.1	0	-0.02, 0.02	0.907	1
NEFA.15.1	0.05	-1.53, 1.63	0.907	1
PC.aa.C40.3	-0.03	-1.18, 1.12	0.931	1
SM.a.C35.1	0	-0.13, 0.13	0.949	1
PC.ae.C42.1	0.02	-1.19, 1.24	0.951	1
SM.a.C36.2	0	-0.03, 0.03	0.965	1
PC.ae.C30.1	0	-0.33, 0.33	0.966	1

NEFA.15.0	0	-0.13, 0.13	0.994	1
NEFA.13.1	0	-1.98, 1.99	0.994	1

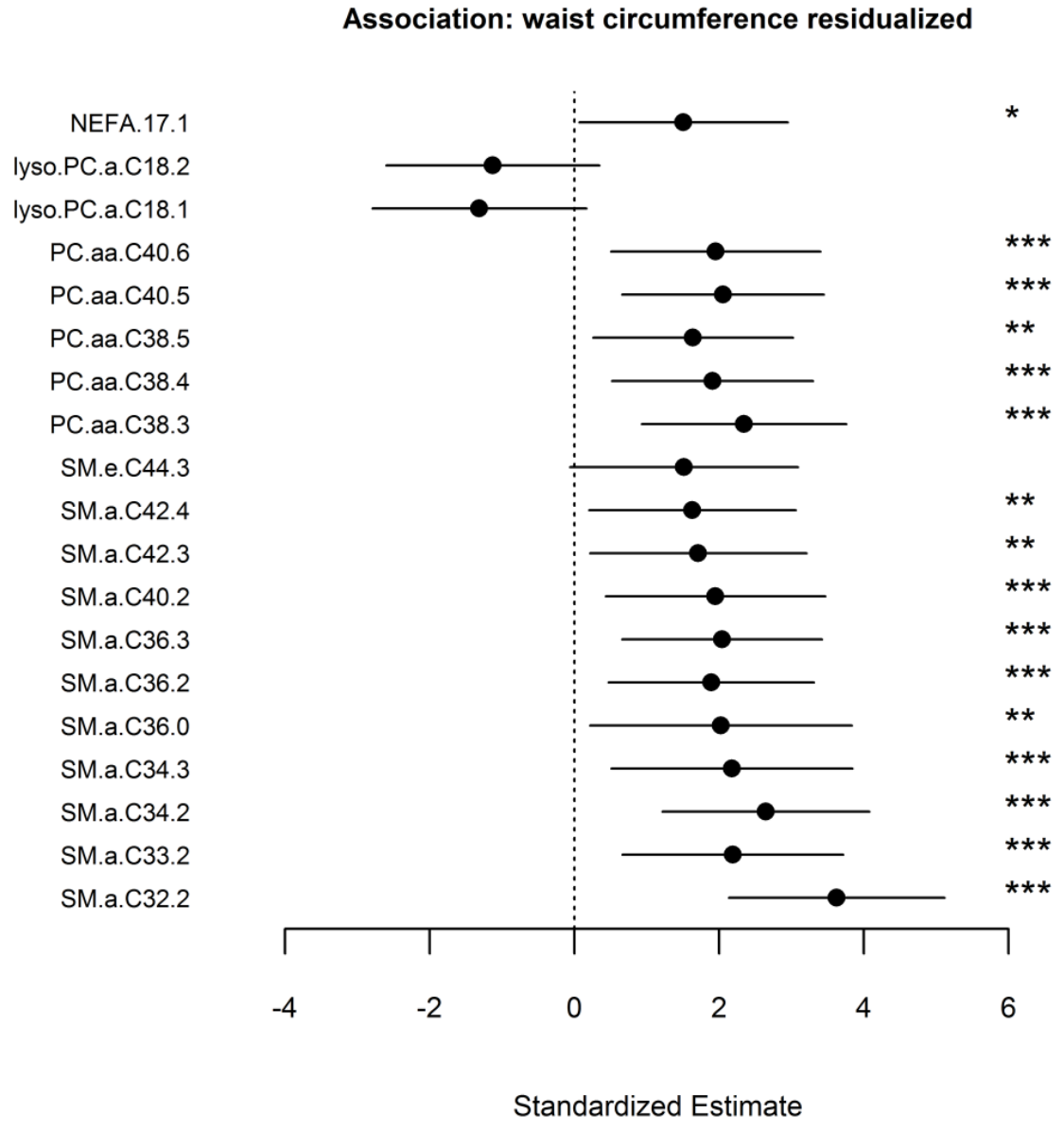
Figures

Supplemental Figure 1. Significant analytes of the multiple linear regression model with BMI as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported.

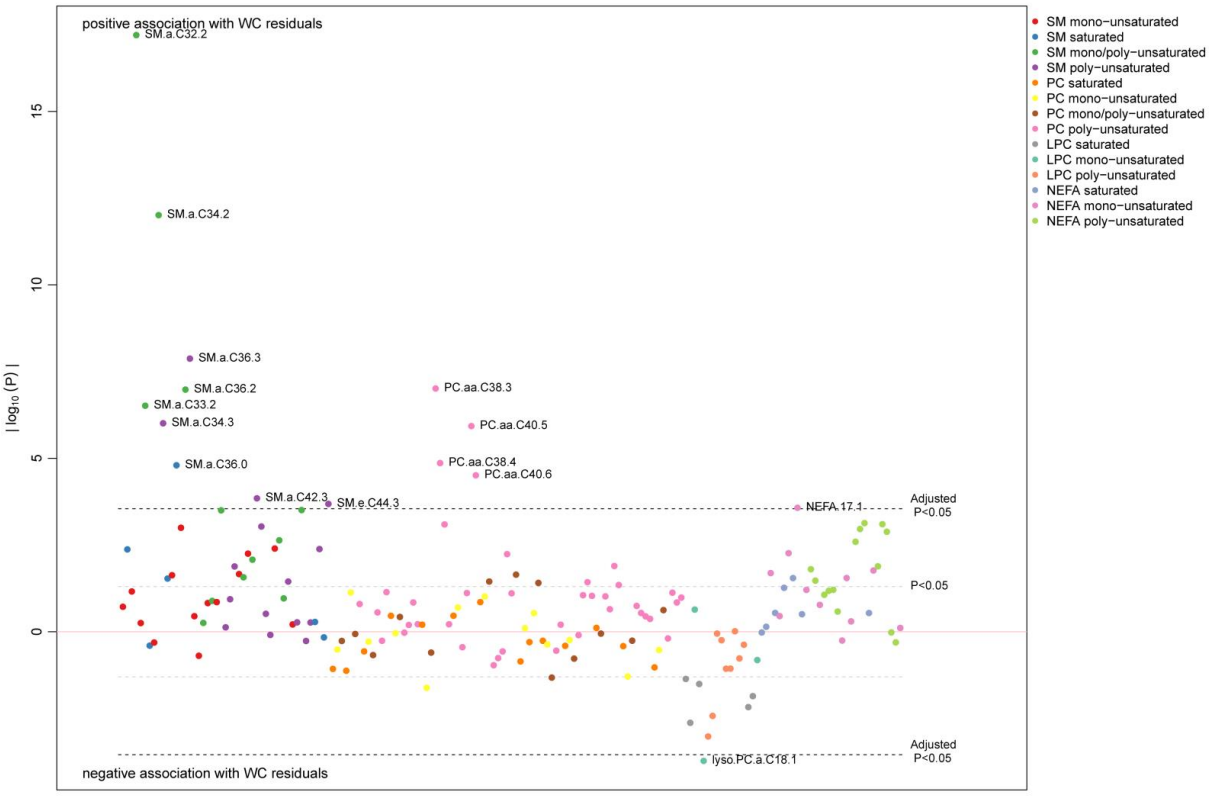


Supplemental Figure 2. Significant analytes of the residualized multiple linear regression model with WC residuals as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported.

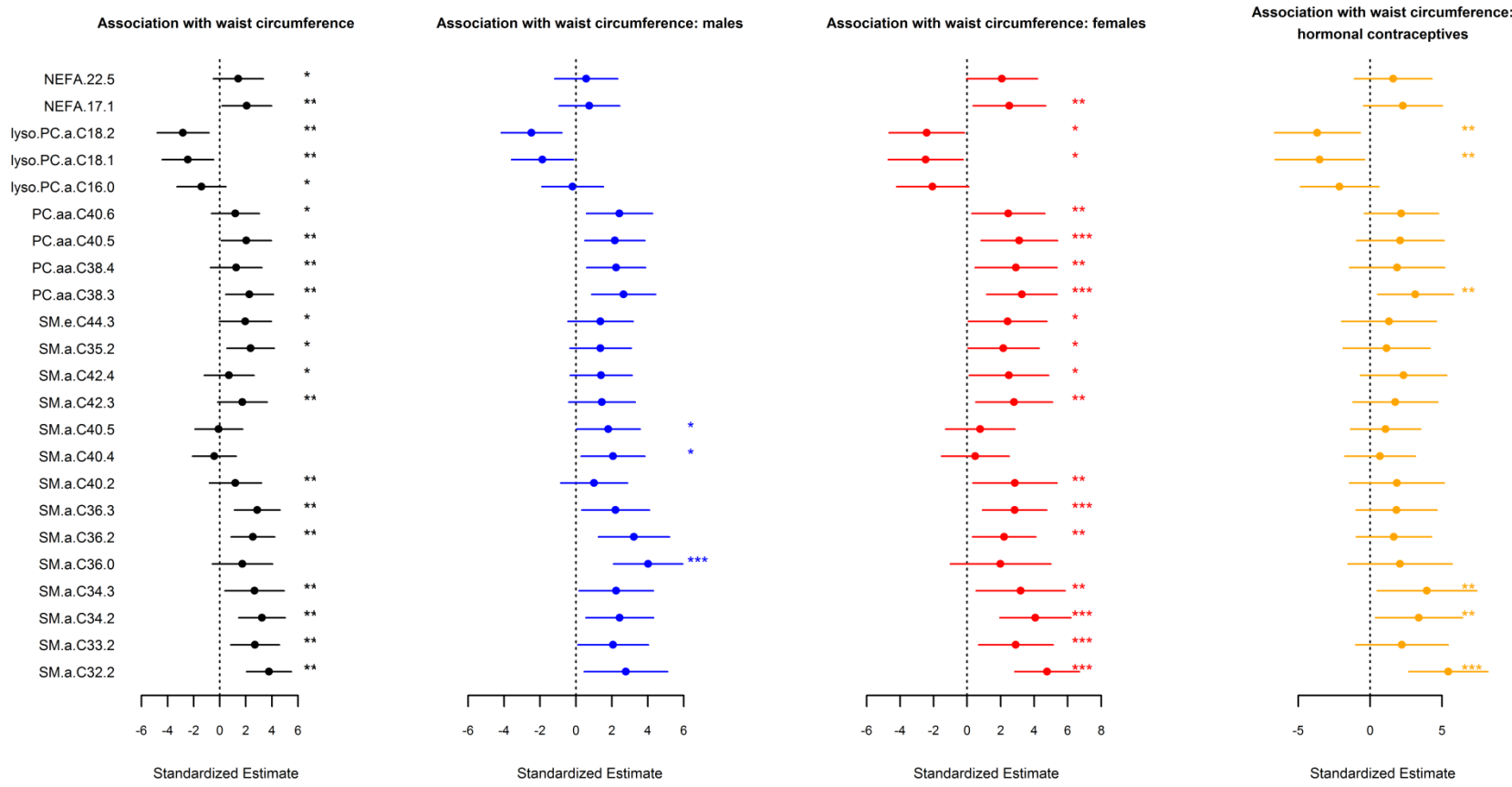
Residualization: Residualizing means running a preliminary regression analysis using one of the predictor variables to predict the outcome (LDL-C and HDL-C concentrations to predict WC, BMI, HOMA and insulin). The residuals from this analysis constitute the new outcome variable, and is guaranteed to be uncorrelated with the predictor, providing an apparent solution to the problem of co-linearity and is the reason why we applied this technique.



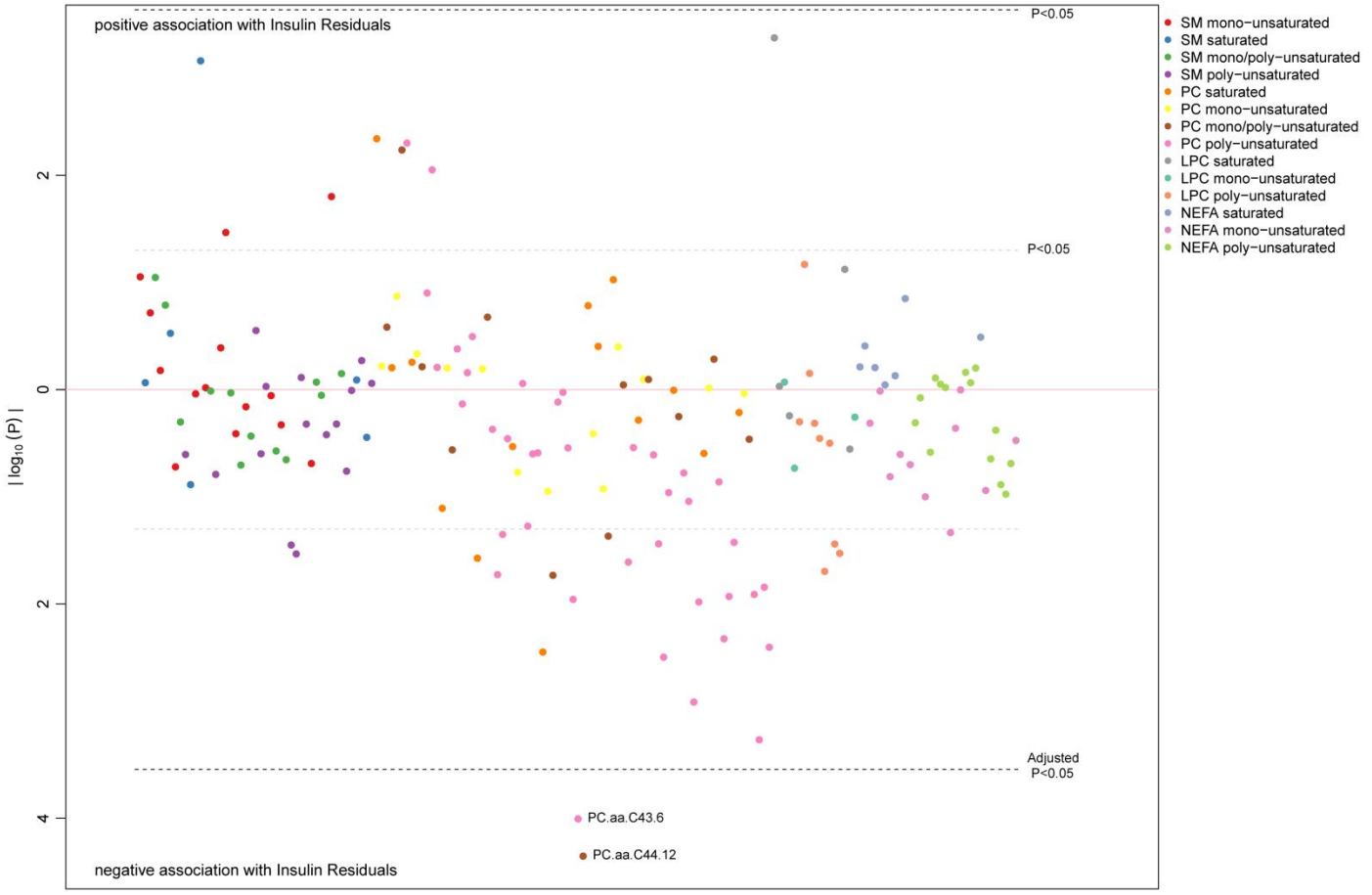
Supplemental Figure 3. Manhattan plot of the analytes of the multiple regression model for WC values to show metabolite trends. Light dashed line: corresponds to the significance level of α=0.05. Dark dashed line: corresponds to the Bonferroni corrected significance level of α=0.05/175 (number of analytes). Points are - log10 p-values of the regression model. Dependent variable: WC values; Independent variable: the respective analyte; Adjustment: HDL-cholesterol, LDL-cholesterol, BMI, smoking, alcohol consumption, dietary patterns, physical and sedentary behaviour and biological sex and triglycerides at 20yrs.



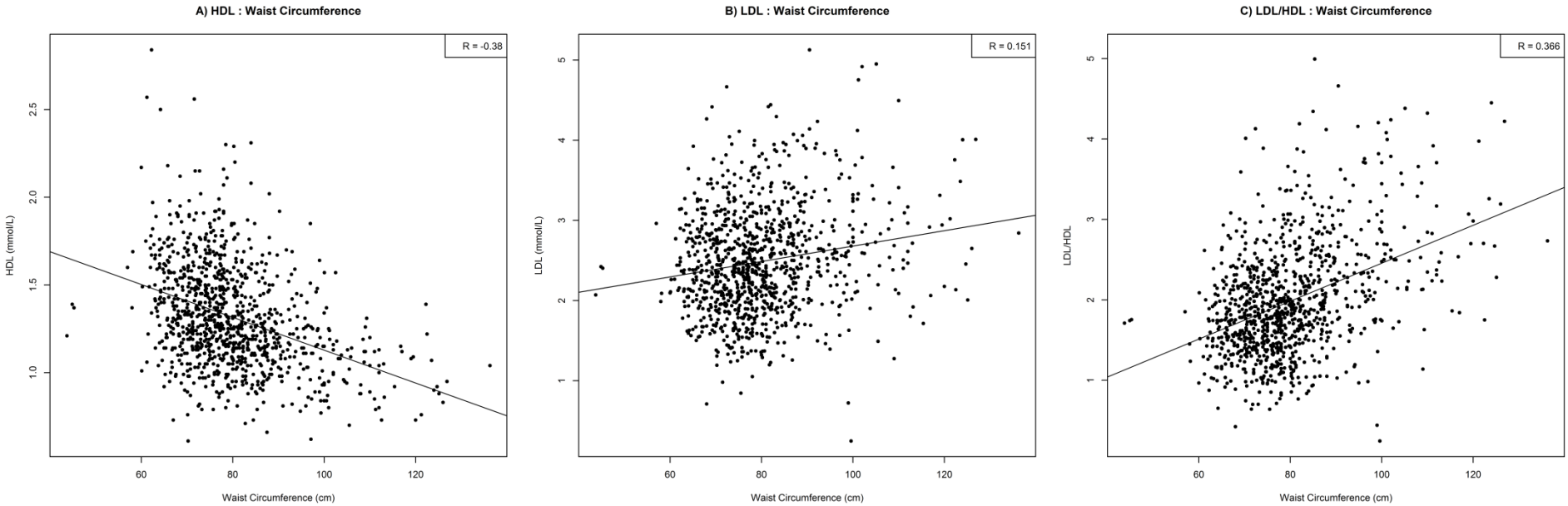
Supplemental Figure 4. Significant analytes of the stratified multiple linear regression model for all participants (black), males (blue), females not taking oral contraceptives (red) and females taking oral contraceptives (yellow) with waist circumference as outcome and metabolite concentrations as predictor, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. The model with all participants was additionally adjusted for sex. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported.



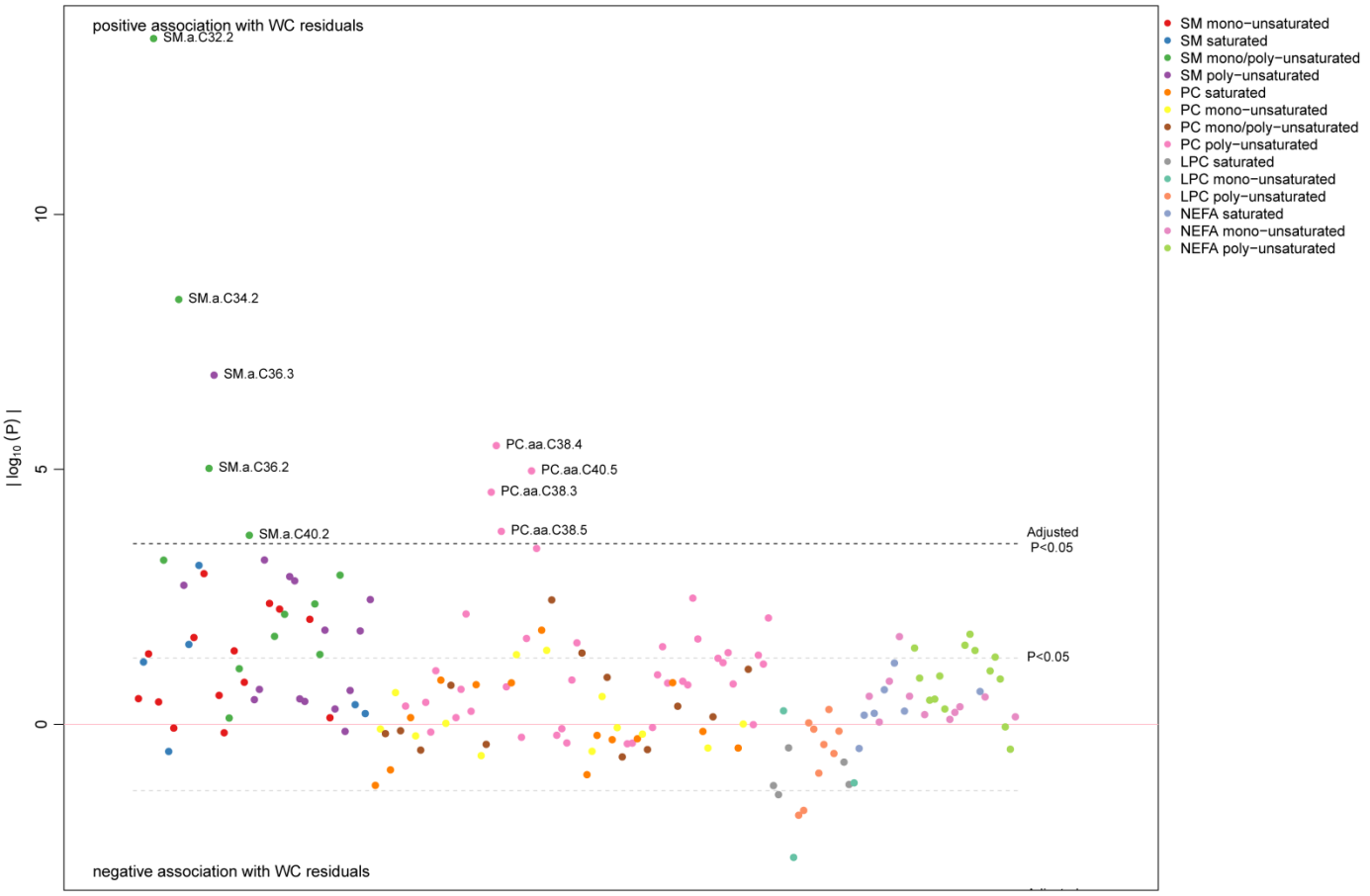
Supplemental Figure 5. Manhattan plot of the analytes of the multiple regression model for insulin values to show metabolite trends. Light dashed line: corresponds to the significance level of α=0.05. Dark dashed line: corresponds to the Bonferroni corrected significance level of α=0.05/175 (number of analytes). Points are - log10 p-values of the regression model. Dependent variable: insulin values; Independent variable: the respective analyte; Adjustment: HDL-cholesterol, LDL-cholesterol, BMI, smoking, alcohol consumption, dietary patterns, physical and sedentary behaviour and biological sex.



Supplemental Figure 6. Scatterplots between waist circumference, LDL, and HDL. Scatterplot and Spearman rank correlation coefficients are reported as a measure for the association. a) Association between HDL and waist circumference; b) association between LDL and waist circumference; c) Association between the LDL to HDL ratio and waist circumference. Solid line: regression line with dependent variable: LDL, HDL, LDL/HDL; independent variable: waist circumference.



Supplemental Figure 7. Manhattan plot of the analytes of the multiple regression model for WC values to show metabolite trends. Light dashed line: corresponds to the significance level of α=0.05. Dark dashed line: corresponds to the Bonferroni corrected significance level of α=0.05/175 (number of analytes). Points are - log10 p-values of the regression model. Dependent variable: WC values; Independent variable: the respective analyte; Adjustment: HDL-cholesterol, LDL-cholesterol, BMI, smoking, alcohol consumption, dietary patterns, physical and sedentary behaviour and biological sex mothers pre-pregnancy BMI, delivery mode, birthweight, mothers birthweight, triglycerides at 20 yrs and percentage weight change in the first year of life



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Supplemental Figure 8. Significant analytes of the multiple linear regression model with WC as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour, mothers pre-pregnancy BMI, delivery mode, birthweight, mothers birthweight, triglycerides at 20 yrs and percentage weight change in the first year of life in the 20yrs follow-up of The Western Australian Pregnancy Cohort (Raine) Study. Standardized estimates, Bonferroni corrected confidence intervals and p-values reported.