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Analysis of Metabolic Profiles Underlying Surrogates for Obesity and Insulin Resistance in Young Adults from the Western Australian Pregnancy Cohort (Raine) Study

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Table of content

1. List of Abbreviations

AA	Amino Acids
acyl-Carn	Acyl-Carnitine
apoA-I	Apolipoprotein A-I
BMI	Body Mass Index
Carn	Free Carnitine
CoA	Coenzyme A
CPT-I/-II	Carnitine Palmitoyl-Transferase-I/-II
CVD	Cardiovascular Diseases
DALY	Disability Adjusted Life Years
GC	Gas Chromatography
HDL	High Density Lipoprotein
HOMA IR	Homeostasis Model Assessment
LC	Liquid Chromatography
LCAT	Lecithin-Cholesterol-Acyl-Transferase
LDL	Low Density Lipoprotein
LPC	Lyso-Phosphatidylcholine
MS	Mass Spectrometry
M_W	Molecular Weight
NCD	Non-Communicable Diseases
NEFA	Non-Esterified Fatty Acids
NIH	National Institute of Health (America)
PC	Phophatidylcholine
Raine	Western Australian Pregnancy Cohort Study
SM	Sphingomyeline
Sn	Stereospecific Numbering
T2DM	Type-2 Diabetes Mellitus
TAG	Triacylglycerol
VLDL	Very Low Density Lipoprotein
WHO	World Health Organisation

This dissertation is based on the following publications:

1. Research Article:

Rauschert S, Uhl O, Koletzko B, Kirchberg F, Mori TA, Huang RC, Beilin LJ, Hellmuth C, Oddy WH. Lipidomics Reveals Associations of Phospholipids With Obesity and Insulin Resistance in Young Adults. The Journal of Clinical Endocrinology and Metabolism. 2016 Mar;101(3):871-9

2. Research Article:

Rauschert S, Uhl O, Koletzko B, Mori TA, Beilin LJ, Oddy WH, Hellmuth C. Sex differences in the association of phospholipids with components of the metabolic syndrome in young adults. Biology of sex differences. 2017;8(1):10

2. Introduction

In recent years, the increasing incidence of diseases and disorders such as obesity and insulin resistance have become a global public health burden, as these diseases are precursors for more severe diagnoses such as type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVD) (1, 2).

According to the World Health Organisation (3) global status report on non-communicable diseases (NCD) (3), the prevalence of obesity in 2014, which are the most recent numbers provided on the WHO website, has more than doubled compared to obesity numbers in 1980. In 2014, the disease has affected more than 1.9 billion (39%), that were classified as overweight (body mass index (BMI)>25) and 600 million (13%) of those were classified as obese (BMI≥30). However, obesity is not a disease limited to adults, but now is also a leading health problem in children, where 42 million children in 2014 were classified as overweight or obese (6.2%). Further, 35.9 million (2.3%) of the global disability adjusted life years (DALYs), are due to obesity or overweight (3). A DALY is one "healthy" year that is lost due to disability or death due to a disease. Hence, DALYs are a measure for the current state of global health and life expectancy compared to an ideal aging, free from diseases. Obesity also has implications on global costs due to this disease. The direct and indirect costs increase with increasing BMI, due to co-morbidities of obesity and also the loss of productivity (4). This shows the severity of these diseases and the need for further research and preventive strategies.

Many factors are known or are suggested to influence the development of these NCD. Factors known to influence the disease development and progression can roughly be divided into two major topics: 1.) current life and 2.) early life influences. Certain aspects of an individual's current lifestyle are known to influence or instigate the development of obesity. This includes but is not limited to sex, physical activity, diet, sedentary behaviour, as well as alcohol consumption (5-8). A western style diet has been pinpointed as a key factor contributing to obesity. This diet involves a high consumption of processed and fast foods, which have been deemed more 'unhealthy', and are a causative factor for the development and persistence of obesity and overweight problems (9).

For statistical association models it is complex to assess diet and decide on lifestyle factors to include, especially because of collinearity issues. Instead, researchers have started using dietary patterns, rather than single or combined variables assessed from a food frequency questionnaire (10, 11). Smoking cigarettes has also been shown to influence the metabolism as well as single metabolite concentrations (12, 13).

Early life factors suggested to influence obesity later in life are breast-feeding duration and exclusivity, maternal BMI, epigenetic factors (e.g. due to smoking behaviour of the mother) or gestational weight gain. However, these topics are not covered in this thesis. Instead it is focusing on current lifestyle and biological factors (14-17), and more specifically the less understood underlying metabolic mechanisms associated with NCD.

Metabolomics as an epidemiological tool

The field of metabolomics investigates, amongst other purposes, the causes and consequences of diseases at a molecular level (18). Metabolomics can be divided into two different approaches. The first is the untargeted metabolomics approach (19). This aims to detect current unknown compounds or metabolites, called features (20). This approach is mainly hypothesis generating and has a high detection rate of newly found compounds and metabolites. The second is a targeted metabolomics approach, where a limited but known amount of metabolites is measured (21). The main goal of this approach is hypothesis testing. Targeted metabolomics is mainly used in the epidemiological application of metabolomics biomarker detection, and when a deeper understanding of metabolic changes in the disease state is required.

The application of targeted metabolomics to epidemiological research roughly consists of four steps: (1.) the laboratory analysis of small molecules (Molecular weight ($M_{w)}$< 1500 Dalton), called metabolites, in biological samples in the laboratory, usually by mass-spectrometry (MS), mostly coupled to gas (GC) or liquid chromatography (LC), (2.) integration and calibration of the peaks for quantification and quality control of the resulting data, (3.) the statistical processing of the metabolite measurements and (4.), the interpretation of the results and putting these results into context. The aim of most metabolomics studies is to find biomarkers for early detection of diseases, in order to implement early treatment and lifestyle advises for patients at risk.

The main metabolite groups measured in the laboratory of the Division of Metabolic and Nutritional Medicine of the Dr. von Hauner Children´s Hospital of the Ludwig-Maximilians-Universität München are amino acids (AA), non-esterified fatty acids (NEFA), free carnitines (Carn) and acyl-carnitines (acyl-Carn), and phospholipids. The phospholipids measured in serum or plasma represent mostly the phospholipid layer of lipoproteins in the blood. During laboratory processing, lipoproteins get broken down into phospholipids, which reflect their phospholipid composition, and are analysed.

Lipoprotein Metabolism, Metabolite Composition and Disease Risk

Human metabolism and the metabolic alterations underlying diseases like obesity and insulin resistance are not fully understood, which make further research in this field necessary. The main metabolic disturbances associated with obesity concern lipid metabolism. Lipid metabolism involves many small molecules: NEFA, Carn and acyl-Carn, as well as triacylglycerols (TAG) and lipoproteins. In the fed state, glucose is used for energy production and lipids are stored in the form of TAG, mainly in the adipose tissue, but also in other tissues. In the fasted state, to provide energy when glucose supply is limited, energy for extrahepatic tissues is also provided in the form of ketone bodies, as NEFA are released from the adipose tissue and get transported to extrahepatic tissues for energy supply, as well as to the liver for ketogenesis (22). Another source of energy in the fasted state is provided by hepatic TAG that is stored in lipid droplets of hepatocytes. These get packed into lipoproteins in the liver and then transported to the cells for energy production (18). Cohn et al. showed that plasma lipoprotein concentrations significantly differed between fasted and fed state, with higher very low density lipoprotein (VLDL) values in fed state (23). Chylomicrons are generally associated with the postprandial state, where they are produced to transport the dietary lipids from the intestine to the liver and there is minimal chylomicron production in the fasted state, due to a lack of dietary lipids (24).

Lipoproteins not only consist of TAG, proteins and cholesterol, but also phospholipids. These lipids provide the outer structure of the lipoproteins and are mainly constructed using phosphatidylcholine (PC) and sphingomyelin (SM). The double layer barrier around the lipoprotein ensures a water-soluble outer surface and a fat-soluble inner surface. This allows transport of water insoluble TAG to enter the cell. The phospholipid surface of the lipoproteins consists of phospholipids formed primarily in the liver. Sphingomyelin is synthesized from serine and palmitoyl-Coenzyme-A (palmitoyl-CoA) (25) via the serine-palmitoyl-transferase. The last step to form SM from ceramide needs the phosphocholine headgroup of PC (26). After that, SM can be packed, for example into VLDL to be transported to other cells in the body.

Cholesterol is known to attract macrophages, which then oxidize and block blood vessels that can lead to cardiovascular complications, such as a stroke and heart attack (27). The role of high density lipoprotein (HDL) is essential to prevent such complications, as it collects cholesterol and transports it back to the liver. In this process, lyso-phosphatidylcholine (LPC) is created as a by-product. In the process to build up spherical HDL from the nascent form, the enzyme lecithin-cholesterol acyltransferase (LCAT), which is floating around in the bloodstream in its free form (28), binds to apolipoprotein A-I (apoA-I) and becomes activated (29). Cholesterol is esterified by LCAT by cleaving a NEFA from a PC, which is bound to cholesterol. Lecithin-cholesterol acyltransferase has a preference for 16:0 and 18:0 fatty acids to be used for esterification (30). The leftover molecule is the LPC from the stereospecific numbering-1 (sn-1) position of the PC, although it has been shown that LCAT sometimes cleaves the fatty acid on the sn-1 position and leaves a sn-2 LPC (31). Whilst most of LPC is derived from LCAT (32), another path leading to the formation of LPC is through the action of phospholipase A_2 (33). This pathway targets the fatty acid at the sn2-position of phospholipids, and this enzyme is mainly associated with low density lipoprotein (LDL) and has been shown to be associated with cardiovascular disease development (29). For these qualities, HDL and LDL are also used as biomarkers for cardiovascular health and disease risk. Therefore, investigating the small molecule or metabolite level of the lipoprotein could bring deeper and more mechanistic insights into the development of obesity as a precursor for cardiovascular diseases.

Another metabolite group measured in the metabolomics approach are the NEFA. Intracellular NEFA are bound to a CoA, and then Carn is used to form acyl-Carn, which enter the mitochondria for β-oxidation and energy production via enzyme carnitine palmitoyl-transferase I (CPT-I) (34). The transport also works the other way around by CPT-II (22). Finding free and acylated Carn in the blood is suspected to be a hint for a spillover of this process in the cell. Depending on the chain length, it can be hypothesized which step in the fatty acid oxidation is disturbed. Based on that, Carn and acyl-Carn have the potential to be implemented in newborn screening to detect disturbed lipid metabolism as early as possible.

Aim of the dissertation

This dissertation is divided into two main goals: (1.) to find cross sectional associations of metabolite concentrations and surrogates for insulin resistance and obesity ("biomarker"), and (2.) to analyse sex differences in the metabolome and its association with the metabolic syndrome at 20 years of age. All data used in this study was resourced from the Western Australian Pregnancy Cohort (Raine) study. This study was initiated in 1989 when pregnant mothers were recruited until 1991 with the initial question to analyse the effect of multiple ultrasound imaging on the child (35). The children were followed up after birth until today, and several different research focuses were analysed at the follow ups. At the 20 year follow-up, blood samples were taken after an overnight fast. Samples were then sent on dried ice to the laboratory of the Dr. von Hauner Childrens Hospital in Munich, to be analysed with a LC-MS/MS targeted metabolomics approach. This project, using the Raine study with more than 1000 blood samples taken and analysed, to our knowledge is one of the biggest metabolomics association studies performed so far. Hence, the Raine study gives the opportunity to analyse a large amount of young adults in the risk age for the occurrence of insulin resistance. This means it is a good target age for early prevention.

In the first part of this thesis, the focus lies on the associations between metabolite concentrations and waist circumference, as well as homeostatic model assessment of insulin resistance (HOMA IR) in a population of Australian Raine study participants aged 20 years.

The field of finding biomarkers for obesity, insulin resistance, and T2DM in metabolomics is still in its infancy. Current literature in adults and children shows an association between metabolites and obesity and insulin resistance surrogates like BMI, waist circumference, and HOMA, but not with sample sizes as large as the Raine study (36, 37).

The special focus was on lipidomics, as it has been shown several times previously that there is an association of obesity with AA (38-42). The associations with lipids, by contrast, were not as prominently analysed although obesity and insulin resistance are known to be associated with a disturbed lipid metabolism as indicated by elevated Carn/acyl-Carn and NEFA levels in the blood (34, 43).

In the second part of the thesis, the aim was to investigate sex differences in metabolic pathways altered in subjects with the metabolic syndrome. We found very prominent sex differences: more than 100 of the 215 analysed metabolites have been significantly different between males and females. Additionally, the effect of hormonal contraceptive use was analysed, because the study population was 20 years old and more than 50% of the female participants took a form of hormonal contraception. The effect of hormonal contraceptives is highly underrepresented in metabolomics studies, although this form of contraception is used by many women since their invention in the 1960s (44). To investigate the sex differences, the three groups of males, females taking hormonal contraceptives, and females not taking hormonal contraceptives were compared. Since this was showing general differences between the groups, the resulting metabolites were analysed group-specifically.

The topic of sex differences in medical research is highly underrepresented. It wasn’t until 1993 that the National Institute of Health (NIH) in America suggested for all medical research funded by this institute to represent also female study subjects (45). It was shown previously that females are still underrepresented in clinical studies (45, 46). The justification for that is that the study design becomes more complicated with the inclusion of females. The time in the monthly cycle needs to be suggested (46) and pregnancy can occur and influence the outcome. There are still a great portion of studies that do not perform stratified analyses for males and females. This is especially prominent for the field of pharmaceutical studies. Inclusion of female participants has the risk factor of a pregnancy during the analysis. This also means medication nowadays is merely suited for males, but not necessarily for females. It was shown that eight out of ten medications that are removed from the market due to adverse effects in the United States are removed because of adverse effects in females (47). An article in Nature even concludes that medicine is less evidence based for females compared to males (40).

Summary

In summary, this PhD thesis contributes to the research and understanding of disturbances in lipid metabolism in insulin resistance, obesity, and the metabolic syndrome. A special focus is given to sex differences with consideration of females taking hormonal contraceptives. This

PhD thesis can conclude that there are potential markers for obesity and insulin resistance, and highlights the importance to consider sex differences in the disease mechanisms. Also, this thesis adds to the first clinical targeted metabolomics studies for hypothesis generation, biomarker research and the aim of more awareness for sex- and gender-differences in medical and biological research. Lastly, the associations of metabolites, obesity, and insulin resistance need to be analysed in younger populations and longitudinally, with the aim to implement routine analysis in preventing those diseases from an early age.

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3. Publication 1

“Lipidomics Reveals Associations of Phospholipids With Obesity and Insulin Resistance in Young Adults”

ORIGINAL ARTICLE

Lipidomics Reveals Associations of Phospholipids With Obesity and Insulin Resistance in Young Adults

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Context: Obesity and related diseases have become a global public health burden. Identifying biomarkers will lead to a better understanding of the underlying mechanisms associated with obesity and the pathways leading to insulin resistance (IR) and diabetes.

Objective: This study aimed to identify the lipidomic biomarkers associated with obesity and IR using plasma samples from a population-based cohort of young adults.

Design and Setting: The Western Australian Pregnancy Cohort (Raine) study enrolled 2900 pregnant women from 1989 to 1991. The 20-year follow-up was conducted between March 2010 and April 2012.

Participants and Samples: Plasma samples from 1176 subjects aged 20 years were analyzed using mass spectrometry-based metabolomics.

Main Outcome Measures: Associations of analytes with markers of obesity and IR including body mass index, waist circumference, homeostasis model assessment (HOMA-IR), and insulin were examined. Analyses were stratified by body mass index and adjusted for lifestyle and other factors.

Results: Waist circumference was positively associated with seven sphingomyelins and five diacylphosphatidylcholines and negatively associated with two lysophosphatidylcholines. HOMA-IR was negatively associated with two diacylphosphatidylcholines and positively with one lysophosphatidylcholine and one diacylphosphatidylcholine. No significant association was found in the obese/overweight group of the HOMA-IR model. In the normal-weight group, one lysophosphatidylcholine was increased.

Conclusion: A possible discriminative effect of sphingomyelins, particularly those with two double bonds, and lysophosphatidylcholines was identified between subjects with normal weight and obesity independent of low-density lipoprotein cholesterol and high-density lipoprotein cholesterol concentrations. Our results suggest weight status-dependent mechanisms for the development of IR with lysophosphatidylcholine C14:0 as a key metabolite in nonobese IR. **(*J Clin Endocrinol Metab* 101: 871–879, 2016)**

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Abbreviations: BMI, body mass index; CI, confidence interval; IR, insulin resistance; HDL-C, high-density lipoprotein-cholesterol; HOMA-IR, homeostasis model assessment index of insulin resistance; LCAT, lecithin cholesterol acyltransferase; LDL-C, low-density lipoprotein-cholesterol; LPC, lysophosphatidylcholine; NEFA, nonesterified fatty acid; PC, phosphatidylcholine; PCaa, diacylphosphatidylcholines; SCD1, stearoyl-CoA desaturase 1; SM, sphingomyelin; T2DM, type 2 diabetes mellitus; WC, waist circumference.

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Obesity has become a global public health burden (1). As a worldwide growing epidemic, obesity raises the need for better tools to monitor this disease adequately and enable better strategies for early prevention and detection of underlying metabolomic changes, especially because obesity is associated with insulin resistance (IR) and type 2 diabetes mellitus (T2DM) (2).

Inflammation of adipose tissue is a key factor in the pathogenesis of IR, but the underlying mechanisms for this inflammation and why not all people with obesity develop IR remain unknown (3). Evidence suggests that dyslipidemia plays a central role in the pathogenesis of IR and T2DM (4), but the underlying metabolic processes are complex and interconnected.

Studies showing correlations between levels of lysophosphatidylcholines (LPC), sphingomyelins (SM), nonesterified fatty acids (NEFAs), and phosphatidylcholines (PC) in the blood plasma of patients with obesity are in accordance with the hypothesis of lipotoxicity. This hypothesis states that an increased supply of fat through nutrition leads to an excess of lipid storage in tissues other than adipocytes, such as hepatocytes, leading to IR (5). Therefore, it may be of particular interest to identify differences between lipid profiles of obese and normal-weight individuals and determine whether these profiles associate with the risk of developing IR or T2DM (6, 7).

Mass spectrometry coupled with liquid or gas chromatography is a powerful tool for the identification of possible lipid biomarkers (8). The aim of this study was to identify lipidomic markers associated with obesity, IR, or diabetes in a population cohort of more than 1000 young adults at 20 years of age. These young adults are of special interest because they are the optimal subjects to study IR and obesity due to an early onset of those diseases, combined with the possibility for lifestyle intervention in this early stage. We specifically focused on the effects of polar lipid species PC, LPC, SM, and NEFAs, in relation to obesity, IR, and clinical lipid measurements, independent of low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) concentrations.

Materials and Methods

The Western Australian Pregnancy Cohort (Raine) Study is a prospective longitudinal cohort study that enrolled 2900 pregnant women from 1989 to 1991 with the purpose to examine the effects of ultrasound imaging on the fetus (9). The 2868 live births were evaluated and followed up serially to 20 years of age. The 20-year follow-up, which occurred between March 2010 and April 2012, included 87% of the active participants. Ethics approval at the 20-year follow-up was obtained from the University of Western Australia Human Research Ethics Committee. Informed and written consent was obtained from the participants.

During the 20-year follow-up, calibrated measurements of height, weight, body mass index (BMI), waist, hip, and arm circumference were measured by trained research assistants. Height and weight were measured by electronic chair scales and stadiometer. Waist and hip measurements were obtained using steel tape measures and skinfold thickness by calipers (Holtain). A phlebotomist visited the home of each participant early in the morning, and venous blood samples were taken from an antecubital vein after an overnight fast. Samples were stored at −80°C until analyzed. Serum insulin, glucose, lipids, and liver function tests were analyzed using standardized protocols in the PathWest Laboratory at Royal Perth Hospital. HDL-C was determined on a heparin manganese supernatant, and LDL-C was calculated by using the Friedewald formula (10).

When the BMI status is reported, the underlying borderlines were those of the World Health Organization, in which a value greater than 29.99 kg/m^2 means obesity, 25.0–29.99 kg/m^2 overweight, 18.5–24.99 kg/m^2 normal weight, and less than 18.5 kg/m^2 underweight (11). We used homeostasis model assessment index of insulin resistance (HOMA-IR) values as a steady variable to measure IR. In general, higher values are associated with IR. HOMA-IR is defined by Insulin (microinternational units per milliliter) × glucose (millimoles per liter)/22.5 (12).

Potential confounding variables

Analyses were adjusted for variables from the 20-year questionnaire, which may confound the relationship between metabolite concentrations and waist circumference (WC), BMI, HOMA-IR, and insulin values. Ethnicity was classified as Caucasian if both parents were Caucasian, or as non-Caucasian if one or both parents were of another ethnicity because numbers of other ethnic groups besides Caucasian were too low for separate statistical analysis (Supplemental Table 1).

Smoking behavior was measured as currently smoking cigarettes (yes or no).

Alcohol consumption was assessed by asking for the frequency of drinking any alcohol. We calculated a dichotomous variable for ever vs never consumption of alcohol in the last month.

To adjust for dietary intake, dietary patterns were calculated as previously described (13).

Dietary misreporting was calculated by using the Goldberg equation (14), and the final variable was categorical with three values: underreporting, overreporting, and plausible reporting.

Physical activity was assessed as more than 10 minutes of moderate or vigorous physical activity in the last 7 days. We created a categorical variable with less than one time, one to three times, and four or more times as categories according to previous reports on the Raine study (15).

The variable for sedentary behavior was created based on the hours spent in front of a screen (watching TV, playing videogames, and socializing and nonsocializing activities on the Internet). The resulting variable includes the amount of hours spent in front of any screen per day from 0 to 4.

A three-level sex variable (females using hormonal contraceptives, females not using hormonal contraceptives, and males) was used to evaluate the effects of sex and hormonal contraceptive use as previously described (16).

Plasma analysis

The plasma EDTA samples of 1176 subjects were labeled and packed in 100-μL tubes at the Royal Perth Hospital Research Unit in Perth, Western Australia. Samples were transported on dry ice to the Division of Metabolic and Nutritional Medicine of the Dr von Hauner Children's Hospital in Munich, Germany, and stored at −80°C until being analyzed.

Polar lipids

Flow-injection mass spectrometry was used to analyze polar lipids. Plasma (10 μL) or standard solution (10 μL) were diluted with 500 μL methanol, containing internal standards for different lipid groups and ammonium-acetate. After centrifugation, a 96-deep well plate was prefilled with 700 μL methanol, and 200 μL of the centrifuged supernatant was carefully pipetted with a multipipette into the plate and then used for flow-injection mass spectrometry analysis. Samples were analyzed with a triple-quadrupole mass spectrometer (QTRAP4000; Sciex) with an electrospray ionization source, which was used in both positive and negative modes. The mass spectrometry was coupled to a liquid chromatography system (Agilent). Tandem mass spectrometry analysis was performed in Multiple Reaction Monitoring mode. Analyst 1.5.1 software, followed by in-house handling with the statistical program R (R Project for Statistical Computing, http://www.r-project.org/) was used to postprocess the data.

The analysis comprised acylcarnitines, diacylphosphatidylcholines (PCaa), acylalkylphosphatidylcholines, SM, lysophophatidylcholine, lysophosphatidylethanolamine, and the sum of hexoses (80% glucose). The analytical technique is not capable of determining the position of the double bonds and the distribution of carbon atoms between fatty acid side chains. The polar lipids are described using the nomenclature CX:Y, where X is the length of the carbon chain, Y is the number of double bonds, OH in the formula means the molecule contains a hydroxyl-group. The letter a means that the acyl chain is bound via an ester bond to the backbone, and e means an ether bond.

Nonesterified fatty acids

Analysis for NEFAs was performed as previously reported (17). Briefly, 20 μL plasma was mixed with 200 μL isopropanol (containing 2 mg per 100 mL ^{13}C-labeled palmitic acid) in a 96-deep well plate. After centrifugation the supernatant was transferred into a 96-well plate for liquid chromatography and tandem mass spectrometry analysis. An ultraperformance liquid chromatography diphenyl column (Pursuit UPS Diphenyl, 1.9 μm, 100 mm, 3.0 mm; Varian) was used for chromatographic separation at 40°C with an Agilent 1200 SL series HPLC system. The injection volume was set to 10 μL with an eluent flow rate of 700 mL/min. A hybrid triple-quadrupole MS (4000 QTRAP; AB Sciex) operating in negative electrospray ionization mode was coupled to the HPLC system for the identification of NEFAs. Fatty acids are separated according to chain length and the number of double bonds but not according to the position of double bonds. NEFAs are mentioned using the nomenclature described above as CX:Y. Metabolite concentrations are reported in micromoles per liter of plasma.

Statistics

Statistical analyses were performed using the software R (3.1.3). The quality control criterion was defined as inter- and intrabatch coefficient of variance of 30%.

For outlier analysis, boxplots with whiskers of 1.5-fold the interquartile range were created and exploratively analyzed. Outliers of metabolites were defined as measured values outside the whiskers. Samples were excluded if more than 30% of the measured analytes were defined as outliers. To test for associations of analytes of the 20-year follow-up with indicators of obesity and IR, we regressed BMI, WC, HOMA-IR, and insulin on each of the analytes separately. We checked the assumptions of the linear models, among them the normality of the residuals, with diagnostic plots, and performed sensitivity analyses using log-transformed outcomes. The only prominent outcome was homeostasis model assessment, which we log transformed in all subsequent analyses.

The first step was to test for possible confounding by HDL-C, LDL-C, smoking, alcohol consumption, dietary patterns, physical and sedentary behavior, and biological sex, which were found to be associated with body composition and metabolite concentration in previous studies (18–20) (Table 1). This was done by a multivariate model with a potential confounder and BMI, WC, HOMA-IR, and insulin values as the outcome. An analysis of association between metabolites and confounder was done accordingly (Supplemental Table 2).

At first, sex and metabolite concentration interaction was added to the models because other studies found differences in metabolite concentrations between males and females (21, 22). We also tested for interactions between metabolites and physical activity, HOMA-IR (model with WC as outcome), and BMI

Table 1. Associations Between BMI, WC, Insulin, and HOMA-IR and Predefined Confounder Variables

	BMI			HOMA-IR			WC			Insulin		
Variables	*P* Value	β	CI	*P* Value	β	CI	*P* Value	β	CI	*P* Value	β	CI
HDL-C	<.001	−5.178	−7.213, −3.142	<.001	−.35	−0.657 to 0.043	<.001	−12.58	−17.73, −7.429	.001	−1.475	−2.823, −0.127
LDL-C	<.001	1.37	0.512, 2.227	.326	.074	−0.055, 0.204	<.001	3.239	1.068, 5.41	.294	.333	−0.235, 0.901
Sex	<.001	−1.588	−2.928, −0.248	.001	−.222	−0.424, −0.02	1.00	1.452	−1.938, 4.842	<.001	−1.091	−1.978, −0.203
Ethnicity	1.00	.562	−0.98, 2.104	1.00	−.006	−0.238, 0.227	.212	2.419	−1.467, 6.304	1.00	−.051	−1.072, 0.97
Western dietary pattern	<.001	1.138	0.16, 2.116	.005	.14	−0.007, 0.287	<.001	3.135	0.663, 5.606	.008	.596	−0.052, 1.244
Healthy dietary pattern	.006	.636	−0.04, 1.312	1.00	−.039	−0.141, 0.063	.272	1.016	−0.69, 2.722	1.00	−.159	−0.607, 0.289
Dietary misreporting	<.001	−2.757	−4.18, −1.333	<.001	−.311	−0.525, −0.096	<.001	−6.601	−10.197, −3.004	<.001	−1.39	−2.333, −0.448
Physical activity	.001	.869	0.051, 1.686	1.00	−.01	−0.133, 0.113	.043	1.602	−0.464, 3.668	1.00	−.041	−0.583, 0.5
Sedentary behavior	1.00	.259	−0.434, 0.951	1.00	.037	−0.067, 0.142	.219	1.081	−0.664, 2.826	1.00	.183	−0.276, 0.641
Smoking	.398	.899	−0.728, 2.526	.689	.119	−0.126, 0.364	.885	1.862	−2.238, 5.961	.96	.478	−0.6, 1.555
Alcohol consumption	1.00	−0.358	−2.292, 1.576	1.00	−.006	−0.297, 0.286	1.00	−.831	−5.704, 4.043	1.00	−.065	−1.345, 1.216

Standardized β, Bonferroni-corrected confidence intervals, and *P* values of multiple linear regression models are from the 20-year follow-up of the Raine Study.

(model with HOMA-IR as outcome). Subsequent results excluded the interaction terms and adjusted for sex, physical activity, BMI (model with HOMA-IR as outcome), and HOMA-IR (model with WC as outcome) because the interactions were not significant.

The standardized concentrations were applied to the final adjusted regression model to make the different metabolite concentrations comparable. Standardization of the coefficients was performed by standardizing the metabolite concentrations (xi) to their mean and standard deviation (sdi), using the following equation: $\frac{xi - mean}{sdi}$.

We focused on models including WC for the association of metabolites with obesity because WC is more closely related to obesity-related health risks than BMI (23). Using BMI instead yielded similar results (Supplemental Figure 1). Additionally, in the final models, the effects of LDL-C and HDL-C were excluded by adjustment because this led to almost the same results as the more complex method of residualizing (Supplemental Figure 2). Adding triglyceride concentrations to the model did not change the tendencies in metabolite concentrations (Supplemental Figure 3).

Bonferroni correction was used to correct for multiple hypothesis testing. The level of significance was divided by the number of analytes, and P values were considered statistically significant if they were less than the adjusted significance level of $\alpha = .000286\ (\frac{0.05}{175\ (number\ of\ analytes)})$. Bonferroni-adjusted confidence intervals (CI) were calculated accordingly by changing the default confidence level to $1 \pm \frac{\alpha}{175\ (number\ of\ analytes)}$.

Overviews and trends of the results for all metabolites were depicted in a figure by plotting the $-\log_{10}(P)$ values on the y-axis and the metabolites on the x-axis, further referred to as a Manhattan plot. The direction below or above 0 was used to make statements on whether the concentration of the metabolites was higher or lower in one of the groups, depending on the outcome.

Table 2. Characteristics of the Study Subjects at 20 Years Divided by Sex

	Female	Male
n, %	464 (45.85)	547 (54.05)
Ethnicity, n/%		
Caucasian	390 (84.05)	449 (84.05)
Not Caucasian	66 (14.22)	84 (15.36)
NA	8 (1.72)	14 (2.56)
BMI status, n/%		
Obese	57 (12.28)	55 (10.05)
Overweight	85 (18.32)	133 (24.31)
Normal weight	302 (65.09)	350 (63.99)
Underweight	20 (4.31)	9 (1.65)
BMI, kg/m^2, mean ± SD		
Obese	35.46 ± 4.52	33.39 ± 3.39
Overweight	26.81 ± 1.42	26.75 ± 1.33
Normal weight	21.70 ± 1.71	22.11 ± 1.68
Underweight	17.39 ± 0.91	17.73 ± 0.63
Smoking, n/%		
Yes	56 (12.07)	67 (12.25)
No	368 (79.31)	355 (64.90)
Not reported	40 (8.62)	125 (22.85)
Alcohol, n/%		
Yes	385 (82.97)	378 (69.10)
No	36 (7.76)	43 (7.86)
Not reported	43 (9.27)	40 (7.31)
Physical activity (last 7 d), n/%		
Less than once	94 (20.26)	37 (6.76)
1–3 times	194 (41.81)	135 (24.68)
4 or more	133 (28.66)	244 (44.61)
NA	43 (9.27)	131 (23.95)
Sedentary behavior (hours per day), n/%		
0	1 (0.22)	/
1	69 (14.87)	38 (6.95)
2	193 (41.59)	203 (37.11)
3	120 (25.86)	141 (25.78)
4	42 (9.05)	41 (7.50)
NA	39 (8.41)	124 (22.67)
WC, cm, mean ± SD	76.71 ± 12.27	82.43 ± 11.18
HOMA-IR, mean ± SD	0.93 ± 0.67	0.81 ± 0.62
Glucose, mmol/L, mean ± SD	4.84 ± 0.37	5.03 ± 0.42
Insulin mU/L, mean ± SD	4.26 ± 2.97	3.58 ± 2.68
Calculated LDL, mmol/L, mean ± SD	2.55 ± 0.63	2.43 ± 0.67
HDL, mmol/L, mean ± SD	1.42 ± 0.31	1.23 ± 0.26
Western dietary pattern z-score, mean ± SD	−0.34 ± 0.72	0.41 ± 0.93
Healthy dietary pattern z-score, mean ± SD	0.004 ± 0.82	0.03 ± 0.96
Dietary misreporting, n/%		
Underreporting	190 (40.95)	128 (23.40)
Plausible reporting	190 (40.95)	224 (40.95)
Overreporting	19 (4.09)	33 (6.03)
NA	65 (14.01)	163 (29.80)

Abbreviation: NA, not applicable. Sample size/percentages and means ± standard deviations are reported.

Results

One hundred seventy-five different lipid metabolites (32 NEFAs, 14 LPCa, three lysophosphatidylethanolamines, 43 PCaas, 37 acylalkylphosphatidylcholines, 47 SMs) of 1011 subjects were included in the analysis. The characteristics of the study population are provided in Table 2. Standardized estimates, Bonferroni CIs, and Bonferroni P values can be seen in Supplemental Tables 3 and 4.

Obesity

The regression analysis showed significant associations between WC and SM, LPC, and PC concentrations (Figure 1). There was no significant sex and metabolite concentration interaction. The stratified analysis of the data is shown in Supplemental Figure 4.

The analytes that were significantly positively associated with WC values are shown in Figure 2. These were NEFA C17:1, PCaa C40:6, PCaa C40:5, PCaa C38:5, PCaa C38:4, PCaa C38:3, SMa C43:3, SMa C42:4, SMa C42:3, SMa C40:2, SMa C36:3, SMa C36:2, SMa C36:0, SMa C34:3, SMa C34:2, SMa C33:2 and SMa C32:2. The

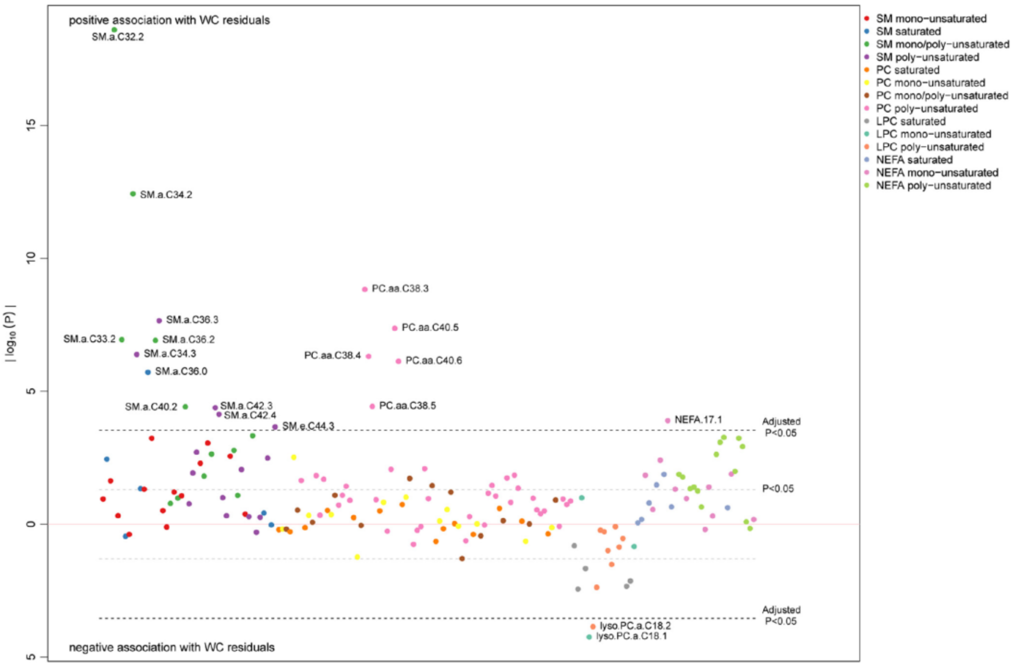

Figure 1. Manhattan plot of the analytes of the multiple regression model for WC to show metabolite trends. Light dashed line corresponds to the significance level of $\alpha = .05$. Dark dashed line corresponds to the Bonferroni-corrected significance level of $\alpha = .05/175$ (number of analytes). Points are −log10 *P* values of the regression model. Dependent variable is WC; independent variable is the respective analyte; adjustment is HDL-C, LDL-C, HOMA values, smoking, alcohol consumption, dietary patterns, physical and sedentary behavior, and biological sex. Metabolite names given only for significant values. All β-coefficients, CIs, *P* values, and Bonferroni corrected *P* values can be seen in Supplemental Table 3.

metabolites LPCa C18:2 and LPCa C18:1 were significantly decreased.

Although NEFA concentrations were not significantly elevated, there was a trend toward an increase of most of the species (Figure 1).

Insulin resistance

Log-HOMA-IR values were used as a continuous variable to examine associations with lipid analytes. The additional model used insulin values (Supplemental Figure 5). The increased metabolites in subjects with high HOMA-IR values were PCaa C32:2 and LPCa C14:0, whereas PCaa C43:6 and PCaa C44:12 were decreased (Table 3).

The associations between insulin and analytes showed the same trend (Supplemental Figure 5).

The HOMA-IR model without BMI as confounder showed similar metabolite trends as the WC model for differences in obesity, meaning that elevated SM values and SMa C32:2 are the most significant analytes with higher BMI (Supplemental Table 5).

Our data suggest increased SM concentrations are indicative of only obesity but not for IR. To explore the link between obesity and IR, we stratified the data into subjects with overweight/obesity and normal weight. This analysis showed a significant association between LPC C14:0 (SE 0.11; Bonferroni CI 0.02, 0.2; *P* correlation 0.001) concentration and log-HOMA in the normal-weight group. In the obese/overweight group, no metabolites were significantly associated with log-HOMA concentrations, but there was a trend toward decreased LPC concentrations.

Discussion

Concentrations of NEFA C17:1, PCaa C40:6, PCaa C40:5, PCaa C38:5, PCaa C38:4, PCaa C38:3, SMa C43:3, SMa C42:4, SMa C42:3, SMa C40:2, SMa C36:3, SMa C36:2, SMa C36:0, SMa C34:3, SMa C34:2, SMa C33:2, and SMa C32:2 were positively and LPCa C18:2 and LPCa C18:1 were negatively associated with WC in study participants, after adjusting for HOMA-IR, ethnicity, sex, dietary patterns and misreporting, smoking, alcohol consumption, physical activity, sedentary be-

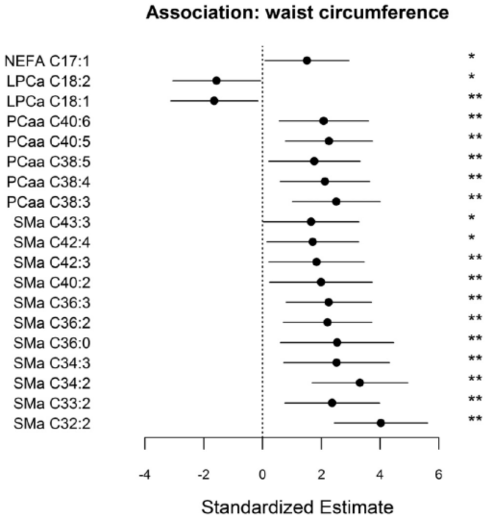

Figure 2. Significant analytes of the multiple linear regression model with WC as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-C, HDL-C, dietary patterns, dietary misreporting, smoking and drinking behavior, physical activity, and sedentary behavior in the 20-year follow-up of the Western Australian Pregnancy Cohort (Raine) Study. Standardized estimates, Bonferroni-corrected CIs, and *P* values are reported.

havior, and LDL-C and HDL-C concentrations. HOMA-IR values were positively associated with LPC C14:0 and PCaa C32:3 and negatively with PCaa C44:12 and PCaa C43:6, with the same covariates but BMI instead of HOMA-IR.

The main source of phospholipids are lipoproteins, secreted by the liver. Although many studies focus on the effect of HDL-C or LDL-C on metabolic diseases, our study is among the few metabolomics studies that account for their possible effect of the polar lipid compartments (24, 25).

HDL has a lower SM to PC ratio than LDL, with PC being the first and SM being the second most abundant lipid subclass in lipoproteins (26). Triacylgylcerols, glycerophospholipids, and sphingolipids are packed in very low-density lipoprotein, which can cross the cell border into the bloodstream. By the release of triacylglycerols, very low-density lipoproteins are converted to LDL.

Table 3. Significant Analytes 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 Behavior, Physical Activity, and Sedentary Behavior at 20 Years

Analyte	Standardized Estimate	Bonferroni CI	Bonferroni *P* Value
PCaa C43:6	−0.09	−0.18 to 0.01	.01
PCaa C44:12	−0.09	−0.18 to 0.01	.01
LPCa C14:0	0.08	0.001, 0.16	.05

Standardized estimates, Bonferroni corrected confidence intervals, and *P* values are reported.

Obesity

Increased concentration of SM species associated with high WC suggests an enhanced SM biosynthesis. During SM biosynthesis, the phosphocholine head group of PC is bound to a ceramide molecule, an intermediate in sphingolipid metabolism, via ceramide-choline phosphotransferase (27). The major flux through this pathway occurs through ceramidase to generate sphingosine and subsequently sphingosine 1 phosphate (28). Our finding of higher LDL compared with HDL with higher WC values (Supplemental Figure 6) suggests greater amounts of LDL-derived SM, reflected in our findings that higher SM levels are associated with obesity.

This could also be an explanation for the decreased levels of LPC C18:1 and C18:2 in subjects with higher WC. Barber et al (29) reported decreased LPC C18:1 and C18:2 with obesity and suggested that obesity-related factors, such as diet and adiposity, rather than IR and diabetes per se, may make the major contribution to the changes in the LPC profile. LPCs in human plasma are mainly derived by the action of lecithin cholesterol acyltransferase (LCAT). LCAT removes fatty acids from the sn-1 or -2 position of PC; the former are then transferred to cholesterol (30). LCAT is extracted from the liver into the bloodstream and bound to the surface of HDL. LCAT is negatively affected by higher levels of SM (31). Subjects with higher BMI had higher levels of LDL, lower levels of HDL, and therefore a higher level of SM. A decrease in LCAT activity could be a reason for higher PC levels, which are no longer used for the esterification of cholesterol as well as the lower LPC levels and subsequent the concentration of HDL. In the process to form HDL, LCAT activity is the final step to esterify the cholesterol. Otherwise, reverse cholesterol transport is disturbed.

A possible biological explanation for the elevated SM species C34:2 and C36:2 could be an increase in the activity of the δ9 desaturase stearoyl-CoA desaturase 1 (SCD1). This desaturase is specific for palmitic acid (C16:0) and stearic acid (C18:0) and is a key enzyme in the synthesis of palmitoleic acid (C16:1) and oleic acid (C18:1), respectively. The monounsaturated fatty acids resulting from the SCD1 activity are major substrates in the synthesis of complex lipids (32). Because the sphingosine backbone of SM consists of a C18:1 molecule, the species C34:2 and C36:2 likely also contain palmitoleic and oleic acids, respectively (33). Studies in rats have found positive associations between SCD1 activity and obesity (34). This is reflected in our analysis of the ratio of NEFA C16:1 to C16:0, which is a marker for elevated SCD1 activity. The ratio was significantly positive associated with WC, supporting our hypothesis. Although the ratio of NEFA C18:1 to C18:0, another marker for the SCD1 activity, was increased, it was not significantly associated (Supplemental Table 6).

Insulin resistance

In normal-weight subjects, increased LPC C14:0 was significantly associated with high HOMA-IR, whereas there was no significant association with obesity.

A study in infants found elevated LPC C14:0 levels predictive of later obesity at early school age (35). Some evidence exists that myristic acid augments the release of insulin in pancreatic β-cells (36).

The lipotoxicity hypothesis is a possible explanation for the development of IR in obesity. This hypothesis states that an oversupply of fats, which exceed the capacity of adipocytes, leads to storage in other tissues. In response, these cells produce bioactive lipids that reduce insulin sensitivity and fat flow into the cell.

Higher NEFAs in adipose tissue can lead to IR and consequently more NEFA release. Elevated levels of NEFAs are then taken up by other insulin-sensitive tissues including liver or muscle cells, resulting in constant NEFA blood levels during early stages of IR/T2DM. Our finding of few elevated NEFAs may be due to the young age of the Raine participants (37).

Epigenetic programming

To look for possible associations of early-life influences (possibly mediated through epigenetic mechanisms) on the metabolite concentration at 20 years of age, we adjusted the models for maternal prepregnancy BMI, maternal birth weight, birth weight of the child, mode of delivery, and weight change in the first year of life (Supplemental Figures 7 and 8) (38). The results suggest that there is no change in the trend of the metabolite concentrations by including those variables, but LPC concentrations were no longer significantly associated with WC after adding weight change in the first year of life. This could suggest genetic effects on the body composition of the child and should be further analyzed.

Strengths and limitations

The strength of our study is the metabolomics/lipidomics approach targeting polar lipids with a sample size of more than 1000 subjects, from a general population with a relatively high prevalence of overweight and obesity. Thus, our statistical power is exceptionally high. To our knowledge, this is the first time a statistical approach that accounts for the effects of LDL and HDL and then also examines the residual relation of lipidomics in obesity and IR has been applied. Additionally, our analyses accounted for possible sex differences, ethnicity, and a number of potential lifestyle confounders.

Limitation is the cross-sectional design, which does not allow for differentiation between causes and consequences. The study's primary aim is hypothesis generation because most of the pathways are not very well understood at the moment. Also, although the number of obese and overweight is relatively high at approximately 33%, higher rates of obese subjects would lead to more valid conclusions.

There are also limitations to the HOMA model as a measure for insulin resistance, with the gold standard being clamp techniques. Nevertheless, it is frequently used in population-based studies (39).

Conclusion

Even though the pathways are not very well understood to date, the results presented here suggest that SM, PC, and LPC are associated with obesity and IR independent of LDL-C and HDL-C. The underlying mechanism for the elevated SM and PC levels in human plasma could be explained by the hypothesis of lipotoxicity.

In conclusion, we have shown plasma SM and particularly SMa C32:2 associates predominantly with obesity, and plasma LPCa C14:0 associates with IR, in young adults. In normal-weight individuals, there was a significant association with LPC C14:0, whereas there was no significant association between HOMA-IR and metabolite concentrations in the obese/overweight group. Future studies should focus on metabolites involved in sphingolipid metabolism, and their relationship to a diet rich in saturated fats in individuals with obesity and normal weight and those with IR to examine the effects of sphingolipids on diseases associated with the metabolic syndrome and examine saturated, monounsaturated, and polyunsaturated SM in relation to IR, obesity, or overweight.

It is also of major interest for future research to analyze the influence of different lifestyle factors on metabolites for a better understanding of their interplay and influence on diseases like obesity and IR.

In addition, further studies are required to examine possible different diagnostic approaches for IR in normal-weight/underweight compared with overweight/obese patients. Also, longitudinal studies are necessary to determine causality in the hypotheses we have generated here.

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Author contributions included the following: S.R. wrote the paper and performed the statistical analysis and data interpretation. C.H. performed the quality control analysis and contributed to the statistical analysis and data interpretation. O.U. performed the liquid chromatography and tandem mass spectrometry analysis and contributed to the data interpretation. F.K. contributed to the statistical analysis. B.K. and W.H.O. conceived the study. T.A.M. was responsible for the collection, storage, and shipment of the plasma to Germany for the metabolomics analysis. T.A.M., L.J.B., and W.H.O. were responsible for all the data collection. All coauthors have contributed to the content and read and approved the final manuscript.

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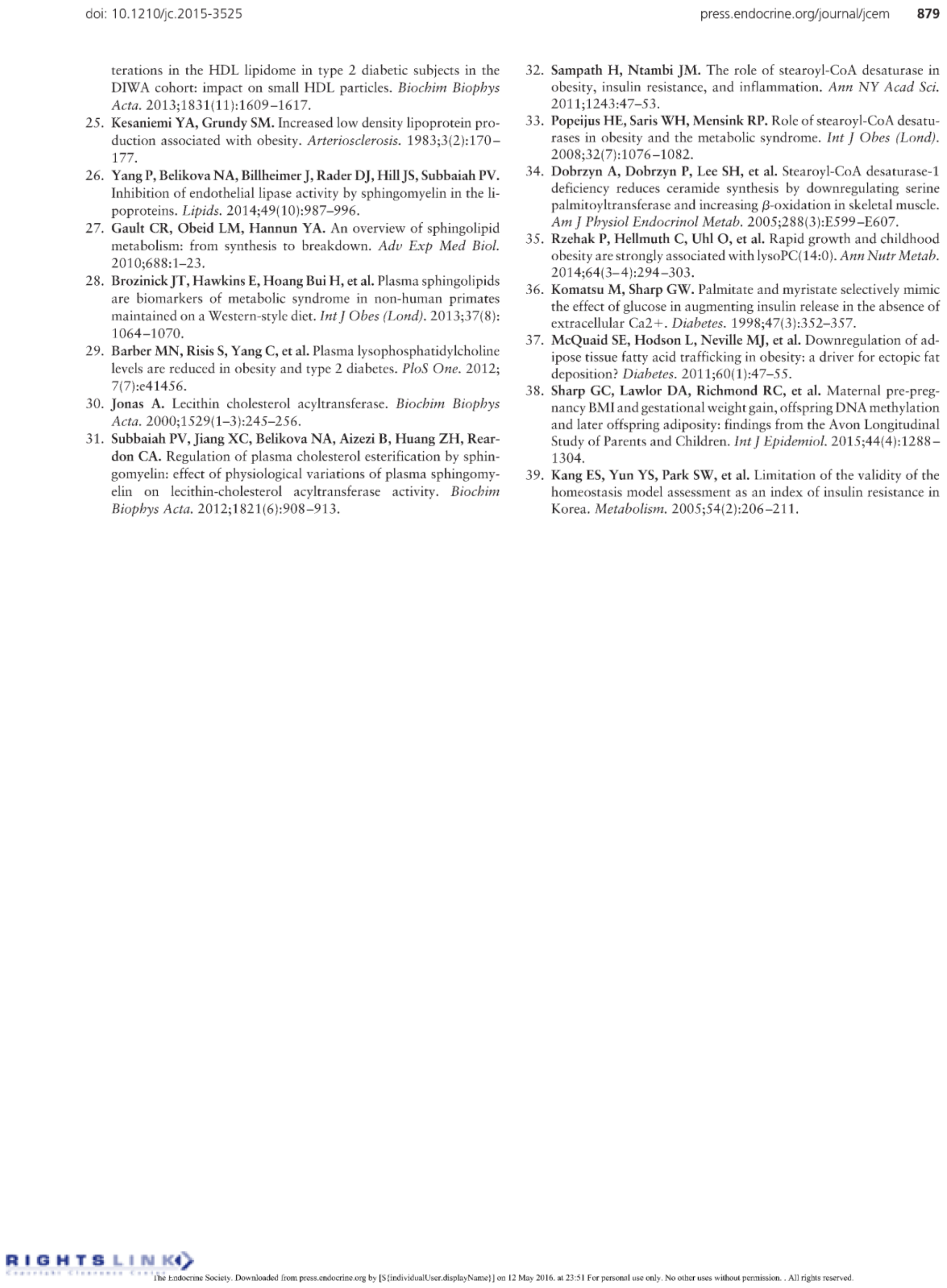

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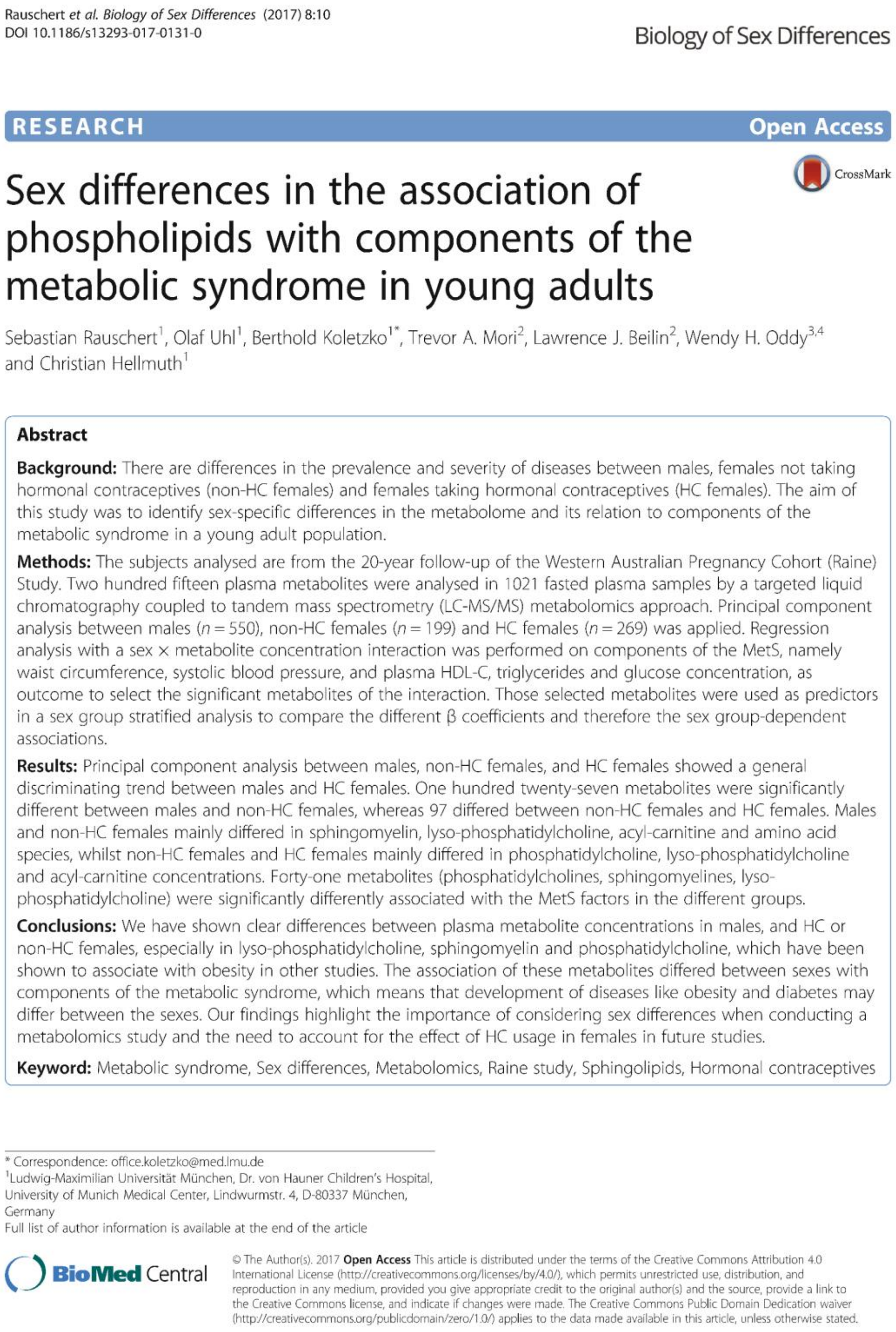
Supplemental Material can be found at the end of this document.

4. Publication 2

"Sex Differences in the Association of Phospholipids and Sphingolipids with Components of the Metabolic Syndrome in Young Adults"



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Biology of Sex Differences

RESEARCH **Open Access**

Sex differences in the association of phospholipids with components of the metabolic syndrome in young adults

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Abstract

Background: There are differences in the prevalence and severity of diseases between males, females not taking hormonal contraceptives (non-HC females) and females taking hormonal contraceptives (HC females). The aim of this study was to identify sex-specific differences in the metabolome and its relation to components of the metabolic syndrome in a young adult population.

Methods: The subjects analysed are from the 20-year follow-up of the Western Australian Pregnancy Cohort (Raine) Study. Two hundred fifteen plasma metabolites were analysed in 1021 fasted plasma samples by a targeted liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS) metabolomics approach. Principal component analysis between males ($n = 550$), non-HC females ($n = 199$) and HC females ($n = 269$) was applied. Regression analysis with a sex × metabolite concentration interaction was performed on components of the MetS, namely waist circumference, systolic blood pressure, and plasma HDL-C, triglycerides and glucose concentration, as outcome to select the significant metabolites of the interaction. Those selected metabolites were used as predictors in a sex group stratified analysis to compare the different β coefficients and therefore the sex group-dependent associations.

Results: Principal component analysis between males, non-HC females, and HC females showed a general discriminating trend between males and HC females. One hundred twenty-seven metabolites were significantly different between males and non-HC females, whereas 97 differed between non-HC females and HC females. Males and non-HC females mainly differed in sphingomyelin, lyso-phosphatidylcholine, acyl-carnitine and amino acid species, whilst non-HC females and HC females mainly differed in phosphatidylcholine, lyso-phosphatidylcholine and acyl-carnitine concentrations. Forty-one metabolites (phosphatidylcholines, sphingomyelines, lyso-phosphatidylcholine) were significantly differently associated with the MetS factors in the different groups.

Conclusions: We have shown clear differences between plasma metabolite concentrations in males, and HC or non-HC females, especially in lyso-phosphatidylcholine, sphingomyelin and phosphatidylcholine, which have been shown to associate with obesity in other studies. The association of these metabolites differed between sexes with components of the metabolic syndrome, which means that development of diseases like obesity and diabetes may differ between the sexes. Our findings highlight the importance of considering sex differences when conducting a metabolomics study and the need to account for the effect of HC usage in females in future studies.

Keyword: Metabolic syndrome, Sex differences, Metabolomics, Raine study, Sphingolipids, Hormonal contraceptives

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Background

There is increasing evidence from epidemiological studies that sex and oral contraceptive use in females modulate the development and the severity of cardiovascular disease [1–4]. For example, men are more likely to develop coronary heart diseases than women, especially women prior to menopause, but the risk of developing stroke and heart failure is higher in women [1]. Similarly, more females than males are overweight and obese in developing countries, whereas the opposite is found in developed countries [5]. Since males and females differ in the development and severity of obesity and insulin resistance, it is likely that differences in their metabolism, as a result of genetic effects and environmentally induced changes, may play an important role.

Analysis of the metabolome of males and females could provide insights into the sex-related differences of progression and severity of cardiovascular diseases. Most of the metabolomics studies to date have not stratified analyses according to sex, most likely due to their small sample size. Additionally, to our knowledge there are no studies that have examined sex differences in metabolomics and associated these with components of the metabolic syndrome (MetS). In particular, the characterisation of hormonal contraceptive usage in females with regards to its potential effect on metabolomic changes is highly underrepresented in current research, although a large number of women have been using them since their development in the 1960s [3].

This topic is of high relevance in the approach of implementing sex-specific interventional strategies and biomarker tests in future clinical settings. If biomarkers are different between the sexes, the relevance of those general biomarkers is questionable and also critical in terms of false diagnosis.

The aim of this study was to examine the metabolome of males and females at 20 years of age, including females either using (HC) or not using hormonal contraceptives (non-HC), taking part in the Western Australian Pregnancy Cohort (Raine) Study. The study related potential differences in the metabolome to a number of risk factors underlying the MetS [6].

Methods

Details on the Raine study have been reported previously [7, 8]. Briefly, from 1989 to 1991, 2900 pregnant women were enrolled in this prospective longitudinal cohort study with the purpose to examine the effects of prenatal ultrasound imaging on the offspring [8]. Two thousand eight hundred sixty-eight live births were evaluated and followed serially to 20 years of age. The present study used cross-sectional data from the 20-year follow-up of the cohort, which occurred between March 2010 and April 2012 and included 87% of the active participants. Ethics approval at the 20 year follow-up was obtained from the University of Western Australia Human Research Ethics Committee. Informed and written consent was obtained from participants.

Serum insulin, glucose, lipids and liver function tests were analysed using standardised protocols in the PathWest Laboratory at Royal Perth Hospital, Perth, Western Australia.

MetS components were the ones established by the International Diabetes Federation, including central obesity, raised systolic blood pressure (sysBP), fasting raised triacylglycerol (TG), glucose, and reduced high density lipoprotein cholesterol (HDL-C) [6]. HC use in females was derived from a questionnaire and based on current use of the oral contraceptive pill, implant, injection or any intrauterine HC-device and defined as a binary variable yes/no.

Metabolomics measurements

Polar lipids (acyl-carnitines (acyl-Carn), diacyl-phosphatidylcholines (PCaa), acyl-alkyl-phosphatidylcholines (PCae), sphingomyelines (SM), lyso-phosphatidylcholines (LPC/LPCa), alkyl-linked lyso-phosphatidylcholines (LPCe)), non-esterified fatty acids (NEFA) and amino acids (AA) were measured as previously reported [7, 9, 10].

The Additional file 1 provides a detailed description of the metabolomics methodology. Briefly, proteins of plasma were precipitated by adding methanol including internal standards. After centrifugation, the supernatant was used for analyses by liquid chromatography (1200, Agilent) coupled to triple quadrupole mass spectrometry (4000QTRAP, Sciex). Metabolites were quantified by comparison to external standards as μmol/L.

Potential confounding factors

Physical activity was assessed using the short form of the International Physical Activity Questionnaire and asked whether individuals performed more than 10 min of moderate or vigorous physical activity, and time spent walking or sitting in the last 7 days. The number of days, hours and minutes was reported. We created a categorical variable with “less than once a week”, “1 to 3 times” and “4 or more times” more than 10 min of physical activity per week.

Sedentary behaviour assessment was based on hours spent in front of a screen, including TV watching, playing videogames, socializing and non-socializing activities on the Internet.

Smoking cigarettes and drinking alcohol were used as binary variables. Smoking was assessed by asking if the participant was currently smoking. Alcohol consumption was based on any alcohol consumption in the last 7 days.

Ethnicity was applied as a dichotomous variable of Caucasian versus non-Caucasian.

Diet was based on dietary patterns as reported by Ambrosini et al. and included three variables: a healthy dietary pattern, a western dietary pattern and a dietary misreporting variable of food intake to account for over, under, or plausible dietary reporting [11].

Statistics

The software R (R Project for Statistical Computing, http://www.r-project.org/, Version 3.0.2) was used for all statistical analyses. To determine if the residuals were normally distributed, we checked the diagnostic plots of all the models. The *R* function crPlots from the car package in *R* [12] was used to check if outliers influence the linearity. We also assessed the boxplots for all variables used, leading to outlier exclusion. Together with our sufficiently large sample size (Central Limit Theorem), the model assumptions were met. Z-scores for each metabolite within each batch have been calculated to account for batch variation. A batch was defined as 81 samples together with standards and 6 quality control samples. All samples were measured in 15 batches.

We defined a three-level sex variable with the categories males, non-HC females and HC females.

The analysis was divided in three parts. First of all, we aimed at general sex differences.

General sex differences: principal component analysis

To determine whether the variance in the metabolomics data could be explained in part by the sex categories, we applied principal component analysis (PCA), which is used to find components that explain most of the variance in the data. The components explaining most of the variance (component 1 and component 2) were plotted against each other to see if they showed discriminating clusters for the sex categories. To assess which metabolite groups drive that discrimination, the loadings of the metabolite classes were depicted as arrows in the same plot.

Sex differences in the associations with the components of the MetS: analysis of variance

In the second analysis, we aimed to extract those metabolites that were significantly associated with at least one of the components of the MetS, depending on the sex variable.

Therefore, the metabolites that were significantly different between the three levels of the sex variable in association with the five continuous factors of the MetS needed to be identified. This pre-selection of metabolites was performed by applying a sex and metabolite interaction variable into analysis of variance (Anova) models with one of the five MetS indicators per model as outcome adjusted for the above-mentioned confounders. A significant interaction meant that the association between the metabolite and the single MetS factor was different depending on at least one of the three sex categories. To indicate which sex groups differed, we performed regression analysis to compare the three group differences after the anova.

Regression models stratified by sex group

The third analysis aimed to determine if the effect size of the metabolite in association with the single component of the MetS was significantly different between the three sex categories.

The metabolites that were significant in the interaction with at least one of the factors associated with the MetS were used to analyse if the effect sizes are significantly different between the sex categories. Therefore, we stratified the data into a male and non-HC and HC female subset. In all analyses, one of the five factors associated with the MetS was the outcome per model and the identified metabolites the predictor, adjusted for confounding variables.

The resulting standardized β coefficients were compared between the three sex categories. Significance for the difference of the β coefficients was tested by applying a regression model with dummy variables (male and non-HC female, HC female, each: yes (1), no (0)), to determine if they were significantly different to the reference category. This difference can be interpreted as the difference in the association between the metabolite and the outcome, if the respective sex category is added. It is a way to perform a significance test for the difference of β coefficients in different categories (for an overview of the analysis strategy, see Fig. 1).

To determine if the metabolites that showed up significantly in the stratified groups were of any significance in the general, unstratified population, we performed analyses with the whole data set, where a single one of the five MetS indicators was the outcome and metabolite concentration was the predictor, adjusted for the confounders stated above (Additional file 1: Table S1).

We used false discovery rate as described by Benjamini and Hochberg to account for multiple testing for the *p* values [13]. This was performed using the *p.adjust* function of the R core package. The confidence intervals were corrected for multiple testing using the formula $1-\frac{\#\ of\ selected\ metabolites\times 0.05}{\#\ of\ all\ metabolites}$, according to Benjamini and Yekutieli [14]. The correction procedure for multiple testing was applied using the number of metabolites. This approach was used, as the main aim of this study was hypothesis generation, and the Bonferroni correction is very restrictive in this regards.

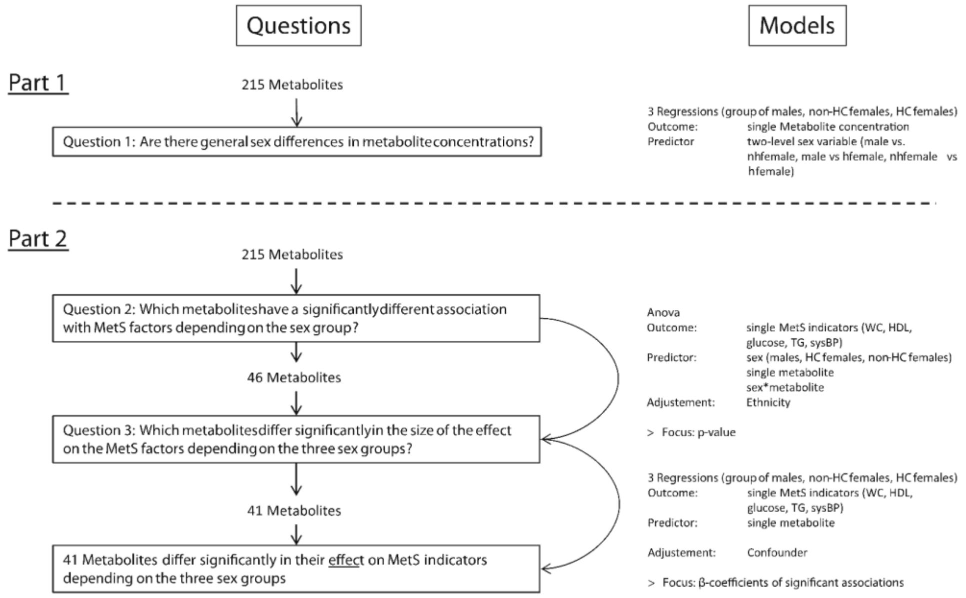

Fig. 1 Overview of the analytical strategy

Results

The study characteristics of the participants are shown in Table 1. Results for all models and metabolites can be found in the Additional file 1: Table S1 which shows that there were significant differences in the concentrations of HDL-C, glucose and triglycerides, sysBP and waist circumference (WC) between males and non-HC and HC females.

General sex differences: principal component analysis

PCA (Figure Fig. 2) showed a clustering effect between males and HC females, predominantly due to differences in SM, PC and LPC.

In the regression, there were 127 metabolites significantly different between males and non-HC females and 97 metabolites that differed significantly between HC and non-HC females.

Males and HC females, however, significantly differed in 161 metabolites (Additional file 1: Table S2–Table S4, Table 2).

Sex differences in the associations with components of the MetS: analysis of variance

In the Anova, we found that 46 metabolites showed a sex interaction with at least one component of the MetS (Additional file 1: Table S5, group differences Additional file 1: Table S5). These 46 metabolites were included in the stratified analysis to examine the standardized β values. All of the 46 metabolites were significantly associated with the indicators of the MetS in the unstratified analysis of the general Raine study population.

Those metabolites were acyl-Carn C3:0, NEFA C24:5, NEFA C26:1, PCaa C32:3, PCaa C34:1, PCaa C34:2, PCaa C34:3, PCaa C36:0, PCaa C36:1, PCaa C36:2, PCaa C36:3, PCaa C36:4, PCaa C38:0, PCaa C38:3, PCaa C38:4, PCaa C38:5, PCaa C38:6 , PCaa C40:6, PCaa C40:4, PCaa C40:5, PCae C36:1, PCae C38:0, PCae C40:0, PCae C40:6, SM C36:0, SM C38:1, SM C38:2, SM C40:3, SM C40:4, SM C40:5, SM C41:0, SM C42:4, SM C42:6, SM C44:6, LPCa C16:0, LPCa C16:1, LPCa C18:0, LPCa C18:1, LPCa C18:3, LPCa C20:3, LPCa C20:4, LPCa C20:5, LPCa C22:5, LPCa C22:6, LPCe C18:0, and LPCe C18:1 (for sex group differences: Table 3, for *p* values, β-coefficients and confidence interval: Additional file 1: Table S6).

In regression models stratified by sex group, we found that 41 of these metabolites had significantly different between-group β coefficients, whereas acyl-Carn C3:0, PCaa C34:2, PCaa C40:4, SMa C38:2 and NEFA C26:1 showed no significant difference (Additional file 1: Table S5). None of the metabolites were significantly different between the sex categories for all MetS factors.

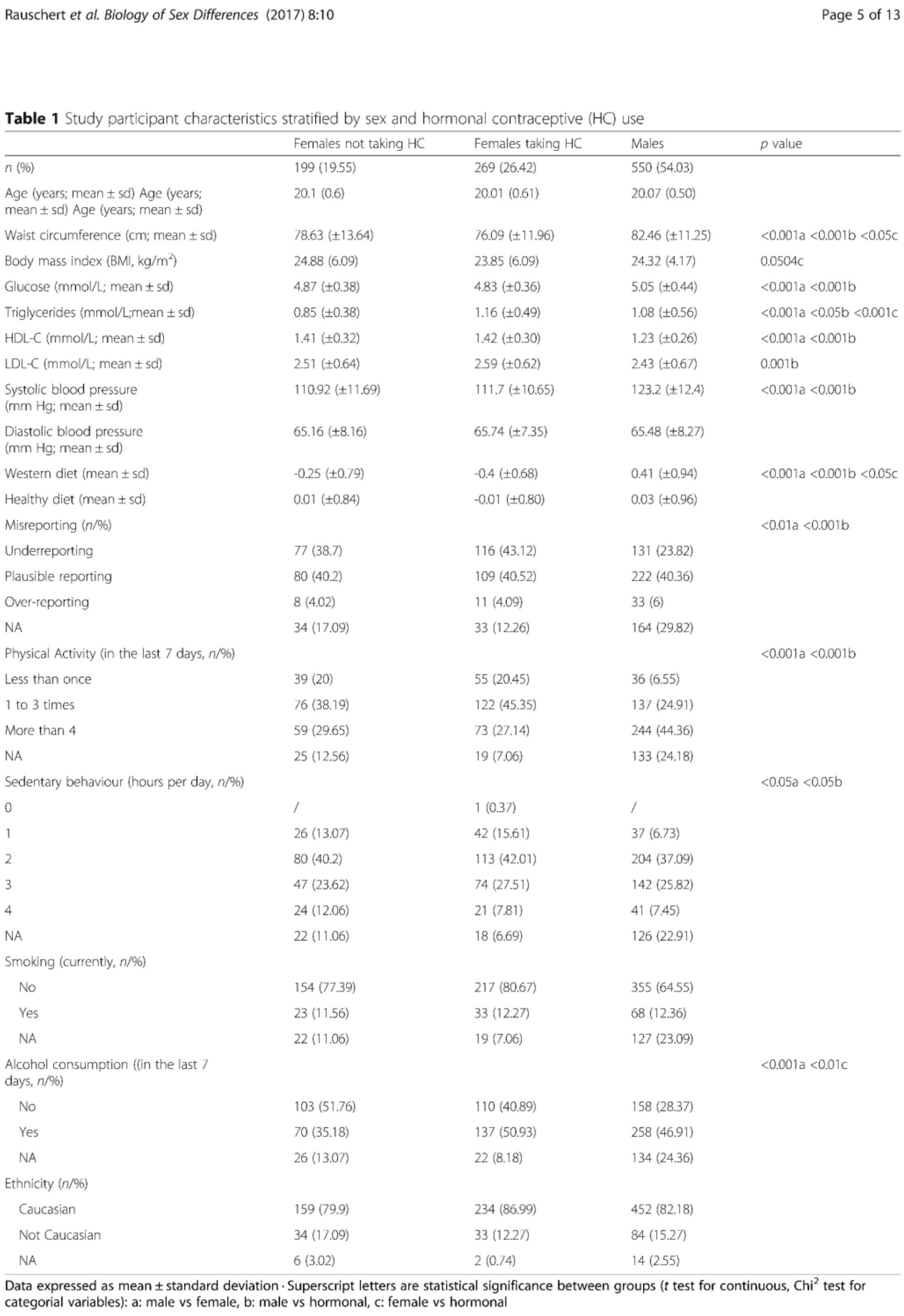

Table 1 Study participant characteristics stratified by sex and hormonal contraceptive (HC) use

	Females not taking HC	Females taking HC	Males	*p* value
n (%)	199 (19.55)	269 (26.42)	550 (54.03)	
Age (years; mean ± sd) Age (years; mean ± sd) Age (years; mean ± sd)	20.1 (0.6)	20.01 (0.61)	20.07 (0.50)	
Waist circumference (cm; mean ± sd)	78.63 (±13.64)	76.09 (±11.96)	82.46 (±11.25)	<0.001a <0.001b <0.05c
Body mass index (BMI, kg/m^2)	24.88 (6.09)	23.85 (6.09)	24.32 (4.17)	0.0504c
Glucose (mmol/L; mean ± sd)	4.87 (±0.38)	4.83 (±0.36)	5.05 (±0.44)	<0.001a <0.001b
Triglycerides (mmol/L;mean ± sd)	0.85 (±0.38)	1.16 (±0.49)	1.08 (±0.56)	<0.001a <0.05b <0.001c
HDL-C (mmol/L; mean ± sd)	1.41 (±0.32)	1.42 (±0.30)	1.23 (±0.26)	<0.001a <0.001b
LDL-C (mmol/L; mean ± sd)	2.51 (±0.64)	2.59 (±0.62)	2.43 (±0.67)	0.001b
Systolic blood pressure (mm Hg; mean ± sd)	110.92 (±11.69)	111.7 (±10.65)	123.2 (±12.4)	<0.001a <0.001b
Diastolic blood pressure (mm Hg; mean ± sd)	65.16 (±8.16)	65.74 (±7.35)	65.48 (±8.27)	
Western diet (mean ± sd)	-0.25 (±0.79)	-0.4 (±0.68)	0.41 (±0.94)	<0.001a <0.001b <0.05c
Healthy diet (mean ± sd)	0.01 (±0.84)	-0.01 (±0.80)	0.03 (±0.96)	
Misreporting (*n*/%)				<0.01a <0.001b
Underreporting	77 (38.7)	116 (43.12)	131 (23.82)	
Plausible reporting	80 (40.2)	109 (40.52)	222 (40.36)	
Over-reporting	8 (4.02)	11 (4.09)	33 (6)	
NA	34 (17.09)	33 (12.26)	164 (29.82)	
Physical Activity (in the last 7 days, *n*/%)				<0.001a <0.001b
Less than once	39 (20)	55 (20.45)	36 (6.55)	
1 to 3 times	76 (38.19)	122 (45.35)	137 (24.91)	
More than 4	59 (29.65)	73 (27.14)	244 (44.36)	
NA	25 (12.56)	19 (7.06)	133 (24.18)	
Sedentary behaviour (hours per day, *n*/%)				<0.05a <0.05b
0	/	1 (0.37)	/	
1	26 (13.07)	42 (15.61)	37 (6.73)	
2	80 (40.2)	113 (42.01)	204 (37.09)	
3	47 (23.62)	74 (27.51)	142 (25.82)	
4	24 (12.06)	21 (7.81)	41 (7.45)	
NA	22 (11.06)	18 (6.69)	126 (22.91)	
Smoking (currently, *n*/%)				
No	154 (77.39)	217 (80.67)	355 (64.55)	
Yes	23 (11.56)	33 (12.27)	68 (12.36)	
NA	22 (11.06)	19 (7.06)	127 (23.09)	
Alcohol consumption ((in the last 7 days, *n*/%)				<0.001a <0.01c
No	103 (51.76)	110 (40.89)	158 (28.37)	
Yes	70 (35.18)	137 (50.93)	258 (46.91)	
NA	26 (13.07)	22 (8.18)	134 (24.36)	
Ethnicity (*n*/%)				
Caucasian	159 (79.9)	234 (86.99)	452 (82.18)	
Not Caucasian	34 (17.09)	33 (12.27)	84 (15.27)	
NA	6 (3.02)	2 (0.74)	14 (2.55)	

Data expressed as mean ± standard deviation · Superscript letters are statistical significance between groups (*t* test for continuous, Chi^2 test for categorial variables): a: male vs female, b: male vs hormonal, c: female vs hormonal

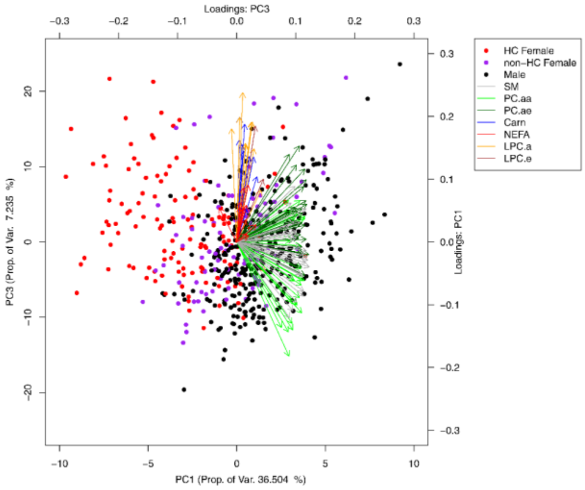

Fig. 2 Loadings plot of the first two components of the PCA. *Arrows*: metabolite groups that separate the data set into the different directions. *Points*: loading of the metabolite in the respective component according to male and HC female or non-HC female

For HDL, TAG and WC, LPCa C18:3 was significantly different. LPCa C18:1, LPCa C20:4, LPCa C22:6 and SMa C41:0 shared different associations depending on the sex category for HDL and WC.

HDL and TAG had significant differences in the metabolites LPCa C16:0, LPCa C18:0, LPCa C18:3, LPCe C18:1, PCaa C34:1, PCaa C34:3, PCaa C38:3, PCaa C38:4, SMa C36:0 and SMa C42:4 between the sex categories in common.

For HDL, LPCa C16:1, LPCa C20:3, LPCa C20:5, LPCa C22:5, LPCe C18:0, NEFA C24:5, PCaa C38:0, PCaa C38:6, PCaa C40:5, PCaa C40:6, PCae C40:0, PCae C40:6 and SMa C42:6 were significantly different between males, hormonal contraceptive-taking females and non-hormonal contraceptive-taking females.

TAG was significantly differently associated with PCaa C32:3, PCaa C36:0, PCaa C36:1, PCaa C36:2, PCaa C36:3, PCaa C36:4, PCaa C38:5, PCae C36:1, PCae C38:0, SMa C38:1, SMa C40:3 and SMa C40:4 (Fig. 3).

Discussion

Our results show significant differences in the concentrations of metabolites in males, HC and non-HC females. In general, males have higher LPC and Carn levels, and non-HC females have higher SM and PC levels. HC females have higher NEFA concentrations than non-HC females and males. The concentrations of HDL-C, glucose and TG, sysBP and WC differed significantly between males, HC and non-HC females and also in their associations with metabolite concentrations.

Numerous epidemiological studies have shown the prevalence of non-communicable diseases differs between males and females, and it is well established that sex hormones have a significant effect on certain diseases [1, 4]. In the field of metabolomics, however, there are few studies addressing sex differences, and how they affect the metabolome underlying diseases risk factors [3, 15, 16]. Most of the metabolomics studies conducted to date have either not taken potential sex differences into account or have used males and females in the same model. There are several studies showing similar results as our study concerning the sex differences in metabolites [3, 15, 17]. However, to our knowledge there is only one other study that has examined sex differences with respect to HC use and

Table 2 Overview of number of significantly sex group between different metabolite groups

	Males vs hfemales	Males vs nhfemales	hfemales vs nhfemales
AA	15 ↑; 1 ↓	15 ↑ ; 2↓	4 ↑; 12 ↓
Carn	12 ↑	11 ↑	8 ↓
LPCa	13 ↑	11 ↑	13 ↓
LPCe	3 ↑	3 ↑	3 ↓
NEFA	2 ↑; 16 ↓	3 ↑; 6↓	6 ↑
PCaa	32 ↓	20 ↓	20 ↑; 2 ↓
PCae	3 ↑; 24 ↓	1 ↑, 20↓	8 ↑; 2 ↓
SM	1 ↑; 39 ↓	1 ↑; 35↓	15 ↑; 4↓

Arrows: ↑ meaning higher and ↓ meaning lower in the firstly mentiones group in the group comparison

Table 3 Results for the group testing after anova

Metabolite	HDL	Triacylglycerol	Waist circumference	Systolic blood pressure	Glucose
Acyl-Carn C3:0	–	males > HC	–	–	–
NEFA C24:5	HC > non-HC HC > males	–	–	–	–
NEFA C26:1	–	males > non-HC	–	–	–
PCaa C32:3	HC > males	–	–	–	–
PCaa C34:1	non-HC > males	HC > non-HC males > non-HC	–	–	–
PCaa C34:2	non-HC > HC	males > non-HC	–	–	males > HC males > non-HC
PCaa C34:3	–	HC > non-HC males > non-HC	–	–	males > HC
PCaa C36:0	HC > males non-HC > males	HC > non-HC HC > males	–	–	–
PCaa C36:1	–	males > non-HC males > HC	–	–	–
PCaa C36:2	–	males > non-HC males > HC	–	–	–
PCaa C36:3	–	males > non-HC	–	–	males > HC
PCaa C36:4	–	males > non-HC	–	–	males > HC
PCaa C38:0	HC > males non-HC > males	HC > non-HC HC > males	–	–	–
PCaa C38:3	HC > non-HC HC > males	males > non-HC males > HC	–	–	–
PCaa C38:4	non-HC > HC HC > males	males > non-HC	–	–	–
PCaa C38:5	HC > males	males > non-HC	–	–	–
PCaa C38:6	HC > males	–	–	–	–
PCaa C40:6	non-HC > HC HC > males	–	–	–	–
PCaa C40:4	HC > males	males > non-HC	–	–	–
PCaa C40:5	HC > males	males > non-HC males > HC	–	–	–
PCae C36:1	–	males > non-HC	–	–	–
PCae C38:0	non-HC > males	HC > non-HC males > non-HC	–	–	–
PCae C40:0	HC > males	–	–	–	–
PCae C40:6	HC > males	–	–	–	–
SM C36:0	HC > non-HC HC > males	males > non-HC males > HC	non-HC > HC	–	–
SM C38:1	non-HC > males	males > non-HC	–	–	–
SM C38:2	–	–	–	–	–
SM C40:3	–	males > non-HC	–	–	–
SM C40:4	–	males > non-HC	–	–	–
SM C40:5	non-HC > HC non-HC > males	HC > non-HC males > non-HC	–	–	–
SM C41:0	HC > non-HC HC > males	–	non-HC > HC non-HC > males	–	–

Table 3 Results for the group testing after anova *(Continued)*

SM C42:4	non-HC > HC HC > males	males > non-HC	–	–	–
SM C42:6	HC > males non-HC > males	–	–	–	–
SM C44:6	non-HC > HC HC > males	–	–	–	–
LPCa C16:0	non-HC > HC males > HC	males > non-HC males > HC	–	–	–
LPCa C16:1	non-HC > HC males > HC	–	–	–	–
LPCa C18:0	non-HC > HC males > HC	males > non-HC males > HC	–	–	–
LPCa C18:1	non-HC > HC males > HC non-HC > males	males > HC	HC > non-HC males > non-HC	–	–
LPCa C18:3	non-HC > HC males > HC non-HC > males	males > non-HC	HC > non-HC males > non-HC	–	–
LPCa C20:3	non-HC > HC males > HC	–	–	–	–
LPCa C20:4	non-HC > HC males > HC non-HC > males	–	–	–	–
LPCa C20:5	non-HC > HC males > HC	–	HC > non-HC	–	–
LPCa C22:5	non-HC > HC males > HC	–	–	–	–
LPCa C22:6	non-HC > HC non-HC > males	–	males > non-HC	–	–
LPCe C18:0	non-HC > HC	–	–	–	–
LPCe C18:1	non-HC > HC males > HC non-HC > males	males > HC	–	–	–

Direction of the difference in the 46 metabolites found significant in the anova in association with the according MetS factor. Males, HC (hormonal contraceptive-taking females) and non-HC (non-hormonal-taking females) are indicated

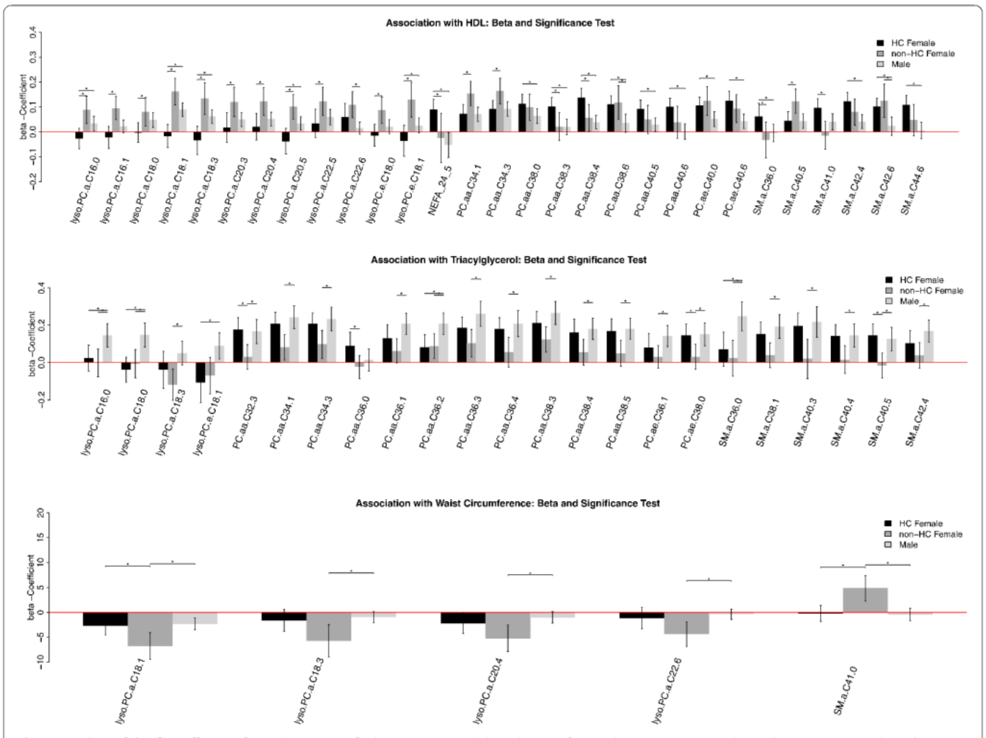

Fig. 3 Barplots of the β coefficients from the sex stratified regression models with MetS factors (WC, HDL-C, TG and sysBP) as outcome and single metabolite concentration as predictor, adjusted for ethnicity, physical activity, sedentary behaviour, dietary patterns, smoking, and alcohol consumption. Significance (*): FDR-corrected significant difference of the effect size between the sex groups. Confidence intervals: False coverage rate

metabolomics or that has investigated associations between metabolomics with different components of the MetS [3, 15]. Given a significant number of women of childbearing age are taking HC, this is a large group that is not represented or analysed in many clinical studies.

General sex differences

In the present study, we found higher WC in males than females which supports data showing obese males have more visceral adiposity than obese females [18]. Our data supports the literature in showing that HDL-C concentrations were higher in women than in men. Higher HDL-C is known to associate with lower cardiovascular risk [17]. Previous reports have shown that lower HDL-C in males associate with lower SM concentrations compared with that in females [19]. Our data are in accordance with these results.

We found LPC and SM concentrations most differentiating between males, non-HC and HC females. This might be due to a suppression of lecithin cholesterol acyltransferase (LCAT) activity by higher SM concentrations. Males, having lower SM concentrations than females, showed higher LPC concentrations, which is in accordance with LPCs being associated with higher LDL and lower HDL. The sex difference may also explain previous findings of decreased LPC concentrations in association with obesity, as LPC are higher in males than in females [20, 21].

Although higher circulating LPC levels in the blood have been predominantly associated with LCAT activity [22], higher levels of LPC have also been associated with phospholipase A_2 (PLA2) activity. This enzyme mainly associates with LDL and hydrolyses the fatty acid at the sn-2 position from phospholipids, leading to a LPC and a non-esterified fatty acid. This reaction by LPC by PLA2 is thought to play an important role in the early onset of cardiovascular diseases [23]. There is some evidence that PLA2 activity is increased in males compared with females, in accordance with our finding that LPCs were associated with male sex [24].

The difference in PC and SM levels between males and HC and non-HC females is likely related to the different distribution of lipoprotein species and their associated metabolic consequences. This may also explain some of the differences associated with HDL which is enriched in PC containing polyunsaturated fatty acids [25].

Serine was significantly higher in females. Together with palmitoyl-CoA concentrations, serine is the initial and rate-limiting metabolite in the metabolism of sphingolipids. We found that AA and especially branched chain amino acids (BCAA) concentrations were higher in males than in HC or non-HC females. BCAA and associated metabolites have been shown to associate with insulin resistance, cardiovascular disease and female sex hormones [26].

BCAA have been shown to be important in muscle metabolism, which could explain the significantly positive association of leucine with male sex rather than HC or non-HC females, since males have a higher percentage of lean body mass including muscle mass than females [27]. Testosterone is long known as an anabolic hormone linked to AA metabolism [28]. In a study in elderly men, testosterone supply led to increased strength and lean body weight [28]. In general the differences between males and females in the metabolome likely reflect differences in lipid and AA metabolism.

Hormones and hormonal contraceptives

The majority of HC provide the two hormones estrogen and progesterone, which influence AA and lipid metabolism [28–39]. We found that HC females have decreased free Carn and acyl-Carn levels together with decreased AA levels. Previous reports show female free Carn and acyl-Carn levels decrease significantly upon reaching fertile age [30]. It was suggested that estrogen levels might be the reason.

Furthermore, estrogen is associated with an increased availability of fatty acids by lipolysis and also decreases carbohydrate metabolism [19, 31].

A recent study showed that a decrease in estrogen enhances the accumulation of visceral fat in women through Aldehyde dehydrogenase 1 family, member A1 (aldh1a1), but the effect of the enzyme was not relevant in men, supporting sex differences in lipid metabolism driven by hormones [32].

Our observation of reduced concentrations of some NEFA species in males compared to non-HC females and especially HC females could be due to the higher testosterone levels in males [33]. Higher insulin concentrations are known to associate with lower NEFA levels that associate with a lower β-oxidation in the fasting state and therefore also lower acyl-Carn levels, as carrier of fatty acids.

Estrogen and estradiol have been shown to increase HDL-C blood concentrations, which is a protective marker for cardiovascular diseases. This could, in part, explain the increased risk of cardiovascular diseases in women after menopause [34]. In accordance with our findings, HC use has been associated with higher HDL-C and low-density lipoprotein-cholesterol (LDL-C) (higher than in males in our data), TG (lower in HC females compared to that in males and non-HC females in our data) concentrations [34]. This could explain the higher PC and SM concentrations in HC females compared to those in males and non-HC females, as they are the most abundant phospholipids in lipoproteins [35].

Some estrogen compounds have been shown to not only decrease concentrations of stearic acid but also, amongst others, increase palmitic acid in PC in the serum [38]. The lower levels of LPCa C16:0, LPCa C18:0 and LPCa C18:1 in HC females compared to non-HC females could be a reflection of that, since they potentially occur after cleaving a fatty acid from PCs by LCAT activity.

MetS dependent differences

Males in our study have a more adverse metabolic profile than non-HC females and HC females, with respect to WC, sysBP and TG, HDL-C and glucose concentrations and also differences in the relationships between these components and different metabolites, for example LPC concentrations between males and either HC or non-HC females.

HC and non-HC females mainly differed in SM and PC concentrations. WC, TG and HDL were associated with increased LPC concentrations that are also differently elevated between males and HC and non-HC females. This is in keeping with the finding that LPC concentrations have been associated to WC in other studies and highlights the importance of our findings.

HDL levels are associated with LCAT, an enzyme that leads to the formation of LPC [36]. In our study, males had higher levels of LPC and lower levels of HDL-C than females.

HDL is known to contain a lower SM/PC ratio than LDL, which could be a reason for HDL being mainly associated with PC and LPC species in our study [37]. The β coefficient for the association between LPC levels and components of the MetS was higher in females than in males; irrespective of whether it was a positive (sysBP, TG, HDL) or negative (TG, WC, HDL) association. This suggests a more negative effect of LPC in females than in males, possibly due to the fact, that males already have higher levels of LPC.

In our study SM had a strong association with high levels of components of the MetS in males and in HC or non-HC females. But in general, SM concentrations were higher in females (HC and non-HC) than in males.

To our knowledge there are no other studies that have performed a comprehensive metabolomics analysis examining sex differences in relation to components of the

MetS. Newbern et al. reported sex differences in insulin resistance in adults in their metabolomics study, although these were mainly in BCAAs and their by-products short-chain acyl-Carn [15].

Because of the young age of 20 years of the participants, the analysis of this cohort is valuable for future lifestyle and other prevention strategies in this age group. Additionally, the sample size is exceptionally high with more than 1000 participants. Studies like ours provide some insight into the possible mechanisms for the differences in the prevalence of diseases between sexes. These data are also important in assisting intervention and metabolomics studies conducted in the future.

The limitations of our study are that we do not have blood sex hormone concentrations or any information on the time of the estrous cycle, so the focus of this study is hypothesis generation. It is an observational cohort study with a cross-sectional analysis, which does not allow for interpretations of the directions of associations. Additionally, we had only plasma and no cell samples to measure and interpret metabolic changes, and we did not have separated lipoprotein species.

Conclusions

This study has shown clear differences between plasma metabolite concentrations in males and HC or non-HC females, especially in LPC, SM and PC, which have been shown to associate with obesity in other studies [7, 21, 38]. Further, the association of these metabolites differed between sexes with components of the MetS, which means that development of diseases like obesity and diabetes may differ between the sexes, potentially mediated by sex hormones. Our findings highlight the importance of considering sex differences when conducting a metabolomics study, and the need to account for the effect of HC usage in females in future studies. The latter finding could be of importance for early programming or pregnancy studies, as the use of HC leads to a hormonal state in the body similar to pregnant women [29, 39]. To our knowledge this is the first comprehensive analysis demonstrating differences in metabolomics between males and females, as well as the effect of HC use. Additionally, we show that the association between metabolomics markers and components of the MetS are significantly different between males and females.

Additional file

Supplemental information is available on the website of Biology of Sex Differences.

Additional file 1: Table S1. Results for the regression model of the unstratified population with the five MetS. **Table S2–S4.** Results of the Regression model with Metabolite concentration as outcome and two-level sex variable as predictor. **Table S5.** Results for the ANOVA for the five MetS Factors. **Table S6**: Results for the group testing after the Anova. **Table S6.1.** Results for the testing of hfemales versus nhfemales. **Table 6.2.** Results for the testing of males versus hfemales. **Table S6.3.** Results for the testing of males versus nhfemales. **Table 7.** Median, 25% and 75% quartile for every metabolite (215) of the Raine Study metabolomics dataset stratified by males and non-hormonal and hormonal contraceptive-taking females. **Table S7.1.** Non-hormonal contraceptive-taking females. **Table S7.2.** Hormonal contraceptive-taking females. **Table S7.3.** Male subset. (DOCX 530 kb)

Abbreviations

AA: Amino acids; acyl-Carn: Acyl-Carnitine; aldh1a1: Aldehyde dehydrogenase 1 family, member A1; Anova: Analysis of variance; BCAA: Branched chain amino acids; Carn: Free carnitine; CoA: Coenzyme A; HC females: Hormonal contraceptive-taking females; HDL-C: High-density lipoprotein cholesterol; LCAT: Lecithin cholesterol acyltransferase; LC-MS/MS: Liquid chromatography-tandem mass spectrometry; LDL-C: Low-density lipoprotein cholesterol; LPC/LPCa: Lyso-phosphatidylcholines; LPCe: alkyl-linked lyso-phosphatidylcholines; MetS: Metabolic syndrome; NEFA: Non-esterified fatty acids; Non-HC females: Non-hormonal contraceptive-taking females; PCA: Principal component analysis; PCaa: Diacyl-phosphatidylcholines; PCae: Acyl-alkyl-phosphatidylcholines; SM: Sphingomyelines; sysBP: Systolic blood pressure; TG: Triacylglycerol; WC: Waist circumference

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Availability of data and materials

The datasets during and/or analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

SR wrote the paper and performed the statistical analysis and data interpretation. CH contributed to the statistical analysis and data interpretation. OU performed LC-MS/MS analysis and contributed to data interpretation. BK and WO conceived the study. TM was responsible for the collection, storage and shipment of plasma to Germany, for metabolomics analysis. TM, LB and WO were responsible for all data collection. All co-authors have contributed to the content, read and approved the final manuscript.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Ethics approval at the 20-year follow-up was obtained from the University of Western Australia Human Research Ethics Committee. Informed and written consent was obtained from participants.

Publisher's Note

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Supplemental Material can be found at the end of this document.

5. Summary

Objectives

The prevalence of non-communicable disorders and diseases such as insulin resistance and obesity are currently on the rise worldwide in adults and children. However, the underlying metabolic mechanisms are not fully understood yet. Therefore, the methods of metabolomics are a good tool to analyse these mechanisms. Metabolomics analyses small molecules (M_W<1.5kDa) in biological samples. The results collected can then be used for basic research, epidemiological studies or in the clinic in the form of biomarker.

In the field of metabolomics, sex differences and underlying non-communicable disease development, are highly underrepresented. The aim of this thesis was to find potential markers for obesity and insulin resistance, as well as to analyse sex differences with respect to females taking hormonal contraceptives. The group of females taking hormonal contraceptives was taken into account, as the majority of the women are at least taking the pill, since its development in the 1960s and hormones are known to influence the metabolism. The overall aim was to set the foundation for future biomarker studies for obesity, insulin resistance and the metabolic syndrome, as well as to sensitise future biomarker studies and clinical application of those to sex differences.

Methods

Blood plasma samples together with anthropometric, sociodemographic and biological data from the 20 year follow-up of the Western Australian Pregnancy Cohort (Raine) Study have been analysed with the aim to find potential biomarkers for obesity and insulin resistance, as well as variables being associated with the metabolome.

Firstly, metabolomics data coming from the laboratory underwent quality control. Following, was an analysis strategy, which has been developed for the metabolomics data set containing more than 200 individual metabolites, in association with obesity and insulin resistance. Further, markers for the metabolic syndrome, namely HDL-C, triacylglycerol and glucose concentrations as well as systolic blood pressure and waist circumference, have been analysed with respect to sex differences. To analyse the association between the metabolomics data and waist circumference/BMI and HOMA-Index as a marker for insulin resistance, multiple linear regression analysis has been performed, as it was possible to analyse single metabolites

and their associations with the aforementioned obesity and insulin resistance marker. For sex differences, principal components analysis, analysis of variance and post-hoc regression analysis have been performed. All models have been corrected for multiple testing.

Principal component analysis was used to depict the general variance in the data, by that the data was reduced to its principal components. These components contain a loading factor for every metabolite resulting from the laboratory analysis based on the variance, which this metabolite explains in relation to the general data set. By plotting the two components, that explain the biggest part of the variance, one can see if there are cluster, which, in the case of sex group analysis, explain the grouping.

Results

Sphingomyelin (SM), and phosphatidylcholine (PC) patterns have been identified as potential markers for waist circumference, while lyso-phosphatidylcholine C14:0 was associated with HOMA-IR. The results suggest weight status-dependent mechanisms for the development of IR with the respective lyso-phosphatidylcholine C14:0 as a key metabolite in non-obese IR.

Further, an analysis according to sex showed significant differences, not only in general, but also disease specific. More than 100 metabolites have been significantly differently associated with sex and hormonal contraceptive use, 43 were significantly different in their effect size on disease markers for the metabolic syndrome and highlighted the importance and need for sex specific analysis in metabolomics and interventional as well as biomarker studies that also take hormonal contraceptive-usage in females into account.[1]

Conclusion

In conclusion, this thesis showed that metabolomics seems to be valid for cross sectional analyses, showing potential marker for obesity and insulin resistance. Furthermore, the importance of sex sensitive or stratified analysis in the field of metabolomics biomarker studies was shown.

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[1] As from the presentation of this thesis at the Power of Programming Conference 2016 in Munich: "The Power of Programming 2016. Developmental Origins of Adiposity and Long-Term Health. October 13-15, 2016, Munich: Abstracts." Ann Nutr Metab 69(2): 99-118.

6. Zusammenfassung

Ziele

Die Prävalenz nicht-übertragbarer Krankheiten wie Insulinresistenz und Adipositas steigt weltweit unter Erwachsenen und Kindern. Die zugrundeliegenden metabolischen Mechanismen sind nicht vollständig geklärt. Für dieses Forschungsfeld bietet sich daher die Analyse von Humanproben mit Hilfe von Metabolomics an. Metabolomics beruht auf der Erfassung und Erforschung der kleinsten Moleküle im Stoffwechsel (M_W<1.5kDa). Die Ergebnisse können dann für Grundlagenforschung, epidemiologische Studien oder in der Klinik in Form von Biomarkern verwendet werden. In den oben genannten Krankheiten sind Geschlechterunterschiede bekannt, die auf der metabolischen Ebene so gut wie nicht erforscht sind, obwohl es etliche Hinweise auf deren Bestehen gibt. Aus diesem Grund war das Ziel dieser Arbeit, frühe Marker für Adipositas und Insulinresistenz, sowie deren zugrunde liegenden Geschlechterunterschiede mit Berücksichtigung der Gruppe von Frauen, die Hormonkontrazeptiva verwenden, zu finden. Die Gruppe der Kontrazeptiva wurde deshalb berücksichtigt, weil ein Großteil der Frauen zumindest die Pille verwendet, seit diese in den 60ern eingeführt wurde und Hormone bekanntermaßen den Stoffwechsel beeinflussen. Das übergeordnete Ziel war es, die Grundlage für zukünftige Biomarker für Adipositas, Insulinresistenz und das Metabolische Syndrom zu schaffen, sowie zukünftige Biomarker- und Metabolomics-Studien und deren Anwendung für Geschlechterunterschiede zu sensibilisieren.

Methoden

In dieser Arbeit wurden Blutplasmaproben sowie anthropometrische, soziodemographische und biologische Daten der Western Australian Pregnancy Cohort (Raine) Study mit dem Ziel analysiert, einerseits potentielle Biomarker für Adipositas und Insulinresistenz zu finden und andererseits potentielle Geschlechterunterschiede im Metabolom zu untersuchen.

Zuerst musste eine Qualitätskontrolle der aus dem Labor kommenden Metabolomics Daten durchgeführt werden. Im Anschluss wurde eine Analysestrategie für den Datensatz mit mehr als 200 individuellen Metaboliten entwickelt, die diesen zusammen mit Markern für Adipositas und Insulinresistenz untersucht. Im Weiteren wurden Marker für das metabolische Syndrom, namentlich HDL-C, Triacylglycerol und Glukose-Konzentrationen, sowie systolischer

Blutdruck und Hüftumfang, unter Berücksichtigung von Geschlechterunterschieden analysiert.

Um die Assoziationen zwischen den Metabolomics Daten und Hüftumfang bzw. BMI und dem HOMA-Index als Marker für Insulinresistenz zu analysieren, wurde die Methodik der multiplen linearen Regression verwendet, da hierbei einzelne Metaboliten und deren Assoziation mit BMI und HOMA untersucht werden konnten.

Für die Geschlechterunterschiede wurde die Hauptkomponentenanalyse (principal components analysis, PCA), Varianzanalyse (ANOVA) und post-hoc Regressionsanalyse verwendet. Alle Modelle wurden für multiples testen korrigiert.

Die PCA wurde zur Untersuchung der generellen Varianz in den Daten herangezogen, indem hierbei der Datensatz auf seine Hauptkomponenten reduziert wurde. Diese Hauptkomponenten enthalten, basierend auf der Varianz, die dieser Analyt in den Gesamtdaten erklärt, für jeden aus der Laboranalyse resultierenden Analyten einen Gewichtungsfaktor. Indem man die beiden Komponenten die die meiste Varianz erklären plottet, erkennt man, ob sich Cluster bilden, die in diesem Fall die Geschlechtergruppen erklären.

Ergebnisse

Es konnten sowohl Sphingomyelin- und Phosphatidylcholine-Muster als potentielle Marker für Hüftumfang identifiziert werden, als auch Lyso-Phosphatidylcholine C14:0 als Marker für Insulinresistenz in nicht-adpösen Patienten. Diese Ergebnisse suggerieren einen gewichtsabhängigen Mechanismus welcher der Entwicklung von Insulinresistenz zugrunde liegt, mit dem Lyso-Phosphatidylcholine C14:0 als Schlüsselmetaboliten in nicht-adipösen Insulinresistenzpatienten.

Des Weiteren konnten nicht nur generelle, sondern auch krankheitsbildspezifische, signifikante Geschlechterunterschiede gezeigt werden. Mehr als 100 Metaboliten waren signifikant Unterschiedlich mit dem Geschlecht oder der Hormonkontrazeptiva Gruppe assoziiert, während 43 signifikant unterschiedliche Effektgrößen in Assoziation mit Markern für das Metabolische Syndrom zeigten. Dieses Ergebnis zeigt die Bedeutung und den Bedarf an geschlechtsspezifischer Analyse in Biomarker Studien in Metabolomics, die auch die Gruppe der Frauen, die hormonelle Kontrazeptiva einnehmen, berücksichtigt.

Schlussfolgerungen

Zusammenfassend konnte diese Arbeit zeigen, dass Metabolomics ein valides Instrument zur Querschnittsanalyse darstellt, welches potentielle Biomarker für Adipositas und Insulinresistenz aufzeigen konnte. Außerdem zeigte sich die Wichtigkeit Geschlechtersensitiver oder –stratifizierter Analysen im Bereich der Biomarkersuche und –Forschung in Metabolomics. Es kann empfohlen werden, dass in zukünftigen Studien das Geschlecht der Studienteilnehmer stärkere Berücksichtigung finden sollte.

7. Publications and Presentations

Publications

Rauschert S, Uhl O, Koletzko B, Hellmuth C. Metabolomic biomarkers for obesity in humans: a short review. Annals of Nutrition & Metabolism. 2014;64(3-4):314-24.

Rauschert S, Uhl O, Koletzko B, Kirchberg F, Mori TA, Huang RC, et al. Lipidomics Reveals Associations of Phospholipids With Obesity and Insulin Resistance in Young Adults. The Journal of Clinical Endocrinology and Metabolism. 2016 Mar;101(3):871-9

Rauschert S, Uhl O, Koletzko B, Mori TA, Beilin LJ, Oddy WH, et al. Sex differences in the association of phospholipids with components of the metabolic syndrome in young adults. Biology of sex differences. 2017;8(1):10

Rauschert S, Kirchberg FF, Marchioro L, Koletzko B, Hellmuth C, Uhl O. Power of Programming - Early Programming of Obesity throughout the Lifecourse: A Metabolomics Perspective. 2017; Accepted for publication by Annals of Nutrition and Metabolism

Presentations

Rauschert S, Uhl O, Koletzko B, Kirchberg F, Mori TA, Huang RC, et al. Lipidomics Reveals Associations of Phospholipids With Obesity and Insulin Resistance in Young Adults Metabomeeting 2015, Cambridge, UK: Oral Presentation.

Rauschert S, Uhl O, Koletzko B, Mori TA, Beilin LJ, Oddy WH et al. Sex Differences in the Association of Phospholipids with Components of the Metabolic Syndrome in Young Adults. Metabolomics 2016, Dublin, Ireland: Poster Presentation.

Rauschert S. Analysis of Metabolic Profiles in Adolescents from the RAINE Cohort by Clinical Targeted Metabolomics - Metabolic Consequences of Early Programming 2016, The Power of Programming Conference, Munich: Invited Speaker

Rauschert S, Standl M, Uhl O, Thiering E, Lehmann I, Koletzko B, et. al. Obesity associated sex differences in the metabolome of pre- and post-pubertal children 2017 ESPGHAN 50th Annual Meeting, Prague, Czech Republic: Poster Presentation.

Awards/Grants

2014	Brain Mobility Grant for the Project EarlyNutrition; Grant Agreement No. 289346
2015	Danone Travel Award
2017	ESPGHAN Young Investigators Award 2017

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Supplemental Material

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

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Abbreviated title: Associations of phospholipids with obesity and IR

Key terms (7): obesity, insulin resistance, lipidomics, sphingomyelin, lyso-phosphatidylcholine, lipoproteins, Raine study

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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

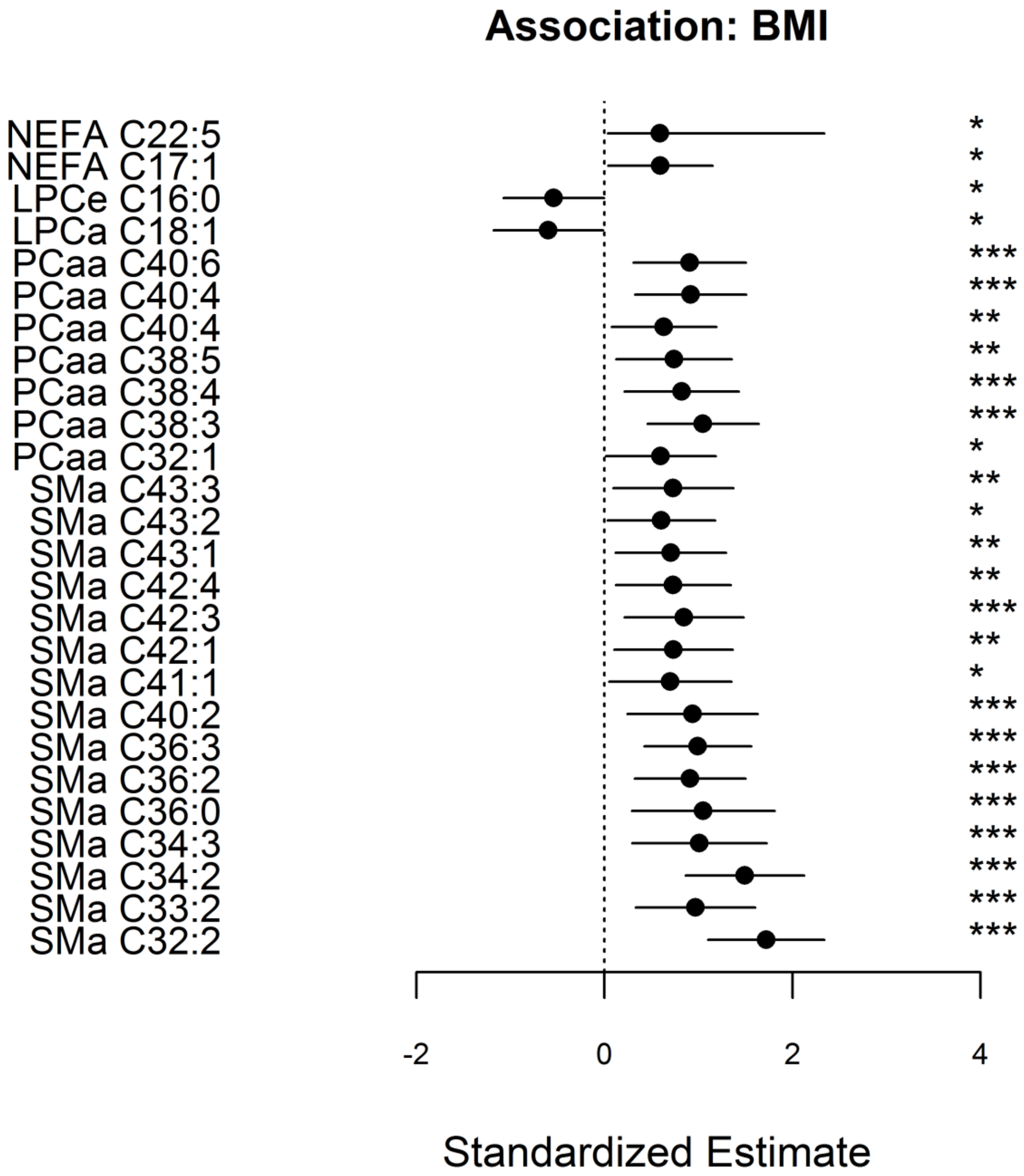
PC.aa.C40.1	-0.43	-1.83, 0.97	0.259	1
PC.ae.C32.1	-0.03	-0.15, 0.08	0.27	1
NEFA.18.2	0	-0.01, 0	0.27	1
PC.aa.C42.6	-0.14	-0.59, 0.32	0.274	1
PC.aa.C40.6	0	-0.01, 0.01	0.278	1
SM.a.C39.2	-0.05	-0.23, 0.13	0.283	1
SM.a.C34.1	0	-0.01, 0	0.285	1
PC.ae.C36.1	0.02	-0.05, 0.09	0.287	1
PC.ae.C38.4	-0.01	-0.04, 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

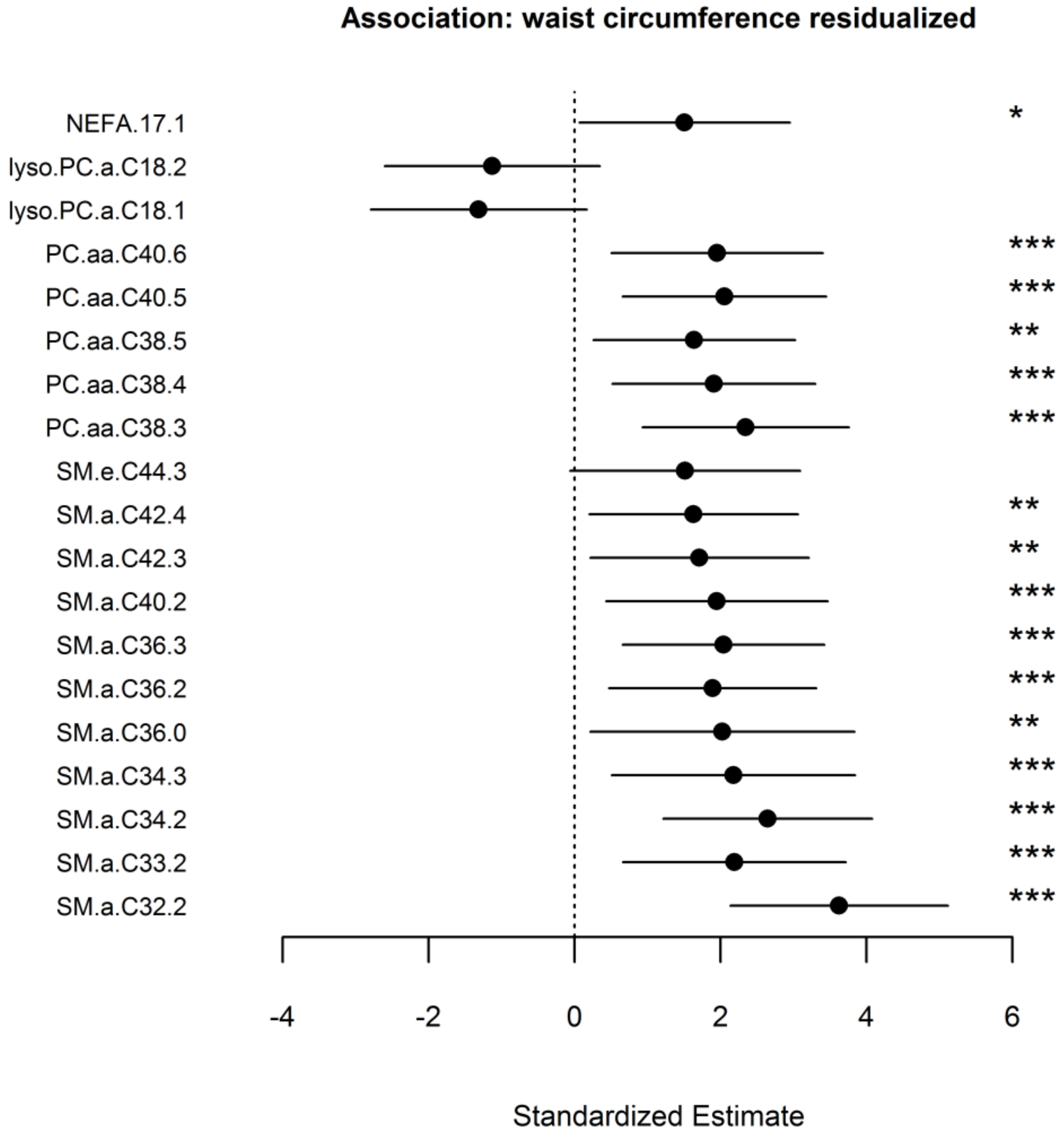
Figures

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.

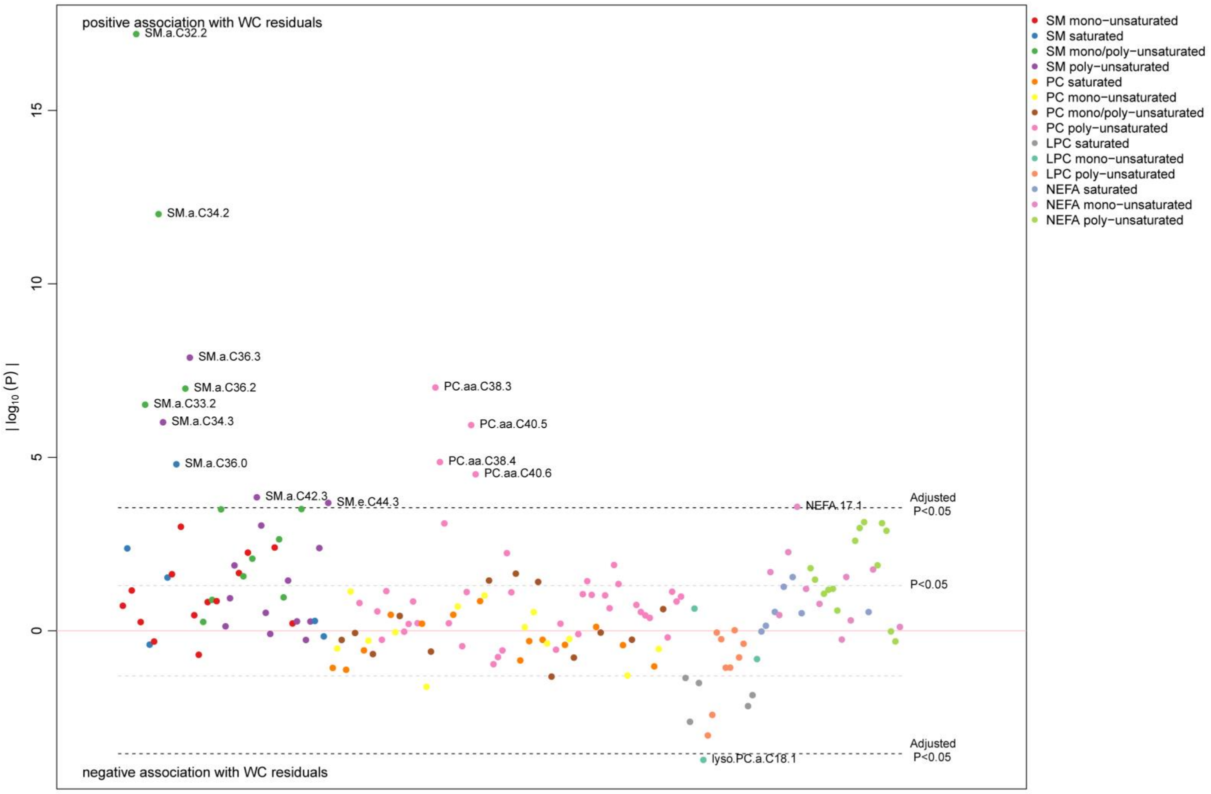


Supplemental Figure 2. Significant analytes of the residualized multiple linear regression model with WC residuals as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity 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.

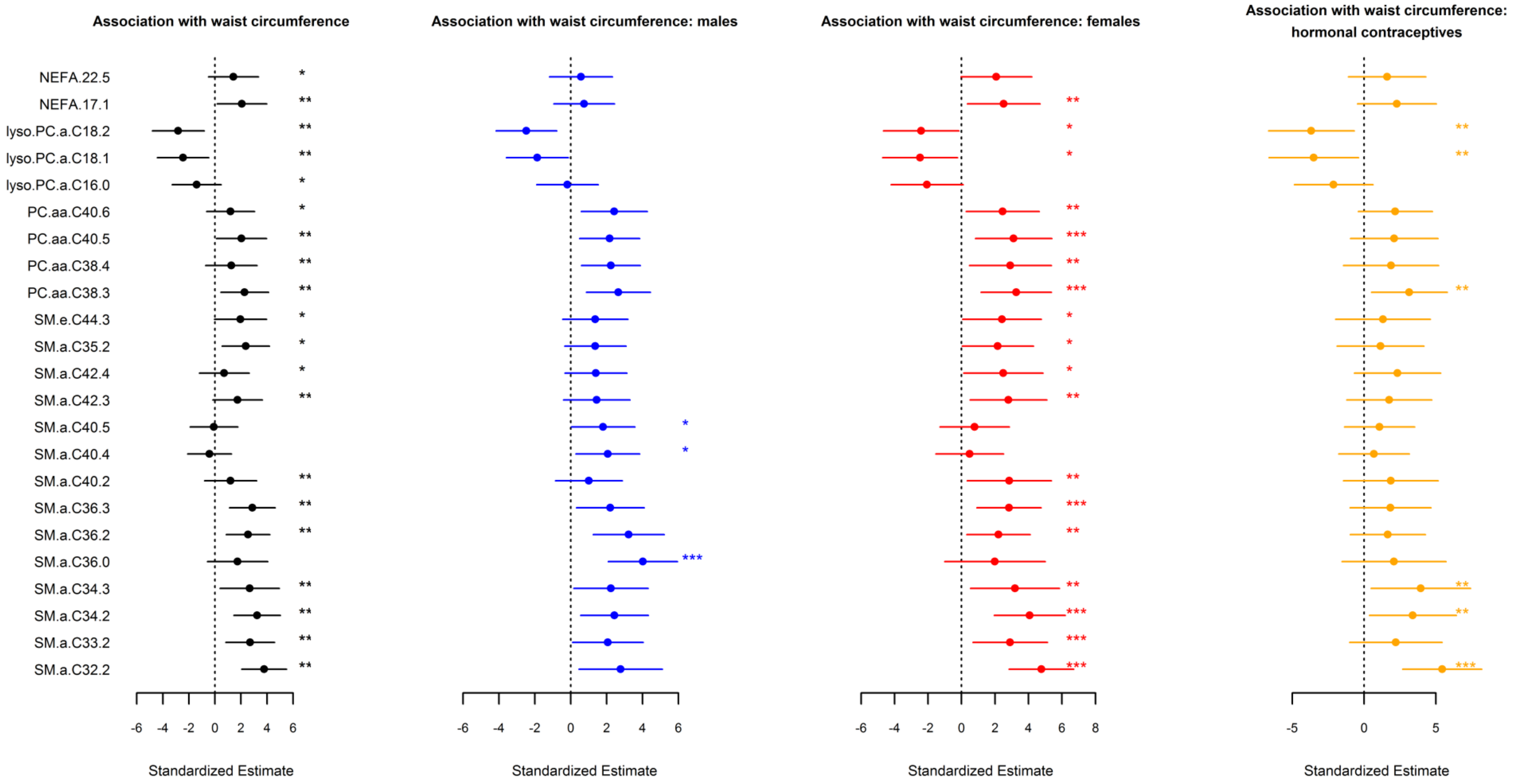
Residualization: Residualizing means running a preliminary regression analysis using one of the predictor variables to predict the outcome (LDL-C and HDL-C concentrations to predict WC, BMI, HOMA and insulin). The residuals from this analysis constitute the new outcome variable, and is guaranteed to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



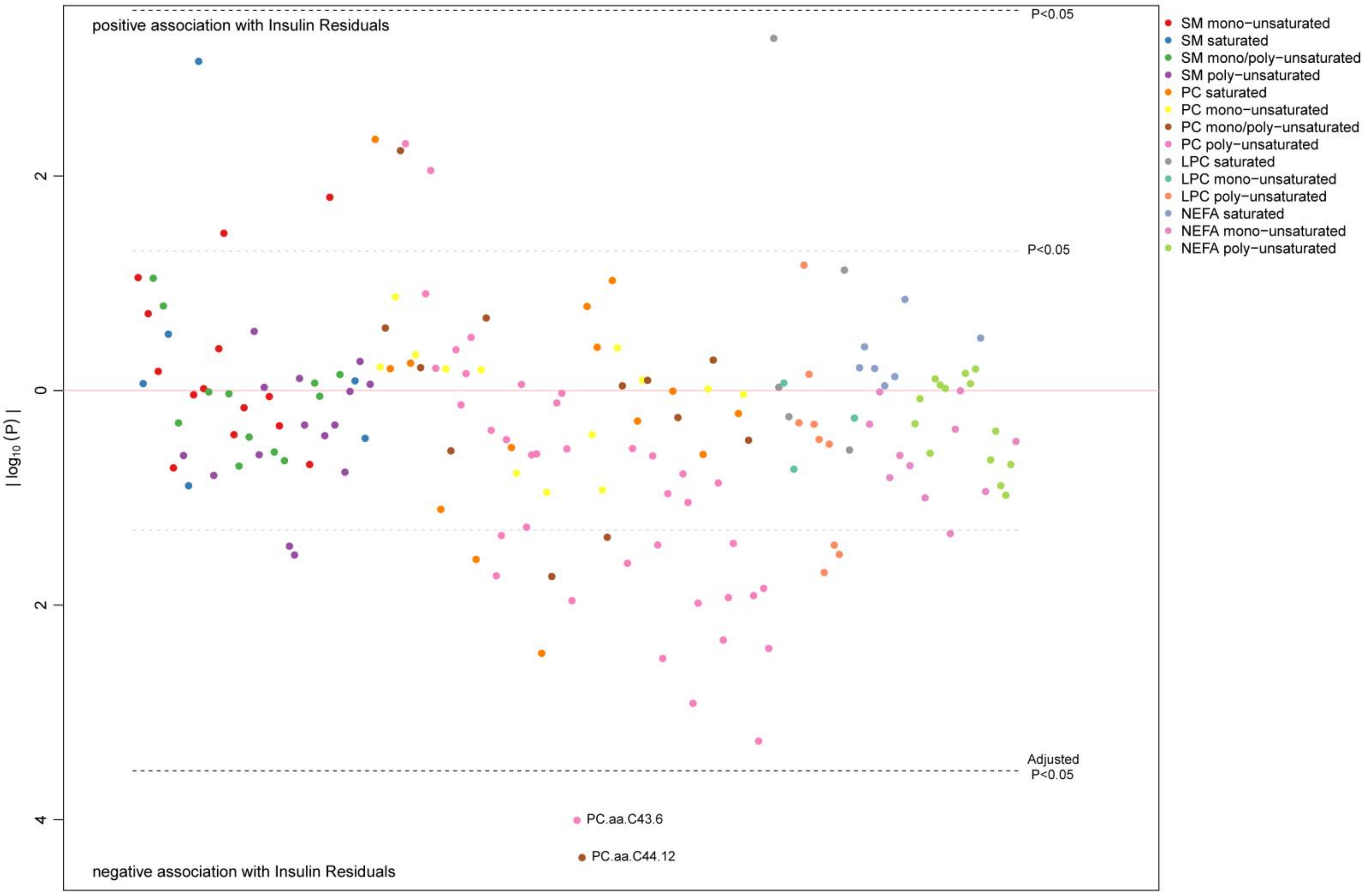
Supplemental Figure 3. Manhattan plot of the analytes of the multiple regression model for WC values to show metabolite trends. Light dashed line: corresponds to the significance level of α=0.05. Dark dashed line: corresponds to the Bonferroni corrected significance level of α=0.05/175 (number of analytes). 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.



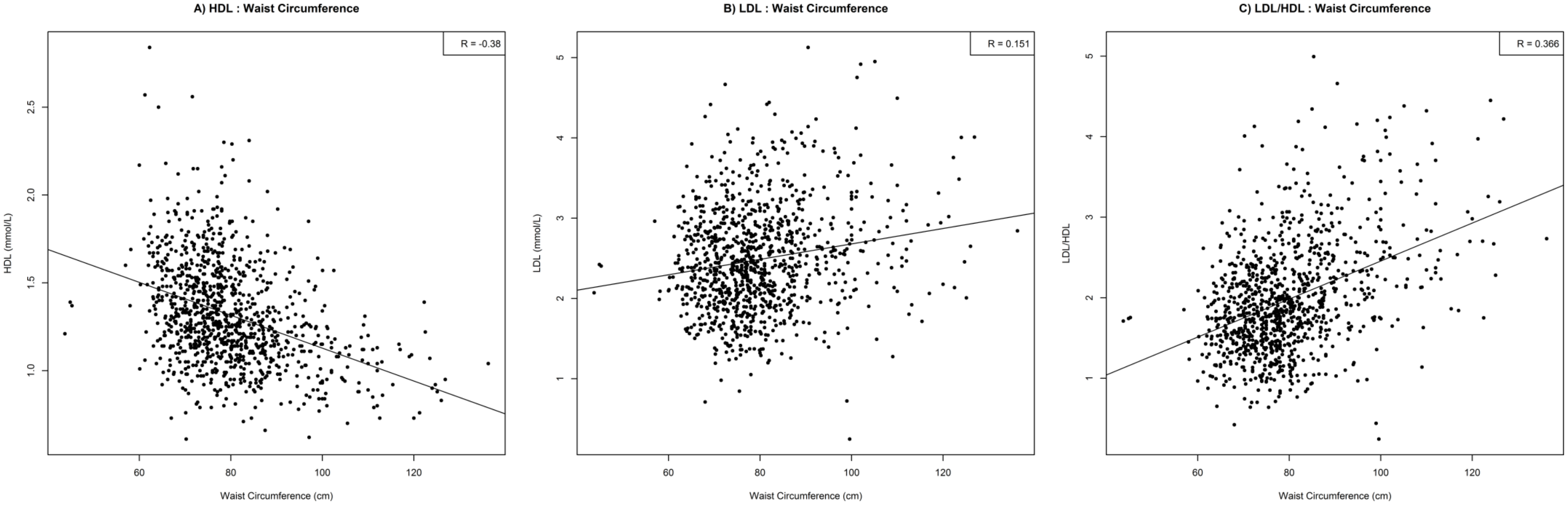
Supplemental Figure 4. Significant analytes of the stratified multiple linear regression model for all participants (black), males (blue), females not taking oral contraceptives (red) and females taking oral contraceptives (yellow) with waist circumference as outcome and metabolite concentrations as 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.



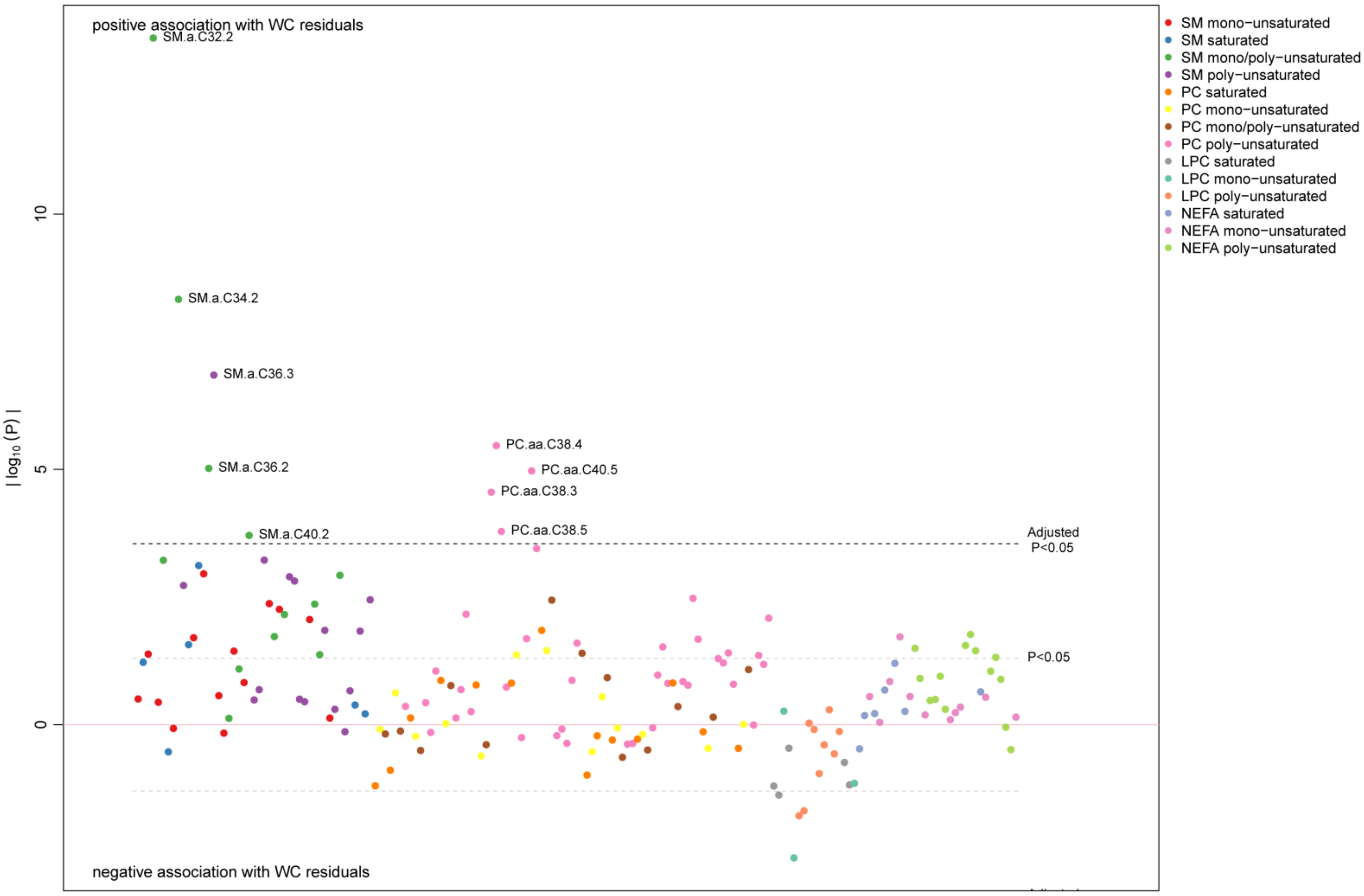
Supplemental Figure 5. Manhattan plot of the analytes of the multiple regression model for insulin values to show metabolite trends. Light dashed line: corresponds to the significance level of α=0.05. Dark dashed line: corresponds to the Bonferroni corrected significance level of α=0.05/175 (number of 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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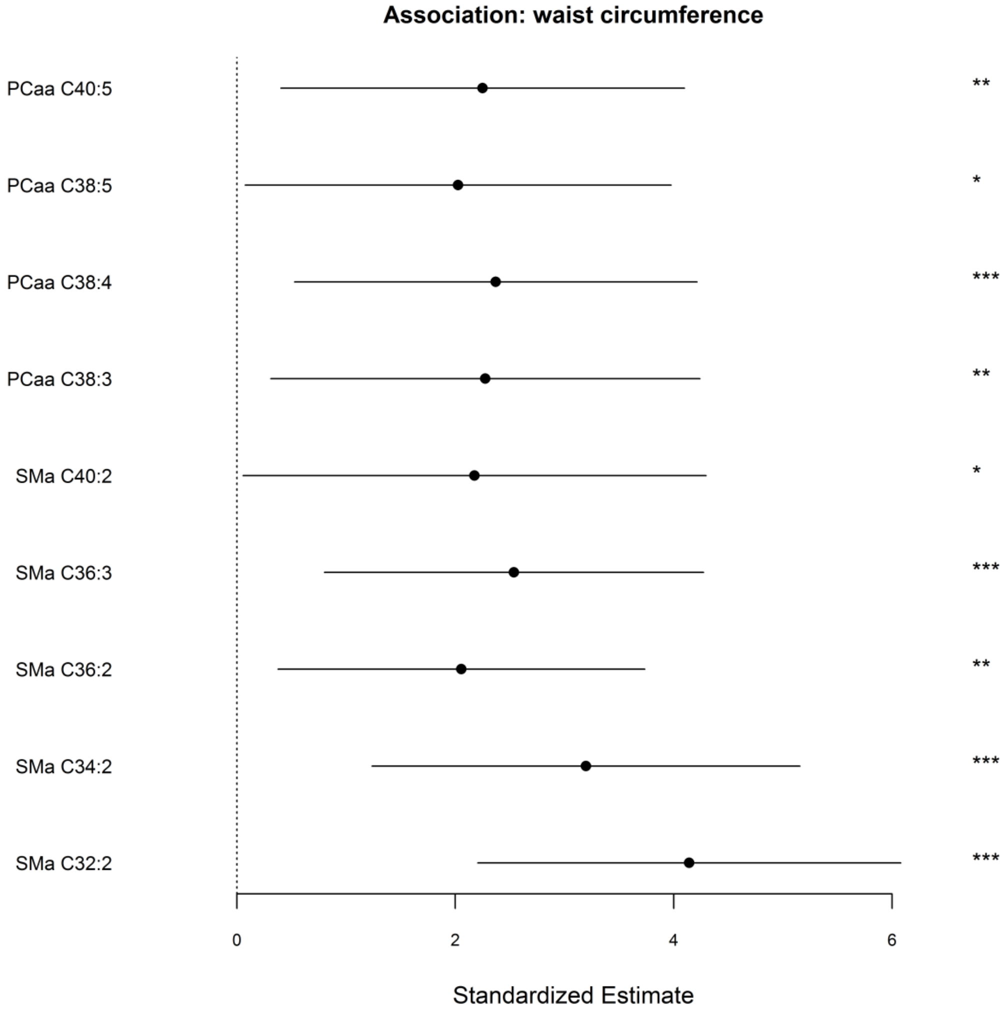
Supplemental Figure 8. Significant analytes of the multiple linear regression model with WC as outcome and metabolite concentrations as predictor, adjusted for sex, HOMA values, LDL-c, HDL-c, dietary patterns, dietary misreporting, smoking and drinking behaviour, physical activity and sedentary behaviour, 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.



Supplemental Material

Sex Differences in the Association of Phospholipids with Components of the Metabolic Syndrome in Young Adults

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Inhalt

Metabolomics measurements

A phlebotomist visited the home of each participant early in the morning and venous blood samples were taken from an antecubital vein after an overnight fast. Samples were processed and stored at -80˚C. After labelling and packing 1176 plasma EDTA samples in 100µl tubes, they were transported on dry ice from the Royal Perth Hospital Research Unit in Perth, Western Australia, to the Division of Metabolic and Nutritional Medicine of the Dr. von Hauner Children´s Hospital in Munich, Germany, and stored at –80°C until analysis by liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS).

Amino Acids

AA were prepared by derivatization to AA butylester, and determined by LC-MS/MS equipped with 150 x 2.1 mm, 3.5 µm particle size C18 HPLC column (X-Bridge, Waters, Milford, USA) and 0.1% heptafluorobutyric acid as ion pair reagent in water as mobile phase A and in methanol as mobile phase B (1). Mass spectrometry detection was performed with an atmospheric pressure chemical ionization source operating in positive ionization mode.

Non-esterified fatty acids

NEFA were analysed by LC-MS/MS operating in negative electrospray ionization mode as described previously (2).

Isopropanol (200 µl, containing 2 mg/100 ml ^{13}C-labelled palmitic acid) and 20 µl plasma was mixed in a 96-deepwell plate. After centrifugation the supernatant was transferred into another 96-well plate for LC-MS/MS analysis. For chromatographic separation an UPLC diphenyl column (Pursuit UPS Diphenyl, 1.9 µm, 100 mm, 3.0 mm; Varian, Darmstadt, Germany) was used with 5 mM ammonium acetate and 2.1 mM acetic acid in water as mobile phase A and acetonitrile/ isopropanol (80:20) as mobile phase B at 40°C with an Agilent 1200 SL series HPLC system (Waldbronn, Germany). The injection volume was set to 10 µL with an eluent flow rate of 700 µL/min. A hybrid triple quadrupole MS (4000 QTRAP, AB Sciex, Darmstadt, Germany) operating in negative electrospray ionization mode was coupled to the HPLC system for identification of NEFA. Fatty acids are separated according to chain length and number of double bonds, but not according to position of double bonds.

Quantification of NEFA has been carried out by comparison of signal-to-internal standard-ratios between samples and dilutions of a commercial available standard mixture. The lipid species are described using the nomenclature CX:Y, where X is the length of the carbon chain (C), Y is the number of double bonds. Metabolite concentrations are reported in µmol/L plasma.

Polar lipids

Polar lipids were analyzed by flow-injection analysis with a LC-MS/MS with electrospray ionization source (3).

Proteins of 10 µL plasma were precipitated by adding 500 µL methanol, including 1-tridecanoyl-2-hydroxy-sn-glycero-3-phosphocholine and 1,2-dimyristoyl-sn-glycero-3-phosphocholine as internal standards with a concentration of approximately 2 µmol/L and ammonium acetate with a concentration of 0.4 g/l. Samples were prepared using a 1.2 mL 96-deepwell plate. The plate was shaken for 30 minutes with 800 rpm and afterwards cooled for 20 minutes at -20°C. After centrifugation at 4000 rpm for 10 minutes, 100 µL of the supernatant was transferred to a 1.0 mL 96 deepwell-plate, prefilled with 350 µL methanol.

A liquid chromatographic system (1200, Agilent, Waldbronn, Germany) was used as flow-injection analyses coupled to a triple quadrupole mass spectrometer (QTRAP4000, Sciex, Darmstadt, Germany) with an electrospray ionization source. Analyses were split in two periods per sample each with 30 µL injection volume to cover the full range of analytes. Samples were injected in 40 µL/min mobile phase with isocratic elution (76% isopropanol, 19% methanol and 5% water) and the flow was diluted by adding a further 200 µL/min mobile phase "post-column" via a T-piece adapter to stabilize the electro spray for ionization. Mass spectrometric analysis was carried out in Multiple Reaction Monitoring mode. Period one was operated with positive and negative ionisation and period two with positive ionisation.

Quantification of metabolites was performed by comparison of signal-to-internal standard-ratios between samples and commercially available lyophilized aliquots of control plasma (Recipe, Germany). The concentrations of the control plasma were determined by AbsoluteIDQ p150 Kit from Biocrates®, a previous published LC-MS/MS method [4] and by in-house quantification with various standards. The entire analytical process was post-processed by Analyst 1.5.1 and the isotopomer correction for up to M+4 was applied by R (programming language, version 3.0.1).

Quality Control

The quality control (QC) criterion was defined as inter- and intra-batch coefficient of variance of 30% and values above 1.5 times the interquartile range were defined as outlier. Further, z-scores for metabolites per batch were used.

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Tables

Supplemental Table 1: Results for the regression model of the unstratified population with the five MetS Factors (waist circumference, HDL, triglyceride, glucose and systolic blood pressure) as outcome and single metabolite concentration as predictor. Adjusted for ethnicity, dietary patterns, dietary misreporting, physical activity, sedentary behaviour smoking and alcohol consumption. P-value, beta coefficient, confidence intervals (CI), number of observations per metabolite and FDR corrected P-values reported.

Waist circumference

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	0.00036183	1.58088007	0.00228806	0.71469855	2.4470616	757
Carn.a.C10.0	0.66588078	0.22371168	0.72672268	-0.79370052	1.24112388	480
Carn.a.C10.1	0.37514533	0.4983321	0.4744485	-0.60482466	1.60148885	467
Carn.a.C12.0	0.19050003	-0.65947435	0.2989599	-1.6479726	0.32902389	474
Carn.a.C12.1	0.07088087	1.11424383	0.14795521	-0.09527556	2.32376321	408
Carn.a.C14.0	0.07743779	0.80104334	0.15706721	-0.0883679	1.69045458	630
Carn.a.C14.1	0.10574007	0.72957349	0.19104298	-0.15479316	1.61394014	689
Carn.a.C14.2	0.2695129	0.49413102	0.37488662	-0.38382846	1.3720905	683
Carn.a.C16.0	0.04049564	0.91238205	0.10035271	0.03960509	1.78515901	754
Carn.a.C16.1	0.045927	0.90452202	0.10944375	0.01640582	1.79263822	687
Carn.a.C18.0	0.05786634	-0.93071987	0.12695167	-1.89257833	0.03113859	606
Carn.a.C18.1	0.0562722	0.82490344	0.12602628	-0.02211339	1.67192027	756
Carn.a.C2.0	0.03129602	0.94386456	0.08410806	0.08498827	1.80274085	706
Carn.a.C3.0	6.95E-06	2.00711941	9.34E-05	1.1367953	2.87744352	756
Carn.a.C4.0	0.15842469	0.66308807	0.25804022	-0.25904465	1.58522079	656
Carn.a.C4.0.DC	0.10200087	0.93233223	0.18584904	-0.18595786	2.05062231	417
Carn.a.C5.0	0.06901166	0.93094902	0.14546575	-0.07278094	1.93467899	503
Carn.a.C6.0	0.00180767	1.43751107	0.00883291	0.53664385	2.33837829	640
Carn.a.C8.1	0.10793109	0.76306158	0.19337653	-0.16779586	1.69391901	576
lyso.PC.a.C14.0	0.67965645	0.17581925	0.7362138	-0.65973595	1.01137445	754
lyso.PC.a.C16.0	0.0830574	-0.76100589	0.16534576	-1.62183148	0.09981969	706
lyso.PC.a.C16.1	0.01495541	1.06852715	0.04728549	0.20851321	1.92854108	757
lyso.PC.a.C18.0	0.58056149	-0.23119537	0.66749049	-1.05222972	0.58983897	757
lyso.PC.a.C18.1	4.50E-06	-2.02800999	6.45E-05	-2.88921907	-1.16680091	706
lyso.PC.a.C18.2	2.08E-06	-2.05996676	3.44E-05	-2.90507296	-1.21486056	706
lyso.PC.a.C18.3	0.00996003	-1.26663425	0.03569012	-2.22876313	-0.30450536	605
lyso.PC.a.C18.6	0.62260907	-0.24901276	0.70084267	-1.24235693	0.74433142	548
lyso.PC.a.C20.2	0.00683885	-1.46529388	0.02514551	-2.52526266	-0.4053251	499
lyso.PC.a.C20.3	0.09298055	-0.80299958	0.17233465	-1.74026028	0.13426112	646
lyso.PC.a.C20.4	0.0463227	-0.86113669	0.10944375	-1.70820015	-0.01407323	757
lyso.PC.a.C20.5	0.37439658	0.38901964	0.4744485	-0.47031033	1.2483496	698
lyso.PC.a.C22.5	0.22093947	-0.56552746	0.33218172	-1.47188279	0.34082786	666
lyso.PC.a.C22.6	0.2702671	-0.46678049	0.37488662	-1.29741289	0.3638519	717
lyso.PC.e.C16.0	0.45389071	-0.31616098	0.54517599	-1.14446031	0.51213835	756
lyso.PC.e.C18.0	0.04764896	-0.87089278	0.11135355	-1.7327373	-0.00904825	740

lyso.PC.e.C18.1	0.24602805	-0.59728802	0.3526402	-1.60761758	0.41304155	548
PC.aa.C30.0	0.39979	-0.355774	0.49399339	-1.18480889	0.4732609	753
PC.aa.C30.1	0.20686477	-0.64889327	0.31997069	-1.65755925	0.3597727	538
PC.aa.C30.2	0.12700512	-0.83025723	0.2238205	-1.89743804	0.23692358	501
PC.aa.C32.0	0.02747963	-0.95245345	0.07574514	-1.79891217	-0.10599474	757
PC.aa.C32.1	0.08604688	0.76025907	0.16725214	-0.10806643	1.62858456	665
PC.aa.C32.2	0.3889363	-0.39743258	0.48608559	-1.30267206	0.50780691	648
PC.aa.C32.3	0.13866685	0.66047265	0.23313763	-0.21428781	1.53523312	666
PC.aa.C34.0	0.17264647	-0.65811486	0.27293375	-1.60483055	0.28860083	547
PC.aa.C34.1	0.40628223	-0.36238661	0.49631068	-1.21862118	0.49384795	716
PC.aa.C34.2	0.00419193	-1.27298828	0.01669011	-2.14297717	-0.40299939	706
PC.aa.C34.3	0.86032556	-0.07736999	0.89357486	-0.94036005	0.78562007	706
PC.aa.C34.4	0.70717396	-0.1663548	0.75268516	-1.03554136	0.70283175	665
PC.aa.C34.5	0.07242832	0.77830654	0.14842342	-0.07105577	1.62766884	674
PC.aa.C36.0	0.95749141	-0.02394423	0.96196567	-0.90562312	0.85773467	705
PC.aa.C36.1	0.88355671	0.06683623	0.91329179	-0.82880898	0.96248143	705
PC.aa.C36.2	0.22678755	-0.53473464	0.33396796	-1.40259662	0.33312735	706
PC.aa.C36.3	0.14156174	-0.63882779	0.23412134	-1.49109309	0.2134375	716
PC.aa.C36.4	0.5644323	-0.25873223	0.65243519	-1.13989909	0.62243463	665
PC.aa.C36.5	0.01757331	1.0704991	0.05321496	0.18753199	1.95346622	625
PC.aa.C36.6	0.32910692	0.42134587	0.43409809	-0.42568999	1.26838173	750
PC.aa.C38.0	0.16658191	-0.6494705	0.26727695	-1.57039149	0.27145049	665
PC.aa.C38.1	0.00414973	-1.37491523	0.01669011	-2.31325491	-0.43657554	605
PC.aa.C38.2	0.21850264	-0.54734569	0.33083147	-1.4198794	0.32518801	715
PC.aa.C38.3	4.12E-07	2.33589443	1.27E-05	1.43942678	3.23236209	648
PC.aa.C38.4	0.00206409	1.40604322	0.00986175	0.51354803	2.2985384	648
PC.aa.C38.5	0.03608309	0.93896377	0.091269	0.06112834	1.81679921	648
PC.aa.C38.6	0.69328292	-0.19156882	0.74157128	-1.14494385	0.7618062	648
PC.aa.C40.0	0.24571313	-0.58028038	0.3526402	-1.5610733	0.40051254	605
PC.aa.C40.1	0.42638524	-0.45392472	0.51792557	-1.57457417	0.66672473	439
PC.aa.C40.3	0.01426608	-1.36045672	0.04728549	-2.44720175	-0.27371168	440
PC.aa.C40.4	0.02570967	0.94847391	0.07469702	0.11540766	1.78154016	706
PC.aa.C40.5	1.81E-06	2.16894902	3.25E-05	1.28498162	3.05291643	648
PC.aa.C40.6	0.00016069	1.76264029	0.00127956	0.85072143	2.67455916	696
PC.aa.C42.0	0.34246675	-0.46397681	0.44355633	-1.42311174	0.49515811	606
PC.aa.C42.1	0.09145537	-0.9331362	0.17098177	-2.01731911	0.1510467	498
PC.aa.C42.2	0.33530731	-0.52712105	0.4395797	-1.60110839	0.54686629	477
PC.aa.C42.4	0.01175327	-1.47621049	0.04075731	-2.62284557	-0.32957541	425
PC.aa.C42.5	0.01305095	-1.27263048	0.04453897	-2.27636049	-0.26890047	555
PC.aa.C42.6	0.02646147	-1.1470398	0.07514057	-2.15948588	-0.13459372	538
PC.aa.C43.4	0.48580444	-0.38748241	0.57388986	-1.47905365	0.70408883	479
PC.aa.C43.6	0.08929256	-0.76300695	0.16840264	-1.64344143	0.11742753	706
PC.aa.C44.12	0.49093017	-0.3004267	0.57677588	-1.1562879	0.5554345	706
PC.ae.C30.0	0.0963481	-0.78099444	0.17704992	-1.70194707	0.1399582	639
PC.ae.C30.1	0.83574092	-0.10355261	0.87225387	-1.08404713	0.87694192	581

PC.ae.C32.0	0.28227004	-0.45172894	0.38444179	-1.27589726	0.37243939	757
PC.ae.C32.1	0.26445505	-0.47575018	0.37161984	-1.31207038	0.36057002	757
PC.ae.C32.2	0.46695003	-0.30796327	0.55774587	-1.13863371	0.52270716	756
PC.ae.C34.0	0.64778796	-0.19912559	0.71790933	-1.05453892	0.65628775	716
PC.ae.C34.1	0.01681857	-1.04359641	0.05165703	-1.89861259	-0.18858023	716
PC.ae.C34.2	1.76E-07	-2.31799639	7.24E-06	-3.18061119	-1.45538159	716
PC.ae.C34.3	2.54E-08	-2.50481382	1.36E-06	-3.37753921	-1.63208844	716
PC.ae.C34.4	0.20330646	-0.5761846	0.31674557	-1.46462927	0.31226007	663
PC.ae.C36.0	0.00176361	-1.36377324	0.00881803	-2.21662408	-0.5109224	705
PC.ae.C36.1	0.14423487	-0.65150311	0.23672136	-1.52652822	0.223522	706
PC.ae.C36.2	0.00024883	-1.64897045	0.00167185	-2.52811997	-0.76982093	706
PC.ae.C36.3	1.88E-05	-1.84304742	0.0002249	-2.68325889	-1.00283594	757
PC.ae.C36.4	0.68485005	-0.18280004	0.7362138	-1.0668335	0.70123343	665
PC.ae.C36.5	0.93556426	-0.03676078	0.94880338	-0.92927149	0.85574994	665
PC.ae.C36.6	0.48200962	0.34680682	0.57255286	-0.6214629	1.31507653	564
PC.ae.C38.0	0.9863534	-0.00763487	0.9863534	-0.88372286	0.86845312	706
PC.ae.C38.2	0.0069004	-1.22277294	0.02514551	-2.10875969	-0.33678619	706
PC.ae.C38.3	0.95471604	-0.02512792	0.96196567	-0.89362778	0.84337195	706
PC.ae.C38.4	0.63029979	-0.21699112	0.70580445	-1.10184687	0.66786463	665
PC.ae.C38.5	0.6393673	-0.21219208	0.71224855	-1.10097341	0.67658926	665
PC.ae.C38.6	0.88963262	-0.06167162	0.91517231	-0.93390461	0.81056136	716
PC.ae.C40.0	0.04909169	-0.89788699	0.11228419	-1.79219105	-0.00358293	706
PC.ae.C40.1	0.00078646	-1.46985855	0.00469692	-2.32558838	-0.61412871	706
PC.ae.C40.2	0.11579223	-0.72150694	0.20574652	-1.62116175	0.17814787	665
PC.ae.C40.3	0.21164104	-0.56385235	0.32433732	-1.44939317	0.32168848	666
PC.ae.C40.4	0.13906785	-0.64709771	0.23313763	-1.50498431	0.2107889	706
PC.ae.C40.5	0.23483543	-0.52812695	0.34346678	-1.40020148	0.34394759	706
PC.ae.C40.6	0.26344367	-0.53522201	0.37161984	-1.47423664	0.40379262	648
PC.ae.C42.0	0.0002197	-1.72911076	0.00157454	-2.64278794	-0.81543358	665
PC.ae.C42.1	0.00631209	-1.30823968	0.0242339	-2.2456425	-0.37083686	601
PC.ae.C42.2	0.66400385	0.19381374	0.72672268	-0.68189536	1.06952284	666
PC.ae.C42.3	4.07E-05	-1.81121551	0.00043737	-2.67228048	-0.95015054	714
PC.ae.C42.4	0.08835262	-0.7460528	0.16840264	-1.60438716	0.11228157	706
PC.ae.C42.5	0.16002603	-0.6374958	0.25868869	-1.52744545	0.25245386	666
PC.ae.C42.6	0.32677928	-0.42854927	0.43368855	-1.28592101	0.42882247	756
SM.a.C30.1	0.02907678	1.05537651	0.07913301	0.10792658	2.00282645	655
SM.a.C32.0	0.0068799	1.54456736	0.02514551	0.42668586	2.66244885	443
SM.a.C32.1	0.01483631	1.08617714	0.04728549	0.21304529	1.95930899	706
SM.a.C32.2	1.03E-13	3.2731181	7.35E-12	2.42635939	4.11987681	716
SM.a.C33.1	0.28414618	0.46936916	0.38444179	-0.3903873	1.32912562	706
SM.a.C33.2	8.08E-07	2.31055894	1.74E-05	1.40041082	3.22070705	615
SM.a.C34.0	0.36523858	-0.48954968	0.46741843	-1.55094088	0.57184151	493
SM.a.C34.1	0.22372199	-0.53309622	0.33303898	-1.39258197	0.32638953	717
SM.a.C34.2	5.57E-07	2.16598377	1.33E-05	1.32393054	3.00803701	757
SM.a.C34.3	0.00307422	1.54567481	0.01348892	0.52488212	2.5664675	498

SM.a.C35.0	0.68363321	0.19806801	0.7362138	-0.75615601	1.15229203	564
SM.a.C35.1	0.01484711	1.06584253	0.04728549	0.20896387	1.92272118	706
SM.a.C36.0	4.76E-07	2.73585707	1.28E-05	1.68284266	3.78887149	498
SM.a.C36.1	0.00010692	1.71481854	0.00095781	0.85076684	2.57887023	717
SM.a.C36.2	2.02E-07	2.20602349	7.24E-06	1.38060735	3.03143963	757
SM.a.C36.3	5.65E-05	1.75634598	0.00057881	0.90525506	2.60743691	716
SM.a.C37.1	0.04478623	0.90340775	0.10819146	0.02108407	1.78573142	666
SM.a.C38.1	0.08237314	-0.75036138	0.16534576	-1.59723726	0.09651451	755
SM.a.C38.2	0.35521282	-0.4050729	0.45730992	-1.26467871	0.45453291	757
SM.a.C39.1	0.13867518	0.68722018	0.23313763	-0.22298518	1.59742553	666
SM.a.C39.2	0.22460769	0.55165805	0.33303898	-0.33945989	1.442776	715
SM.a.C40.1	0.00133877	1.42929129	0.00702037	0.55810182	2.30048077	661
SM.a.C40.2	0.30554209	0.47520313	0.41057218	-0.43483774	1.38524401	625
SM.a.C40.3	0.78579582	0.14034279	0.82680606	-0.87360029	1.15428586	536
SM.a.C40.4	0.78834997	-0.11518284	0.82680606	-0.9571934	0.72682773	757
SM.a.C40.5	0.0144783	1.07438021	0.04728549	0.21389205	1.93486837	675
SM.a.C41.1	0.00340845	1.29638177	0.01436897	0.43016916	2.16259438	706
SM.a.C41.2	0.24256396	0.52322662	0.35237331	-0.35510834	1.40156158	706
SM.a.C42.1	0.00262423	1.29931237	0.01175434	0.45447598	2.14414877	706
SM.a.C42.2	0.08634878	0.76045962	0.16725214	-0.10891405	1.62983329	706
SM.a.C42.3	0.07248585	0.81026348	0.14842342	-0.07414233	1.69466928	706
SM.a.C42.4	0.05245473	0.87083667	0.11871333	-0.00926863	1.75094197	665
SM.a.C42.5	0.92844144	-0.04906232	0.94604223	-1.12194101	1.02381638	498
SM.a.C42.6	0.53826247	-0.28818099	0.62554827	-1.20715673	0.63079476	665
SM.a.C43.1	0.00018524	1.65855847	0.00140805	0.79218503	2.52493191	706
SM.a.C43.2	0.00032772	1.58412137	0.00213511	0.72266615	2.44557659	706
SM.a.C44.2	0.13205083	0.74791575	0.2289591	-0.22611473	1.72194622	556
SM.a.C44.6	0.05755283	0.9291211	0.12695167	-0.02987536	1.88811756	624
SM.a.C31.1	0.13723996	0.68481731	0.23313763	-0.21890175	1.58853637	665
SM.a.C33.3	0.33799435	0.4224555	0.44041688	-0.44262271	1.28753371	715
SM.a.C35.2	0.00012215	1.66350566	0.00105046	0.81813087	2.50888045	717
SM.a.C37.3	7.25E-05	-1.73916062	0.00070835	-2.59456932	-0.88375193	717
SM.a.C39.5	0.66066264	0.21376831	0.72672268	-0.74211848	1.1696551	598
SM.a.C41.0	0.5948787	0.24986657	0.6803134	-0.67244836	1.17218151	605
SM.a.C41.3	0.12950752	0.7628841	0.22637493	-0.22409184	1.74986004	550
SM.a.C43.0	0.44881343	-0.40454675	0.54210611	-1.45305072	0.64395722	539
SM.a.C43.3	0.00222239	1.47524034	0.01016627	0.53212023	2.41836044	616
Ala	0.03345487	0.91071316	0.08666022	0.07154765	1.74987866	754
Arg	0.37956035	0.38736796	0.477225	-0.47755996	1.25229588	752
Asn	0.00482713	-1.22966836	0.0188697	-2.08354212	-0.37579459	703
Asp	0.17223186	0.5787043	0.27293375	-0.25275552	1.41016411	754
Cit	0.71109963	-0.16256817	0.75313508	-1.02391991	0.69878357	754
Gln	0.92548567	0.04156364	0.94604223	-0.83067179	0.91379906	703
Glu	1.78E-20	4.02274291	3.83E-18	3.19615278	4.84933303	754
Gly	0.31420423	-0.43477226	0.4195895	-1.28226841	0.41272389	754

His	0.28430812	-0.45207532	0.38444179	-1.28039188	0.37624123	743
Ile	3.71E-05	1.98958082	0.00041945	1.05014568	2.92901596	543
Leu	9.54E-07	2.29777762	1.86E-05	1.38557902	3.20997623	703
Lys	0.04260208	0.90882968	0.10408463	0.03039833	1.78726104	703
Met	0.40358507	0.39685262	0.49583309	-0.53546594	1.32917118	703
Orn	0.00022727	1.70952195	0.00157624	0.80388025	2.61516366	703
Phe	8.55E-05	1.7980518	0.00079897	0.90476754	2.69133606	703
Pro	0.00113642	1.44342607	0.00610825	0.57609983	2.31075231	754
Trp	0.28355377	0.46267472	0.38444179	-0.38372293	1.30907237	754
Ser	0.5193868	-0.27248477	0.60689219	-1.10235763	0.55738808	754
Thr	0.06493008	-0.80070613	0.1382175	-1.65109668	0.04968443	714
Tyr	1.39E-15	3.55111481	1.50E-13	2.69849035	4.40373927	703
Val	2.52E-06	2.15716039	3.87E-05	1.26482649	3.04949428	703
NEFA_12_0	0.60656679	0.25520838	0.68637821	-0.71756683	1.22798358	602
NEFA_14_0	0.39112934	0.38278556	0.48608559	-0.49301327	1.25858438	731
NEFA_14_1	0.01167826	1.09503991	0.04075731	0.24466754	1.94541228	750
NEFA_15_0	0.01627607	1.05145907	0.05071528	0.19430165	1.90861649	747
NEFA_15_1	0.08577699	0.96069591	0.16725214	-0.13573173	2.05712355	506
NEFA_16_0	0.00399577	1.36257009	0.01652098	0.43644412	2.28869607	641
NEFA_16_1	0.03421307	0.90693833	0.08756918	0.06767752	1.74619914	750
NEFA_17_0	0.00013544	1.75399874	0.00111999	0.85676175	2.65123572	692
NEFA_17_1	0.00018992	1.71566292	0.00140805	0.81806831	2.61325753	679
NEFA_18_0	0.0328573	1.03816343	0.08666022	0.08486028	1.99146657	636
NEFA_18_1	0.04060784	0.92882237	0.10035271	0.03982968	1.81781506	694
NEFA_18_2	0.03310715	1.00369299	0.08666022	0.0807195	1.92666649	643
NEFA_18_3	0.08891759	0.72676762	0.16840264	-0.11084803	1.56438327	750
NEFA_20_1	0.25520245	0.510136	0.36336773	-0.3694778	1.3897498	665
NEFA_20_2	0.13988258	0.67399673	0.23313763	-0.22145937	1.56945282	633
NEFA_20_3	0.00111696	1.51492644	0.00610825	0.60638533	2.42346755	643
NEFA_20_4	0.00112209	1.52441169	0.00610825	0.60981411	2.43900927	643
NEFA_22_6	0.0190538	1.09980592	0.05689678	0.18093712	2.01867472	694
NEFA_24_1	0.60633368	0.22192588	0.68637821	-0.62318357	1.06703533	749
NEFA_12_1	0.21270494	0.56095218	0.32433732	-0.32206381	1.44396816	688
NEFA_13_1	0.02130267	1.50059195	0.06274073	0.2245116	2.77667231	393
NEFA_14_2	0.04841729	0.9628656	0.11193244	0.00671694	1.91901427	603
NEFA_16_2	0.00151743	1.45385575	0.00776778	0.55749939	2.35021211	659
NEFA_18_4	0.00104059	1.70271511	0.00604664	0.68847253	2.7169577	527
NEFA_19_0	0.0627718	0.96592172	0.1352872	-0.05164406	1.98348749	577
NEFA_19_1	0.00326016	1.38382304	0.0140187	0.46368209	2.303964	653
NEFA_20_5	7.80E-06	2.05907629	9.86E-05	1.16206055	2.95609203	653
NEFA_22_4	0.00221257	1.52495677	0.01016627	0.55063841	2.49927512	577
NEFA_22_5	0.00069967	1.56520895	0.00429799	0.66290017	2.46751772	653
NEFA_24_4	0.02656132	-1.2025572	0.07514057	-2.26451216	-0.14060223	399
NEFA_24_5	0.02694027	-1.21643461	0.07522283	-2.2934401	-0.13942912	456
NEFA_26_1	0.06292428	1.03111843	0.1352872	-0.05577096	2.11800782	549

HDL

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	0.00151085	-0.03405916	0.00253776	-0.05505613	-0.0130622	757
Carn.a.C10.0	0.74124478	-0.00418459	0.78506221	-0.02907238	0.02070319	480
Carn.a.C10.1	0.47284715	0.00952595	0.53010134	-0.0165307	0.0355826	467
Carn.a.C12.0	0.74987634	0.00407254	0.79031085	-0.02101603	0.0291611	474
Carn.a.C12.1	0.32396329	-0.01414031	0.38061261	-0.04228975	0.01400913	408
Carn.a.C14.0	0.01580481	-0.02680479	0.02311588	-0.04855595	-0.00505363	630
Carn.a.C14.1	0.68562798	0.00441653	0.73338316	-0.01699688	0.02582993	689
Carn.a.C14.2	0.79967215	-0.00274622	0.83057736	-0.02398619	0.01849376	683
Carn.a.C16.0	0.00870769	-0.02814559	0.01309198	-0.04915239	-0.00713879	754
Carn.a.C16.1	0.40592344	-0.00908977	0.46670343	-0.03055137	0.01237184	687
Carn.a.C18.0	0.00246703	-0.03650356	0.00408009	-0.06008341	-0.01292371	606
Carn.a.C18.1	0.0689578	-0.0190248	0.09443265	-0.03953105	0.00148145	756
Carn.a.C2.0	0.06746212	-0.01949336	0.09297664	-0.04039106	0.00140433	706
Carn.a.C3.0	1.55E-05	-0.04675822	2.83E-05	-0.06786194	-0.02565451	756
Carn.a.C4.0	0.36462328	-0.01029311	0.42375138	-0.03257201	0.0119858	656
Carn.a.C4.0.DC	0.08592424	-0.0232983	0.1154607	-0.04990349	0.00330689	417
Carn.a.C5.0	0.00121667	-0.04322413	0.00207606	-0.06932381	-0.01712445	503
Carn.a.C6.0	0.64457198	-0.0051398	0.69735603	-0.02700867	0.01672906	640
Carn.a.C8.1	0.81754417	0.00260221	0.84505767	-0.01954233	0.02474675	576
lyso.PC.a.C14.0	0.08525905	0.01769284	0.11528739	-0.00246321	0.03784889	754
lyso.PC.a.C16.0	0.82623437	-0.00234565	0.84590662	-0.02331597	0.01862468	706
lyso.PC.a.C16.1	0.12342427	0.01638815	0.1618062	-0.00447187	0.03724816	757
lyso.PC.a.C18.0	0.97100729	0.00036801	0.97554471	-0.01950308	0.02023909	757
lyso.PC.a.C18.1	1.36E-02	0.02666437	2.02E-02	0.00550198	0.04782677	706
lyso.PC.a.C18.2	4.83E-03	0.02989826	7.47E-03	0.0091372	0.05065932	706
lyso.PC.a.C18.3	0.02197951	0.02740467	0.0317154	0.00397094	0.05083841	605
lyso.PC.a.C18.6	0.24837738	-0.01449268	0.30170134	-0.03912976	0.0101444	548
lyso.PC.a.C20.2	2.0928E-05	0.05662353	3.7812E-05	0.03073125	0.08251581	499
lyso.PC.a.C20.3	0.22493163	0.0139581	0.27793276	-0.00860691	0.0365231	646
lyso.PC.a.C20.4	0.47339282	0.00750696	0.53010134	-0.01303766	0.02805157	757
lyso.PC.a.C20.5	0.87219335	-0.00169634	0.88453571	-0.02239212	0.01899945	698
lyso.PC.a.C22.5	0.31249521	0.01144916	0.36915643	-0.01079264	0.03369096	666
lyso.PC.a.C22.6	0.54828078	0.00627586	0.60763076	-0.01423876	0.02679049	717
lyso.PC.e.C16.0	0.06174951	-0.01906289	0.08565254	-0.03906568	0.0009399	756
lyso.PC.e.C18.0	0.46459033	-0.00774921	0.52572064	-0.02854138	0.01304295	740
lyso.PC.e.C18.1	0.84582444	-0.0024872	0.86185903	-0.02760194	0.02262753	548
PC.aa.C30.0	7.7936E-15	0.07773781	3.5651E-14	0.05850525	0.09697037	753
PC.aa.C30.1	6.8248E-11	0.08004428	1.9307E-10	0.05644169	0.10364686	538
PC.aa.C30.2	2.2589E-14	0.09751814	1.0118E-13	0.0731808	0.12185548	501
PC.aa.C32.0	1.6572E-25	0.10540948	2.2268E-24	0.08631387	0.12450509	757
PC.aa.C32.1	2.3619E-15	0.08426537	1.2695E-14	0.06388456	0.10464618	665
PC.aa.C32.2	8.6981E-24	0.10903024	8.9052E-23	0.08858944	0.12947104	648
PC.aa.C32.3	2.7121E-19	0.09661952	2.1597E-18	0.07614985	0.11708918	666

PC.aa.C34.0	2.4744E-09	0.07031135	6.1148E-09	0.04754504	0.09307767	547
PC.aa.C34.1	6.8638E-20	0.09453571	5.6758E-19	0.07481369	0.11425773	716
PC.aa.C34.2	6.9849E-36	0.12823256	3.7544E-34	0.10923302	0.1472321	706
PC.aa.C34.3	7.3904E-30	0.11588239	1.7655E-28	0.09676967	0.1349951	706
PC.aa.C34.4	8.504E-21	0.09846654	7.6182E-20	0.078493	0.11844009	665
PC.aa.C34.5	8.1812E-08	0.05750677	1.7415E-07	0.03668905	0.07832449	674
PC.aa.C36.0	5.2786E-17	0.08927331	3.661E-16	0.06889452	0.10965211	705
PC.aa.C36.1	2.5153E-15	0.08584789	1.319E-14	0.06503512	0.10666065	705
PC.aa.C36.2	5.9554E-28	0.11298939	9.8494E-27	0.09362735	0.13235144	706
PC.aa.C36.3	1.5906E-32	0.12009608	5.6995E-31	0.10123625	0.13895591	716
PC.aa.C36.4	4.8222E-24	0.10735479	5.1838E-23	0.087332	0.12737759	665
PC.aa.C36.5	1.29E-08	0.06384472	2.9822E-08	0.04209936	0.08559007	625
PC.aa.C36.6	1.7641E-13	0.07549354	6.7728E-13	0.05574829	0.09523879	750
PC.aa.C38.0	4.5189E-15	0.0894737	2.2001E-14	0.0675985	0.1113489	665
PC.aa.C38.1	1.0689E-12	0.08302578	3.5909E-12	0.06062662	0.10542493	605
PC.aa.C38.2	1.7956E-13	0.07942968	6.7729E-13	0.05866603	0.10019334	715
PC.aa.C38.3	4.14E-08	0.06174215	9.08E-08	0.03990743	0.08357687	648
PC.aa.C38.4	7.3488E-12	0.07530619	2.2898E-11	0.05412696	0.09648542	648
PC.aa.C38.5	2.287E-15	0.08481194	1.2608E-14	0.06432249	0.1053014	648
PC.aa.C38.6	4.9173E-15	0.09074725	2.2983E-14	0.06854253	0.11295197	648
PC.aa.C40.0	5.3607E-10	0.07422263	1.3677E-09	0.05113312	0.09731214	605
PC.aa.C40.1	7.9107E-08	0.07367954	1.7008E-07	0.04717782	0.10018126	439
PC.aa.C40.3	1.6718E-07	0.0714466	3.4897E-07	0.04505362	0.09783957	440
PC.aa.C40.4	4.2387E-10	0.06376576	1.098E-09	0.04400712	0.08352439	706
PC.aa.C40.5	1.05E-05	0.04901424	1.96E-05	0.0273509	0.07067758	648
PC.aa.C40.6	1.2668E-06	0.05490515	2.5218E-06	0.03285362	0.07695669	696
PC.aa.C42.0	2.8463E-10	0.07469423	7.7463E-10	0.05183395	0.09755451	606
PC.aa.C42.1	1.3892E-10	0.08575038	3.879E-10	0.06006317	0.1114376	498
PC.aa.C42.2	2.4958E-10	0.08010739	6.8795E-10	0.05577623	0.10443856	477
PC.aa.C42.4	5.6839E-07	0.07061977	1.1638E-06	0.04330222	0.09793731	425
PC.aa.C42.5	3.8764E-13	0.08901779	1.4126E-12	0.06552586	0.11250972	555
PC.aa.C42.6	7.9546E-17	0.10141312	5.1825E-16	0.07829958	0.12452667	538
PC.aa.C43.4	3.0257E-08	0.07376969	6.8477E-08	0.04804674	0.09949265	479
PC.aa.C43.6	9.6715E-13	0.07655418	3.3006E-12	0.05588236	0.097226	706
PC.aa.C44.12	4.1322E-10	0.06533815	1.0834E-09	0.04510554	0.08557075	706
PC.ae.C30.0	5.2224E-12	0.07538044	1.6512E-11	0.05434029	0.0964206	639
PC.ae.C30.1	8.2581E-07	0.05983334	1.6593E-06	0.03625671	0.08340997	581
PC.ae.C32.0	4.3591E-15	0.07814925	2.1795E-14	0.05900093	0.09729757	757
PC.ae.C32.1	9.5896E-31	0.11383862	2.9454E-29	0.09531839	0.13235885	757
PC.ae.C32.2	6.1613E-34	0.11839212	2.6494E-32	0.10020281	0.13658143	756
PC.ae.C34.0	2.9155E-12	0.07308135	9.4973E-12	0.05289311	0.0932696	716
PC.ae.C34.1	3.0116E-30	0.11666319	8.0937E-29	0.09755321	0.13577317	716
PC.ae.C34.2	2.14E-42	0.1400153	2.30E-40	0.12119751	0.1588331	716
PC.ae.C34.3	1.52E-47	0.14956073	3.28E-45	0.13078956	0.16833191	716
PC.ae.C34.4	4.0021E-14	0.08267849	1.7209E-13	0.06168509	0.10367189	663

PC.ae.C36.0	1.5811E-24	0.10373357	1.8885E-23	0.08456338	0.12290375	705
PC.ae.C36.1	1.117E-11	0.07249452	3.4308E-11	0.05188955	0.09309948	706
PC.ae.C36.2	4.2951E-20	0.0979375	3.6938E-19	0.07763388	0.11824111	706
PC.ae.C36.3	2.20E-41	0.1331108	1.5771E-39	0.11489648	0.15132511	757
PC.ae.C36.4	4.6049E-15	0.08474687	2.2001E-14	0.06402076	0.10547297	665
PC.ae.C36.5	6.4917E-14	0.08200473	2.6841E-13	0.06099853	0.10301094	665
PC.ae.C36.6	6.112E-06	0.05520604	1.1629E-05	0.03146147	0.07895062	564
PC.ae.C38.0	7.7474E-21	0.09845874	7.2421E-20	0.07847023	0.11844725	706
PC.ae.C38.2	1.3373E-24	0.10879283	1.6913E-23	0.08872201	0.12886366	706
PC.ae.C38.3	8.2764E-14	0.07871662	3.3574E-13	0.05843842	0.09899482	706
PC.ae.C38.4	4.1205E-10	0.06821958	1.0834E-09	0.04711336	0.0893258	665
PC.ae.C38.5	3.3622E-13	0.07938997	1.2463E-12	0.05841608	0.10036387	665
PC.ae.C38.6	2.7956E-18	0.09216562	2.1466E-17	0.07197959	0.11235164	716
PC.ae.C40.0	5.9708E-17	0.09061951	4.0117E-16	0.06989493	0.11134408	706
PC.ae.C40.1	8.8525E-30	0.11569865	1.9033E-28	0.0965871	0.1348102	706
PC.ae.C40.2	5.023E-11	0.07372312	1.4399E-10	0.05206269	0.09538355	665
PC.ae.C40.3	3.7309E-15	0.08621972	1.9099E-14	0.06520685	0.1072326	666
PC.ae.C40.4	3.9969E-12	0.07256111	1.2826E-11	0.05238831	0.09273391	706
PC.ae.C40.5	5.4072E-10	0.06618414	1.3677E-09	0.04554645	0.08682183	706
PC.ae.C40.6	2.5143E-11	0.07674247	7.508E-11	0.05456165	0.0989233	648
PC.ae.C42.0	4.0599E-11	0.07499215	1.1796E-10	0.05306743	0.09691687	665
PC.ae.C42.1	1.5776E-15	0.09149543	9.1672E-15	0.06956661	0.11342426	601
PC.ae.C42.2	6.9712E-13	0.07807107	2.4571E-12	0.05714887	0.09899327	666
PC.ae.C42.3	2.17E-24	0.10774744	2.455E-23	0.08776237	0.1277325	714
PC.ae.C42.4	1.5698E-15	0.08300572	9.1672E-15	0.06303578	0.10297565	706
PC.ae.C42.5	1.7984E-09	0.0669481	4.496E-09	0.04540385	0.08849236	666
PC.ae.C42.6	8.8435E-13	0.07440327	3.0667E-12	0.05432472	0.09448182	756
SM.a.C30.1	1.3598E-12	0.08121458	4.4976E-12	0.0591627	0.10326646	655
SM.a.C32.0	0.00397813	0.04077502	0.00633554	0.01309679	0.06845326	443
SM.a.C32.1	2.0051E-16	0.08715483	1.2679E-15	0.06685565	0.10745401	706
SM.a.C32.2	1.12E-13	0.08062424	4.46E-13	0.059733	0.10151547	716
SM.a.C33.1	8.8093E-09	0.06057655	2.0813E-08	0.04015413	0.08099896	706
SM.a.C33.2	2.01E-06	0.05491175	3.90E-06	0.03244035	0.07738314	615
SM.a.C34.0	0.00277829	0.03995007	0.00452525	0.01384331	0.06605683	493
SM.a.C34.1	1.4368E-17	0.08998022	1.0297E-16	0.06981585	0.11014459	717
SM.a.C34.2	4.04E-18	0.08935221	3.00E-17	0.06965444	0.10904998	757
SM.a.C34.3	2.6202E-09	0.07558669	6.4016E-09	0.05110895	0.10006443	498
SM.a.C35.0	8.2188E-05	0.04752269	0.00014604	0.02399552	0.07104986	564
SM.a.C35.1	0.01003914	0.02737427	0.01498899	0.0065551	0.04819344	706
SM.a.C36.0	4.61E-03	0.03827423	7.24E-03	0.01185036	0.0646981	498
SM.a.C36.1	7.6097E-05	0.04321257	0.00013634	0.0218953	0.06452984	717
SM.a.C36.2	6.88E-06	0.04629524	1.30E-05	0.0262307	0.06635978	757
SM.a.C36.3	6.68E-07	0.05280526	1.3552E-06	0.03213743	0.07347308	716
SM.a.C37.1	0.00210257	0.0343375	0.00350428	0.0125009	0.05617409	666
SM.a.C38.1	4.9136E-27	0.10840784	7.0428E-26	0.08941681	0.12739886	755

SM.a.C38.2	1.1855E-28	0.11304359	2.124E-27	0.09388979	0.13219739	757
SM.a.C39.1	3.7811E-09	0.06713646	9.1341E-09	0.04507365	0.08919926	666
SM.a.C39.2	5.3339E-08	0.06046483	1.1584E-07	0.03887939	0.08205028	715
SM.a.C40.1	0.00586239	0.03057157	0.00900296	0.00885688	0.05228625	661
SM.a.C40.2	9.8833E-28	0.12149699	1.5178E-26	0.10070055	0.14229342	625
SM.a.C40.3	1.5316E-13	0.0888104	5.9871E-13	0.06580824	0.11181256	536
SM.a.C40.4	2.0587E-22	0.09796815	2.0119E-21	0.07885324	0.11708306	757
SM.a.C40.5	1.2057E-08	0.06189992	2.8177E-08	0.04084189	0.08295795	675
SM.a.C41.1	3.1388E-08	0.05907968	7.0295E-08	0.03835615	0.07980321	706
SM.a.C41.2	9.3947E-16	0.08548723	5.771E-15	0.0650896	0.10588485	706
SM.a.C42.1	1.7E-08	0.05872628	3.8883E-08	0.03852459	0.07892798	706
SM.a.C42.2	3.7192E-11	0.07026286	1.0954E-10	0.04974408	0.09078163	706
SM.a.C42.3	2.187E-15	0.08512582	1.2374E-14	0.0645348	0.10571684	706
SM.a.C42.4	3.2151E-14	0.08204637	1.4107E-13	0.06129433	0.10279841	665
SM.a.C42.5	6.054E-13	0.09440896	2.1693E-12	0.06934103	0.1194769	498
SM.a.C42.6	6.445E-14	0.08447074	2.6841E-13	0.06283571	0.10610578	665
SM.a.C43.1	0.02116409	0.0249373	0.03074513	0.00374457	0.04613004	706
SM.a.C43.2	0.18792966	0.01417162	0.23628583	-0.00693907	0.03528231	706
SM.a.C44.2	0.00080642	0.04050345	0.0014096	0.01689112	0.06411577	556
SM.a.C44.6	1.1955E-07	0.06360416	2.52E-07	0.04029023	0.08691808	624
SM.a.C31.1	2.1139E-11	0.07535463	6.4012E-11	0.05365119	0.09705808	665
SM.a.C33.3	1.7495E-06	0.05152169	3.4195E-06	0.03054105	0.07250233	715
SM.a.C35.2	0.00089378	0.03555121	0.00154971	0.01462982	0.05647261	717
SM.a.C37.3	1.07E-29	0.11771816	2.1E-28	0.09822695	0.13720938	717
SM.a.C39.5	1.4628E-06	0.05703989	2.8854E-06	0.03401967	0.08006011	598
SM.a.C41.0	3.8582E-08	0.06372241	8.5517E-08	0.04125648	0.08618833	605
SM.a.C41.3	5.2046E-07	0.06064684	1.0759E-06	0.03719731	0.08409637	550
SM.a.C43.0	5.0288E-09	0.07464474	1.2013E-08	0.04998049	0.09930898	539
SM.a.C43.3	0.00357981	0.03468632	0.00578691	0.01139316	0.05797949	616
Ala	0.7585496	0.00319064	0.79555202	-0.01717944	0.02356073	754
Arg	0.29575525	-0.01117605	0.35326321	-0.03214536	0.00979326	752
Asn	0.09259662	0.01778358	0.12365388	-0.00294827	0.03851543	703
Asp	0.64545977	-0.00472305	0.69735603	-0.02486823	0.01542214	754
Cit	0.12232704	0.01640038	0.16135162	-0.00441406	0.03721483	754
Gln	0.09536319	-0.01791055	0.12656226	-0.03896727	0.00314616	703
Glu	3.26E-10	-0.06701455	8.76E-10	-0.08765842	-0.04637068	754
Gly	0.13873112	-0.01547263	0.17649225	-0.03596709	0.00502183	754
His	0.40552354	0.00852305	0.46670343	-0.01158154	0.02862763	743
Ile	1.33E-03	-0.03931936	0.0022516	-0.06325791	-0.0153808	543
Leu	3.03E-06	-0.05299485	5.81E-06	-0.07509629	-0.0308934	703
Lys	0.2002747	-0.01389933	0.2488963	-0.03518653	0.00738786	703
Met	0.98066056	-0.00027868	0.98066056	-0.02284265	0.02228529	703
Orn	0.00275338	-0.03364038	0.00451891	-0.05562136	-0.0116594	703
Phe	3.80E-02	-0.02306067	0.05379497	-0.04484435	-0.001277	703
Pro	0.00011714	-0.04128949	0.00020644	-0.06222002	-0.02035895	754

Trp	0.68430373	0.00424703	0.73338316	-0.01625084	0.02474489	754
Ser	0.55427715	-0.00605298	0.61112609	-0.02613816	0.0140322	754
Thr	0.00102366	0.03507755	0.0017607	0.01419408	0.05596103	714
Tyr	1.37E-02	-0.02706107	2.02E-02	-0.04856849	-0.00555364	703
Val	1.18E-05	-0.04861644	2.20E-05	-0.07024829	-0.02698459	703
NEFA_12_0	0.13216628	0.01765392	0.1701542	-0.00534282	0.04065067	602
NEFA_14_0	0.00733345	0.02874162	0.01118221	0.00775684	0.04972641	731
NEFA_14_1	0.00801268	0.02788893	0.01213188	0.00729633	0.04848154	750
NEFA_15_0	0.30218056	0.01096461	0.35894376	-0.0098837	0.03181292	747
NEFA_15_1	0.02744645	0.02791847	0.03933991	0.00311661	0.05272033	506
NEFA_16_0	0.24565865	0.01296593	0.30009437	-0.00894533	0.0348772	641
NEFA_16_1	0.0046821	0.02931064	0.00729458	0.00902634	0.04959493	750
NEFA_17_0	0.70149603	-0.00429253	0.74664182	-0.02627178	0.01768672	692
NEFA_17_1	0.40934804	0.00924724	0.46813739	-0.01274661	0.03124109	679
NEFA_18_0	0.82346515	0.00263414	0.84590662	-0.02054345	0.02581172	636
NEFA_18_1	0.29122301	0.01160922	0.349793	-0.00997084	0.03318929	694
NEFA_18_2	0.1289579	0.01743422	0.16702379	-0.0050864	0.03995484	643
NEFA_18_3	0.00450678	0.0293469	0.00712469	0.00912519	0.0495686	750
NEFA_20_1	0.19611456	0.01442789	0.2451432	-0.00746562	0.03632139	665
NEFA_20_2	0.13682361	0.01700516	0.17510165	-0.00541261	0.03942293	633
NEFA_20_3	0.33344869	0.01099189	0.38962755	-0.0113084	0.03329217	643
NEFA_20_4	0.60237182	-0.00596196	0.65741087	-0.02842261	0.01649869	643
NEFA_22_6	0.05483709	0.02183073	0.07705865	-0.00045375	0.04411521	694
NEFA_24_1	0.14087254	-0.01536221	0.17816233	-0.03582097	0.00509655	749
NEFA_12_1	0.03617041	0.02293424	0.05150091	0.00148269	0.0443858	688
NEFA_13_1	0.92373386	0.00158415	0.93240742	-0.03093102	0.03409931	393
NEFA_14_2	0.50195197	0.00797852	0.55916929	-0.01534531	0.03130234	603
NEFA_16_2	0.12518925	0.01715073	0.16312539	-0.00478438	0.03908585	659
NEFA_18_4	0.05897082	0.0236231	0.0823294	-0.00089839	0.04814459	527
NEFA_19_0	0.59520783	0.00668121	0.65290654	-0.01800459	0.03136701	577
NEFA_19_1	0.79216913	0.00304392	0.82677846	-0.01963125	0.02571909	653
NEFA_20_5	4.29E-01	0.00898333	4.88E-01	-0.01330926	0.03127593	653
NEFA_22_4	0.26639282	0.01344677	0.32176661	-0.01029406	0.0371876	577
NEFA_22_5	0.23099678	0.01359177	0.28379605	-0.00866956	0.03585309	653
NEFA_24_4	1.3687E-05	0.06176958	2.5152E-05	0.03420344	0.08933573	399
NEFA_24_5	0.00393245	0.03958202	0.00630952	0.01274578	0.06641826	456
NEFA_26_1	0.08193273	0.02386886	0.11149074	-0.00303414	0.05077186	549

Triglyceride

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	0.31617954	-0.01980458	0.39753568	-0.05856725	0.01895809	757
Carn.a.C10.0	0.28252234	-0.02634555	0.36156133	-0.07446337	0.02177226	480
Carn.a.C10.1	0.13641072	-0.03537259	0.19816423	-0.08196609	0.0112209	467
Carn.a.C12.0	0.03097746	-0.0490153	0.0569789	-0.093526	-0.0045046	474
Carn.a.C12.1	0.09945133	-0.04292089	0.15164565	-0.09401816	0.00817637	408
Carn.a.C14.0	0.41424507	-0.01601513	0.49479272	-0.05451074	0.02248049	630
Carn.a.C14.1	0.14745166	-0.02917258	0.20994773	-0.068669	0.01032384	689
Carn.a.C14.2	0.00552579	-0.05545513	0.01277467	-0.09457085	-0.01633941	683
Carn.a.C16.0	0.18273806	-0.02637741	0.25024638	-0.06520659	0.01245178	754
Carn.a.C16.1	0.00717562	-0.05425787	0.0160704	-0.09376178	-0.01475397	687
Carn.a.C18.0	0.02640667	-0.04971779	0.05024278	-0.09358825	-0.00584733	606
Carn.a.C18.1	0.00390388	-0.0552732	0.00932593	-0.09275624	-0.01779016	756
Carn.a.C2.0	0.00124677	-0.06315799	0.00322958	-0.10141525	-0.02490073	706
Carn.a.C3.0	1.22E-02	0.0499972	2.54E-02	0.01094658	0.08904782	756
Carn.a.C4.0	0.04777711	0.04196399	0.07841281	0.00041214	0.08351584	656
Carn.a.C4.0.DC	0.6454637	0.01237723	0.6933273	-0.04046996	0.06522442	417
Carn.a.C5.0	0.77068389	0.00727168	0.80046877	-0.04171825	0.0562616	503
Carn.a.C6.0	0.42154462	0.01669731	0.5007298	-0.02407183	0.05746645	640
Carn.a.C8.1	0.07630435	-0.03601864	0.11887996	-0.07585813	0.00382086	576
lyso.PC.a.C14.0	4.9608E-09	0.10926971	2.5062E-08	0.07302638	0.14551304	754
lyso.PC.a.C16.0	0.0100318	0.05050078	0.02178623	0.01209682	0.08890474	706
lyso.PC.a.C16.1	2.205E-05	0.08238672	7.0756E-05	0.04451188	0.12026156	757
lyso.PC.a.C18.0	0.68281891	-0.00759126	0.7267627	-0.04404822	0.0288657	757
lyso.PC.a.C18.1	8.63E-05	-0.07780585	2.73E-04	-0.11648471	-0.03912698	706
lyso.PC.a.C18.2	3.23E-09	-0.11442464	1.70E-08	-0.15188559	-0.0769637	706
lyso.PC.a.C18.3	0.5348258	-0.01390729	0.60519762	-0.0578893	0.03007473	605
lyso.PC.a.C18.6	0.00011062	-0.09029789	0.0003447	-0.13583807	-0.0447577	548
lyso.PC.a.C20.2	0.18012456	-0.03252199	0.24824859	-0.08012754	0.01508356	499
lyso.PC.a.C20.3	0.95917103	-0.00109629	0.96365314	-0.04313185	0.04093926	646
lyso.PC.a.C20.4	8.7718E-06	-0.0848546	2.9468E-05	-0.12206602	-0.04764318	757
lyso.PC.a.C20.5	0.02095566	-0.04528959	0.04095878	-0.08371575	-0.00686342	698
lyso.PC.a.C22.5	0.0118487	-0.05295627	0.02497519	-0.09415966	-0.01175288	666
lyso.PC.a.C22.6	0.00307643	-0.05646359	0.00760268	-0.09378551	-0.01914166	717
lyso.PC.e.C16.0	0.99804864	4.5858E-05	0.99804864	-0.03675224	0.03684395	756
lyso.PC.e.C18.0	0.03492516	-0.04109784	0.06199939	-0.07927936	-0.00291632	740
lyso.PC.e.C18.1	0.5907928	-0.01287454	0.64806353	-0.05988267	0.0341336	548
PC.aa.C30.0	4.5448E-19	0.16318667	8.1428E-18	0.12825771	0.19811563	753
PC.aa.C30.1	9.5141E-09	0.13428961	4.649E-08	0.08906404	0.17951518	538
PC.aa.C30.2	0.03589061	0.05360488	0.06218577	0.00354523	0.10366452	501
PC.aa.C32.0	7.8617E-14	0.14091379	6.501E-13	0.10459968	0.17722789	757
PC.aa.C32.1	1.4615E-28	0.21285381	6.2846E-27	0.17693278	0.24877484	665
PC.aa.C32.2	1.5182E-23	0.2010066	4.0802E-22	0.163098	0.23891521	648
PC.aa.C32.3	1.087E-14	0.15375792	9.7373E-14	0.11559924	0.1919166	666

PC.aa.C34.0	2.0805E-10	0.13999076	1.278E-09	0.0975571	0.18242441	547
PC.aa.C34.1	1.3686E-31	0.21883097	1.9073E-29	0.18387799	0.25378394	716
PC.aa.C34.2	7.7628E-23	0.18953991	1.8544E-21	0.15303949	0.22604033	706
PC.aa.C34.3	9.4669E-29	0.20937408	5.0885E-27	0.17407617	0.24467199	706
PC.aa.C34.4	3.508E-25	0.19995657	1.257E-23	0.16364919	0.23626395	665
PC.aa.C34.5	1.9755E-07	0.10275625	7.7223E-07	0.06437842	0.14113408	674
PC.aa.C36.0	0.15905307	0.02828893	0.22205462	-0.01110897	0.06768683	705
PC.aa.C36.1	2.6177E-14	0.15212989	2.2512E-13	0.11374501	0.19051477	705
PC.aa.C36.2	1.1621E-11	0.13213228	8.3281E-11	0.09454397	0.1697206	706
PC.aa.C36.3	1.7743E-31	0.2176724	1.9073E-29	0.18283216	0.25251264	716
PC.aa.C36.4	4.3207E-24	0.19836265	1.3271E-22	0.16140838	0.23531692	665
PC.aa.C36.5	4.7475E-10	0.12836248	2.6861E-09	0.08853868	0.16818628	625
PC.aa.C36.6	1.7795E-18	0.16420806	2.943E-17	0.12842023	0.19999588	750
PC.aa.C38.0	0.43288344	0.01680507	0.51137329	-0.02524466	0.0588548	665
PC.aa.C38.1	0.01569873	0.05349859	0.03214503	0.01013206	0.09686512	605
PC.aa.C38.2	8.6966E-17	0.16354849	1.0388E-15	0.12592347	0.20117351	715
PC.aa.C38.3	4.65E-31	0.23220399	3.33E-29	0.19494081	0.26946718	648
PC.aa.C38.4	6.29E-16	0.1634748	6.4398E-15	0.12479709	0.20215251	648
PC.aa.C38.5	9.9573E-16	0.15908674	9.731E-15	0.12117004	0.19700345	648
PC.aa.C38.6	3.0434E-18	0.1860141	4.6738E-17	0.14534041	0.22668779	648
PC.aa.C40.0	0.47851845	0.01614595	0.55312617	-0.0285708	0.0608627	605
PC.aa.C40.1	0.1472221	0.03694371	0.20994773	-0.01306445	0.08695187	439
PC.aa.C40.3	0.03582985	0.05239037	0.06218577	0.00348306	0.10129769	440
PC.aa.C40.4	4.857E-17	0.15588237	6.5267E-16	0.12034085	0.1914239	706
PC.aa.C40.5	7.89E-17	0.16839978	9.98E-16	0.12981252	0.20698704	648
PC.aa.C40.6	1.0631E-20	0.19130991	2.2857E-19	0.1523405	0.23027932	696
PC.aa.C42.0	0.33460273	-0.02153334	0.41108336	-0.06532774	0.02226107	606
PC.aa.C42.1	0.9275611	0.00237242	0.93627059	-0.04887476	0.05361961	498
PC.aa.C42.2	0.15353038	0.03583751	0.21716469	-0.01342684	0.08510186	477
PC.aa.C42.4	0.12091977	0.04299297	0.17685544	-0.0113864	0.09737234	425
PC.aa.C42.5	2.9268E-08	0.1296639	1.3388E-07	0.08440733	0.17492048	555
PC.aa.C42.6	5.0125E-09	0.1372969	2.5062E-08	0.09193663	0.18265718	538
PC.aa.C43.4	0.20029175	-0.03307723	0.26914203	-0.08375722	0.01760277	479
PC.aa.C43.6	0.01985329	-0.04674014	0.03952275	-0.08604981	-0.00743047	706
PC.aa.C44.12	0.07944496	-0.03418424	0.1228825	-0.072395	0.00402651	706
PC.ae.C30.0	0.03644375	0.04397306	0.06218577	0.00278301	0.08516312	639
PC.ae.C30.1	0.48474856	0.01600185	0.55733123	-0.0289533	0.06095699	581
PC.ae.C32.0	0.00623963	0.05090655	0.01427149	0.01446934	0.08734377	757
PC.ae.C32.1	0.7663952	0.00562582	0.79987848	-0.03153538	0.04278701	757
PC.ae.C32.2	0.19349459	-0.0244315	0.2632996	-0.06128394	0.01242094	756
PC.ae.C34.0	2.2746E-08	0.1083866	1.0631E-07	0.07075294	0.14602026	716
PC.ae.C34.1	1.0755E-06	0.09515133	3.9193E-06	0.05718597	0.13311669	716
PC.ae.C34.2	7.43E-01	-0.00661393	7.79E-01	-0.04617198	0.03294411	716
PC.ae.C34.3	3.52E-02	-0.04300076	6.20E-02	-0.08300614	-0.00299538	716
PC.ae.C34.4	0.26571754	0.02308967	0.34209144	-0.01761219	0.06379153	663

PC.ae.C36.0	0.92651552	0.00180865	0.93627059	-0.03668005	0.04029734	705
PC.ae.C36.1	3.2595E-08	0.10917923	1.46E-07	0.07083526	0.14752319	706
PC.ae.C36.2	0.00035676	0.07189766	0.00100925	0.03255408	0.11124124	706
PC.ae.C36.3	5.54E-01	0.01137402	0.61447796	-0.02638479	0.04913283	757
PC.ae.C36.4	0.23123695	0.02444918	0.30130875	-0.01561494	0.06451329	665
PC.ae.C36.5	0.80674963	0.00504569	0.83389985	-0.03544041	0.04553179	665
PC.ae.C36.6	0.72314523	0.00813165	0.76213835	-0.03693355	0.05319686	564
PC.ae.C38.0	1.4934E-12	0.13874436	1.1467E-11	0.10094991	0.17653881	706
PC.ae.C38.2	2.1588E-05	0.085665	7.0326E-05	0.04634148	0.12498851	706
PC.ae.C38.3	1.1614E-11	0.13209172	8.3281E-11	0.09451544	0.16966801	706
PC.ae.C38.4	0.01556245	0.04936666	0.03214503	0.00939918	0.08933413	665
PC.ae.C38.5	0.64603801	-0.00943463	0.6933273	-0.04975348	0.03088422	665
PC.ae.C38.6	0.47393336	0.01431178	0.55078742	-0.02490638	0.05352995	716
PC.ae.C40.0	1.6426E-16	0.16446929	1.8588E-15	0.12627927	0.20265931	706
PC.ae.C40.1	1.3838E-07	0.10253621	5.6135E-07	0.06471258	0.14035984	706
PC.ae.C40.2	1.0558E-07	0.11011502	4.3654E-07	0.06990381	0.15032623	665
PC.ae.C40.3	0.01125775	0.0520668	0.02396451	0.01184426	0.09228935	666
PC.ae.C40.4	0.57231856	0.01105571	0.6310179	-0.0273695	0.04948091	706
PC.ae.C40.5	0.82971364	-0.00427873	0.85353317	-0.04332518	0.03476772	706
PC.ae.C40.6	0.04989998	0.04245931	0.08066538	1.8601E-05	0.08490001	648
PC.ae.C42.0	2.8244E-10	0.13334895	1.6868E-09	0.09248752	0.17421039	665
PC.ae.C42.1	7.6478E-08	0.11713474	3.2241E-07	0.07487908	0.1593904	601
PC.ae.C42.2	0.00024881	0.07414427	0.00072289	0.03462294	0.11366561	666
PC.ae.C42.3	4.06E-01	0.01665539	0.48809439	-0.02270463	0.05601541	714
PC.ae.C42.4	0.11567903	-0.03081087	0.17152409	-0.06921611	0.00759438	706
PC.ae.C42.5	0.32959045	-0.02017605	0.40896292	-0.06078191	0.02042981	666
PC.ae.C42.6	0.31613877	-0.01948642	0.39753568	-0.0576232	0.01865037	756
SM.a.C30.1	8.3694E-06	0.09666471	2.8562E-05	0.05440748	0.13892195	655
SM.a.C32.0	0.03630745	0.05778142	0.06218577	0.00370186	0.11186098	443
SM.a.C32.1	6.2601E-08	0.107005	2.6918E-07	0.0686035	0.14540649	706
SM.a.C32.2	3.45E-08	0.11064935	1.51E-07	0.07171303	0.14958567	716
SM.a.C33.1	0.00664102	0.05308722	0.01502968	0.01480287	0.09137158	706
SM.a.C33.2	3.78E-04	0.07698709	1.06E-03	0.03469319	0.11928099	615
SM.a.C34.0	0.63400268	0.01218863	0.68843725	-0.03808303	0.06246029	493
SM.a.C34.1	0.34278813	0.01878098	0.41874687	-0.02006139	0.05762336	717
SM.a.C34.2	4.33E-04	0.06789319	1.18E-03	0.03018596	0.10560042	757
SM.a.C34.3	0.01744197	0.05859501	0.03537759	0.01033065	0.10685937	498
SM.a.C35.0	0.52390373	-0.01442989	0.59597514	-0.05887453	0.03001475	564
SM.a.C35.1	0.90907984	-0.00223971	0.92631358	-0.04073238	0.03625296	706
SM.a.C36.0	3.26E-10	0.15978868	1.90E-09	0.11087998	0.20869737	498
SM.a.C36.1	0.00019822	0.07443551	0.00058575	0.03537061	0.11350042	717
SM.a.C36.2	3.10E-02	0.0409551	5.70E-02	0.00375098	0.07815922	757
SM.a.C36.3	1.71E-01	0.02699296	0.23722384	-0.01168137	0.0656673	716
SM.a.C37.1	0.00355304	0.05973619	0.00868072	0.01964773	0.09982465	666
SM.a.C38.1	1.2356E-19	0.1696041	2.4151E-18	0.13390353	0.20530467	755

SM.a.C38.2	1.7546E-13	0.14075988	1.3972E-12	0.10394199	0.17757777	757
SM.a.C39.1	7.7979E-06	0.09395343	2.7041E-05	0.05301882	0.13488804	666
SM.a.C39.2	0.02623788	0.04554231	0.05024278	0.00539863	0.08568599	715
SM.a.C40.1	7.4806E-06	0.09046734	2.6366E-05	0.05113279	0.12980188	661
SM.a.C40.2	1.0121E-08	0.1215436	4.8358E-08	0.08045256	0.16263465	625
SM.a.C40.3	1.1847E-17	0.19411156	1.698E-16	0.15110579	0.23711732	536
SM.a.C40.4	2.9571E-16	0.15229936	3.1789E-15	0.11655791	0.18804081	757
SM.a.C40.5	2.3371E-09	0.11921737	1.2562E-08	0.08056487	0.15786986	675
SM.a.C41.1	1.5845E-10	0.12521243	1.002E-09	0.08736241	0.16306245	706
SM.a.C41.2	0.00150929	0.0633451	0.00386307	0.02430356	0.10238664	706
SM.a.C42.1	1.4473E-10	0.12242087	9.4293E-10	0.08549689	0.15934484	706
SM.a.C42.2	5.5668E-07	0.0984957	2.0636E-06	0.06022548	0.13676592	706
SM.a.C42.3	0.00049253	0.07009461	0.00132366	0.03078937	0.10939985	706
SM.a.C42.4	3.4386E-11	0.13292392	2.3849E-10	0.09421217	0.17163566	665
SM.a.C42.5	1.0505E-10	0.16279957	7.0582E-10	0.11436582	0.21123333	498
SM.a.C42.6	9.653E-15	0.16079378	9.0235E-14	0.12097175	0.20061582	665
SM.a.C43.1	0.00183798	0.06191705	0.004649	0.02304429	0.10078982	706
SM.a.C43.2	0.00251025	0.0596911	0.00627564	0.02105294	0.09832926	706
SM.a.C44.2	0.03379673	0.04858449	0.06106132	0.00373398	0.09343501	556
SM.a.C44.6	1.1573E-09	0.13622487	6.3799E-09	0.09295032	0.17949941	624
SM.a.C31.1	0.00019888	0.0778214	0.00058575	0.03698184	0.11866095	665
SM.a.C33.3	0.23084259	0.0238913	0.30130875	-0.01522293	0.06300553	715
SM.a.C35.2	0.2345307	0.0233634	0.30375964	-0.01518997	0.06191678	717
SM.a.C37.3	4.47E-01	-0.01512271	0.52568529	-0.0541843	0.02393887	717
SM.a.C39.5	0.55440399	0.01323446	0.61447796	-0.03070838	0.0571773	598
SM.a.C41.0	0.00014718	0.08214257	0.00044568	0.0399178	0.12436733	605
SM.a.C41.3	0.15833544	0.03287291	0.22205462	-0.01283896	0.07858477	550
SM.a.C43.0	0.00371834	0.07115112	0.00898251	0.02318688	0.11911536	539
SM.a.C43.3	0.116966	0.03489534	0.17224446	-0.00875823	0.0785489	616
Ala	0.00070607	0.06422851	0.00187415	0.02715945	0.10129757	754
Arg	0.00495665	-0.05494955	0.01158347	-0.09322617	-0.01667294	752
Asn	0.03374767	-0.04150764	0.06106132	-0.07981709	-0.00319819	703
Asp	0.01828253	0.0443453	0.03673593	0.00753595	0.08115466	754
Cit	0.00082994	-0.06487252	0.00217607	-0.10281668	-0.02692835	754
Gln	4.7648E-07	-0.09923642	1.8293E-06	-0.13756015	-0.06091268	703
Glu	4.95E-07	0.09877358	1.87E-06	0.06055015	0.13699702	754
Gly	1.4492E-07	-0.09992512	5.7699E-07	-0.13686702	-0.06298321	754
His	0.04093673	0.03843819	0.06876091	0.00158767	0.07528871	743
Ile	3.31E-01	0.02116828	0.40896292	-0.0215678	0.06390437	543
Leu	3.91E-01	0.01816265	4.72E-01	-0.0233577	0.059683	703
Lys	0.88291895	0.00295862	0.90394083	-0.03647133	0.04238858	703
Met	0.10438147	-0.03450818	0.15804237	-0.07617413	0.00715777	703
Orn	0.22320615	-0.02538911	0.29441301	-0.06627785	0.01549962	703
Phe	6.11E-01	-0.01046467	0.66725869	-0.05088543	0.02995608	703
Pro	0.3190935	0.01967611	0.39886687	-0.01906802	0.05842025	754

Trp	0.36633586	0.01729996	0.44498424	-0.02027319	0.0548731	754
Ser	1.5538E-06	-0.08948815	5.568E-06	-0.12575929	-0.05321701	754
Thr	0.03076227	0.04229766	0.0569789	0.00393086	0.08066445	714
Tyr	1.14E-01	0.03214219	1.70E-01	-0.00775235	0.07203672	703
Val	5.52E-02	0.03959145	8.86E-02	-0.00088321	0.08006611	703
NEFA_12_0	0.04024638	0.04585372	0.06813363	0.0020466	0.08966084	602
NEFA_14_0	0.04936508	0.03908993	0.08040525	0.0001089	0.07807096	731
NEFA_14_1	0.19526945	0.02507236	0.2640436	-0.01289792	0.06304263	750
NEFA_15_0	0.00406057	0.05588686	0.00959366	0.01782379	0.09394994	747
NEFA_15_1	0.01014269	0.06100148	0.02180677	0.01456198	0.10744098	506
NEFA_16_0	0.00764537	0.05548301	0.01694591	0.01476737	0.09619865	641
NEFA_16_1	0.52272121	0.01220126	0.59597514	-0.02525743	0.04965995	750
NEFA_17_0	0.00013904	0.07750914	0.00042704	0.03779218	0.1172261	692
NEFA_17_1	0.0348287	0.04327532	0.06199939	0.00309301	0.08345764	679
NEFA_18_0	0.00038635	0.07719958	0.00106494	0.03471852	0.11968063	636
NEFA_18_1	0.29014716	0.02126326	0.36912213	-0.01817431	0.06070084	694
NEFA_18_2	0.46692239	0.0153262	0.54558866	-0.02601896	0.05667137	643
NEFA_18_3	0.04557544	0.03800364	0.07537477	0.00074977	0.07525752	750
NEFA_20_1	0.07218355	0.03616729	0.11328076	-0.00326809	0.07560266	665
NEFA_20_2	0.00932671	0.05359368	0.02046166	0.01323824	0.09394912	633
NEFA_20_3	0.00025288	0.07586556	0.00072491	0.03538579	0.11634533	643
NEFA_20_4	0.06137566	0.03919704	0.09774643	-0.0018742	0.08026829	643
NEFA_22_6	0.09715776	0.03447705	0.14920657	-0.00627604	0.07523014	694
NEFA_24_1	0.22107169	0.02345992	0.29441301	-0.01414565	0.06106549	749
NEFA_12_1	0.54018866	-0.01241064	0.6059387	-0.05217331	0.02735203	688
NEFA_13_1	0.64818041	0.01257385	0.6933273	-0.04156563	0.06671332	393
NEFA_14_2	0.69263643	0.00875535	0.73358046	-0.03472532	0.05223602	603
NEFA_16_2	0.02431892	0.0471045	0.04710422	0.00612896	0.08808004	659
NEFA_18_4	0.04512646	0.04504846	0.07521077	0.00098203	0.08911489	527
NEFA_19_0	0.02048311	0.05140807	0.04040246	0.00795836	0.09485779	577
NEFA_19_1	0.10898027	0.03391434	0.16385146	-0.00757824	0.07540693	653
NEFA_20_5	1.40E-01	0.03071972	2.02E-01	-0.01010305	0.07154249	653
NEFA_22_4	0.22184598	0.02613003	0.29441301	-0.01583626	0.06809633	577
NEFA_22_5	0.54111735	0.0127196	0.6059387	-0.02812945	0.05356864	653
NEFA_24_4	0.02819443	0.05065237	0.05317371	0.0054436	0.09586113	399
NEFA_24_5	2.0929E-05	0.10333826	6.9226E-05	0.05611861	0.15055792	456
NEFA_26_1	0.06897046	0.04658618	0.10903419	-0.00363342	0.09680578	549

Glucose

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	0.00112874	0.05100486	0.01516739	0.02037502	0.0816347	757
Carn.a.C10.0	0.3858932	-0.01567185	0.55682576	-0.05115517	0.01981147	480
Carn.a.C10.1	0.73498835	-0.00606857	0.83609786	-0.04127923	0.02914208	467
Carn.a.C12.0	0.81503317	0.00457793	0.88244232	-0.03385573	0.04301159	474
Carn.a.C12.1	0.83276111	0.00416125	0.88635465	-0.03455603	0.04287853	408
Carn.a.C14.0	0.16292848	0.02236235	0.36489191	-0.00907425	0.05379896	630
Carn.a.C14.1	0.54653921	-0.00934089	0.68716918	-0.03974359	0.02106181	689
Carn.a.C14.2	0.39539379	-0.01307855	0.56453819	-0.04327519	0.01711809	683
Carn.a.C16.0	0.19470705	0.02039978	0.39868586	-0.01045516	0.05125473	754
Carn.a.C16.1	0.10411694	-0.02531405	0.26335463	-0.05585574	0.00522764	687
Carn.a.C18.0	0.00165549	0.05405224	0.01763704	0.02046328	0.08764119	606
Carn.a.C18.1	0.82498096	0.0033792	0.88244232	-0.02660856	0.03336696	756
Carn.a.C2.0	0.61781494	-0.00753045	0.74623715	-0.0371499	0.02208899	706
Carn.a.C3.0	1.41E-02	0.03895913	6.57E-02	0.00789095	0.07002731	756
Carn.a.C4.0	0.05944911	0.02887041	0.17503636	-0.00115379	0.05889462	656
Carn.a.C4.0.DC	0.44582067	0.01374624	0.61839642	-0.02166379	0.04915626	417
Carn.a.C5.0	0.17936231	0.02461953	0.3769847	-0.01135495	0.06059401	503
Carn.a.C6.0	0.59145411	-0.00857958	0.71996623	-0.03995396	0.0227948	640
Carn.a.C8.1	0.85130377	0.00326593	0.88849665	-0.03093941	0.03747127	576
lyso.PC.a.C14.0	0.05620851	0.02863279	0.17503636	-0.00075995	0.05802554	754
lyso.PC.a.C16.0	0.35174653	0.01406649	0.52464828	-0.01557191	0.04370488	706
lyso.PC.a.C16.1	0.22798032	0.01872091	0.43913793	-0.01173904	0.04918086	757
lyso.PC.a.C18.0	0.0053098	0.04108228	0.03805355	0.01223566	0.0699289	757
lyso.PC.a.C18.1	3.49E-03	0.04459592	2.75E-02	0.01472115	0.07447069	706
lyso.PC.a.C18.2	8.76E-04	0.04986532	1.45E-02	0.02057167	0.07915897	706
lyso.PC.a.C18.3	2.596E-05	0.07215581	0.00279069	0.03873122	0.1055804	605
lyso.PC.a.C18.6	0.1484022	0.0261391	0.34268724	-0.00933965	0.06161785	548
lyso.PC.a.C20.2	0.7537001	0.00559961	0.84840587	-0.02944652	0.04064574	499
lyso.PC.a.C20.3	0.00584194	0.04533733	0.03806114	0.01314922	0.07752545	646
lyso.PC.a.C20.4	0.00168539	0.04783775	0.01763704	0.01804511	0.0776304	757
lyso.PC.a.C20.5	0.0034683	0.04335911	0.02750754	0.01433404	0.07238418	698
lyso.PC.a.C22.5	0.05408169	0.03057543	0.17354573	-0.00053781	0.06168867	666
lyso.PC.a.C22.6	0.12307501	0.02344924	0.29731604	-0.00637164	0.05327012	717
lyso.PC.e.C16.0	0.02889532	0.03247419	0.11504619	0.00335255	0.06159584	756
lyso.PC.e.C18.0	0.00030095	0.05587569	0.01078401	0.02567324	0.08607814	740
lyso.PC.e.C18.1	0.00042738	0.06455648	0.01084978	0.02878143	0.10033153	548
PC.aa.C30.0	0.24935078	-0.01720398	0.44675349	-0.04650088	0.01209292	753
PC.aa.C30.1	0.80040875	0.00428402	0.88244232	-0.02898761	0.03755566	538
PC.aa.C30.2	0.24791492	-0.02223593	0.44675349	-0.06000347	0.01553162	501
PC.aa.C32.0	0.0004069	-0.0537982	0.01084978	-0.0835346	-0.02406179	757
PC.aa.C32.1	0.01128017	-0.03909766	0.05774373	-0.06930962	-0.00888571	665
PC.aa.C32.2	0.04547639	-0.03210388	0.16028563	-0.06355965	-0.00064812	648
PC.aa.C32.3	0.8436305	0.0030776	0.88849665	-0.02754719	0.03370238	666

PC.aa.C34.0	0.52486735	-0.01098619	0.66457774	-0.04490452	0.02293214	547
PC.aa.C34.1	0.00168286	-0.04891794	0.01763704	-0.07937538	-0.01846049	716
PC.aa.C34.2	0.0002909	-0.05527745	0.01078401	-0.08507869	-0.02547622	706
PC.aa.C34.3	0.15309126	-0.02158004	0.3464697	-0.051204	0.00804391	706
PC.aa.C34.4	0.52072234	-0.00992087	0.66457774	-0.04023732	0.02039558	665
PC.aa.C34.5	0.43945759	0.01226731	0.61352846	-0.01887069	0.04340531	674
PC.aa.C36.0	0.94883708	-0.00099118	0.9532709	-0.0313084	0.02932604	705
PC.aa.C36.1	0.27636032	0.01707347	0.46785408	-0.01369788	0.04784482	705
PC.aa.C36.2	0.82449739	0.00337451	0.88244232	-0.02649049	0.0332395	706
PC.aa.C36.3	0.01636213	-0.03730742	0.07179303	-0.06774437	-0.00687047	716
PC.aa.C36.4	0.00848886	-0.04112092	0.04932716	-0.0717062	-0.01053564	665
PC.aa.C36.5	0.5790737	0.00890835	0.7155221	-0.02261163	0.04042833	625
PC.aa.C36.6	0.75292926	-0.00479659	0.84840587	-0.03470042	0.02510725	750
PC.aa.C38.0	0.52548008	-0.01042948	0.66457774	-0.04266728	0.02180832	665
PC.aa.C38.1	0.56426428	-0.00960271	0.70533035	-0.04229706	0.02309164	605
PC.aa.C38.2	0.01022123	-0.04100028	0.05615233	-0.07225889	-0.00974168	715
PC.aa.C38.3	3.56E-01	-0.01497217	5.25E-01	-0.04682028	0.01687594	648
PC.aa.C38.4	0.29345513	-0.01675881	0.48826917	-0.04805812	0.0145405	648
PC.aa.C38.5	0.70329262	-0.00595427	0.80859847	-0.03663905	0.0247305	648
PC.aa.C38.6	0.00101268	-0.0553875	0.01451513	-0.08832324	-0.02245176	648
PC.aa.C40.0	0.26046823	-0.01928466	0.46219332	-0.05291029	0.01434097	605
PC.aa.C40.1	0.26871705	-0.02071446	0.46219332	-0.05747878	0.01604986	439
PC.aa.C40.3	0.11567601	-0.02965474	0.28469867	-0.06662995	0.00732047	440
PC.aa.C40.4	0.19771833	-0.01885129	0.40103247	-0.0475584	0.00985581	706
PC.aa.C40.5	4.16E-01	-0.01298047	5.85E-01	-0.04431858	0.01835765	648
PC.aa.C40.6	0.04878319	-0.03314584	0.16516457	-0.06611425	-0.00017742	696
PC.aa.C42.0	0.05847836	-0.03242955	0.17503636	-0.06602607	0.00116696	606
PC.aa.C42.1	0.76020056	-0.00566398	0.84952408	-0.04210588	0.03077791	498
PC.aa.C42.2	0.71220636	-0.00601473	0.81449132	-0.03803541	0.02600595	477
PC.aa.C42.4	0.01070812	-0.04846537	0.05615233	-0.08562562	-0.01130511	425
PC.aa.C42.5	0.00019547	-0.06251303	0.01050642	-0.09525454	-0.02977153	555
PC.aa.C42.6	0.14982605	-0.02443157	0.34268724	-0.05770972	0.00884657	538
PC.aa.C43.4	0.00551522	-0.05049574	0.03806114	-0.08608279	-0.01490869	479
PC.aa.C43.6	0.05142756	-0.03006012	0.16752916	-0.060307	0.00018677	706
PC.aa.C44.12	0.06156094	-0.02799842	0.17503636	-0.05735621	0.00135937	706
PC.ae.C30.0	0.30848938	-0.01623748	0.50246376	-0.04752251	0.01504756	639
PC.ae.C30.1	0.67158211	0.00743292	0.78901723	-0.02698359	0.04184944	581
PC.ae.C32.0	0.35003407	-0.01386511	0.52464828	-0.04297332	0.0152431	757
PC.ae.C32.1	0.21552061	-0.01864339	0.42904566	-0.04816943	0.01088264	757
PC.ae.C32.2	0.06333045	-0.02773221	0.17621649	-0.05700811	0.00154368	756
PC.ae.C34.0	0.89908931	-0.00197923	0.9204962	-0.03261136	0.0286529	716
PC.ae.C34.1	0.16488752	-0.0217365	0.36547234	-0.05243293	0.00895994	716
PC.ae.C34.2	2.29E-01	-0.019302	4.39E-01	-0.05076164	0.01215764	716
PC.ae.C34.3	2.21E-01	-0.01989326	4.35E-01	-0.0518059	0.01201939	716
PC.ae.C34.4	0.81314745	0.00370091	0.88244232	-0.02703186	0.03443368	663

PC.ae.C36.0	0.30286767	-0.01523783	0.4970729	-0.04425418	0.01377852	705
PC.ae.C36.1	0.90537241	0.00182475	0.92253587	-0.02830212	0.03195163	706
PC.ae.C36.2	0.66128328	-0.00681207	0.78550224	-0.03732511	0.02370097	706
PC.ae.C36.3	3.34E-01	-0.01478658	0.52047514	-0.04480484	0.01523168	757
PC.ae.C36.4	0.23204424	0.01876979	0.44150011	-0.012041	0.04958058	665
PC.ae.C36.5	0.34659368	0.01492533	0.52464828	-0.0161901	0.04604076	665
PC.ae.C36.6	0.29523252	0.01847402	0.48826917	-0.01616178	0.05310981	564
PC.ae.C38.0	0.91750423	-0.00158939	0.92905117	-0.03170648	0.02852769	706
PC.ae.C38.2	0.26643476	-0.01732917	0.46219332	-0.0479206	0.01326227	706
PC.ae.C38.3	0.34913071	-0.01423818	0.52464828	-0.04407578	0.01559943	706
PC.ae.C38.4	0.45508784	0.01174682	0.6272044	-0.01911485	0.04260849	665
PC.ae.C38.5	0.397312	0.01336925	0.56453819	-0.01762528	0.04436377	665
PC.ae.C38.6	0.92040884	-0.00158995	0.92905117	-0.0328203	0.02964041	716
PC.ae.C40.0	0.01474432	-0.03822306	0.06604225	-0.06892051	-0.00752562	706
PC.ae.C40.1	0.87764157	0.00232647	0.91156008	-0.02733125	0.03198418	706
PC.ae.C40.2	0.00342793	-0.04681003	0.02750754	-0.0781031	-0.01551696	665
PC.ae.C40.3	0.34902918	-0.01477936	0.52464828	-0.04574659	0.01618787	666
PC.ae.C40.4	0.50821868	-0.00995566	0.66457774	-0.03948461	0.0195733	706
PC.ae.C40.5	0.62416075	0.00749098	0.74969029	-0.02251376	0.03749572	706
PC.ae.C40.6	0.66824704	-0.00714864	0.78901723	-0.03988963	0.02559235	648
PC.ae.C42.0	0.00045418	-0.05633921	0.01084978	-0.08772864	-0.02494979	665
PC.ae.C42.1	0.00403371	-0.0477145	0.02990513	-0.08017564	-0.01525337	601
PC.ae.C42.2	0.81851226	-0.00357846	0.88244232	-0.03418902	0.0270321	666
PC.ae.C42.3	6.30E-03	-0.04362522	0.03982118	-0.07488317	-0.01236728	714
PC.ae.C42.4	0.0639297	-0.02787692	0.17621649	-0.05737265	0.00161881	706
PC.ae.C42.5	0.26777089	-0.01757999	0.46219332	-0.04870289	0.01354292	666
PC.ae.C42.6	0.26277769	-0.0172951	0.46219332	-0.04759146	0.01300125	756
SM.a.C30.1	0.50822149	-0.0104464	0.66457774	-0.0414341	0.0205413	655
SM.a.C32.0	0.57678122	0.01068638	0.7155221	-0.02692033	0.04829308	443
SM.a.C32.1	0.39911537	-0.01294735	0.56453819	-0.04307665	0.01718195	706
SM.a.C32.2	4.79E-01	-0.01139446	6.50E-01	-0.04297096	0.02018205	716
SM.a.C33.1	0.33622555	-0.01448853	0.52047514	-0.04404917	0.0150721	706
SM.a.C33.2	4.64E-01	-0.01141796	6.36E-01	-0.04204571	0.01920979	615
SM.a.C34.0	0.01299778	-0.04164853	0.06210049	-0.07447302	-0.00882405	493
SM.a.C34.1	0.11080604	-0.02509451	0.27701511	-0.05595347	0.00576444	717
SM.a.C34.2	4.92E-02	-0.03027242	1.65E-01	-0.06043388	-0.00011096	757
SM.a.C34.3	0.68494218	0.0071321	0.80034005	-0.02738661	0.04165082	498
SM.a.C35.0	0.33649323	-0.01672299	0.52047514	-0.05087078	0.01742479	564
SM.a.C35.1	0.7646131	-0.00451314	0.84952408	-0.03409485	0.02506857	706
SM.a.C36.0	6.73E-02	-0.03369245	1.83E-01	-0.06979709	0.00241219	498
SM.a.C36.1	0.05052823	-0.0312225	0.16713185	-0.06251703	7.2034E-05	717
SM.a.C36.2	3.98E-02	-0.0310457	1.46E-01	-0.06064314	-0.00144826	757
SM.a.C36.3	2.80E-01	-0.01695429	0.47065843	-0.04775608	0.01384749	716
SM.a.C37.1	0.24305365	-0.01838805	0.44663704	-0.04928972	0.01251361	666
SM.a.C38.1	0.00172269	-0.04778857	0.01763704	-0.07761177	-0.01796538	755

SM.a.C38.2	0.00093577	-0.05102398	0.01446312	-0.08117234	-0.02087562	757
SM.a.C39.1	0.35435138	-0.01503146	0.52464828	-0.04687712	0.01681421	666
SM.a.C39.2	0.32612949	-0.0160572	0.51557236	-0.0481405	0.01602611	715
SM.a.C40.1	0.07306692	-0.02794555	0.19636734	-0.05851083	0.00261974	661
SM.a.C40.2	0.06015506	-0.03095269	0.17503636	-0.06323191	0.00132654	625
SM.a.C40.3	0.14201455	-0.02462959	0.33188183	-0.05753233	0.00827315	536
SM.a.C40.4	0.06187332	-0.02825708	0.17503636	-0.0579215	0.00140734	757
SM.a.C40.5	0.35954917	0.01475825	0.52587124	-0.01684813	0.04636463	675
SM.a.C41.1	0.23586389	-0.01808732	0.44400131	-0.04801992	0.01184528	706
SM.a.C41.2	0.01454483	-0.03754782	0.06604225	-0.067642	-0.00745364	706
SM.a.C42.1	0.11652783	-0.02335668	0.28469867	-0.05253834	0.00582498	706
SM.a.C42.2	0.00246339	-0.04605074	0.02302737	-0.07580299	-0.0162985	706
SM.a.C42.3	0.00203504	-0.04773686	0.01988787	-0.07800211	-0.01747161	706
SM.a.C42.4	0.04735451	-0.03106336	0.16421322	-0.061763	-0.00036372	665
SM.a.C42.5	0.08893059	-0.0311015	0.22761996	-0.06695411	0.00475112	498
SM.a.C42.6	0.00082238	-0.05441859	0.01446312	-0.08621302	-0.02262417	665
SM.a.C43.1	0.52482897	0.00974651	0.66457774	-0.02033053	0.03982356	706
SM.a.C43.2	0.97566484	-0.00046458	0.97566484	-0.03035647	0.02942731	706
SM.a.C44.2	0.76654731	-0.00486271	0.84952408	-0.0370198	0.02729437	556
SM.a.C44.6	0.02853886	-0.03739679	0.11504619	-0.07085544	-0.00393813	624
SM.a.C31.1	0.70258454	-0.00611933	0.80859847	-0.03757465	0.025336	665
SM.a.C33.3	0.18021721	-0.02118795	0.3769847	-0.05219935	0.00982345	715
SM.a.C35.2	0.83918455	-0.00317391	0.88849665	-0.03386905	0.02752123	717
SM.a.C37.3	1.81E-01	-0.02119053	0.3769847	-0.05223307	0.00985202	717
SM.a.C39.5	0.37676946	0.01417284	0.54733401	-0.01729653	0.04564221	598
SM.a.C41.0	0.59271638	-0.00884136	0.71996623	-0.04128618	0.02360346	605
SM.a.C41.3	0.18462461	-0.02216606	0.38167587	-0.05494552	0.01061341	550
SM.a.C43.0	0.01282356	-0.04358746	0.06210049	-0.07787706	-0.00929786	539
SM.a.C43.3	0.0408256	-0.03262172	0.14629173	-0.06387797	-0.00136547	616
Ala	0.07774719	0.02670098	0.20384934	-0.00297508	0.05637704	754
Arg	0.0016906	0.04879212	0.01763704	0.01839672	0.07918752	752
Asn	0.52410416	0.00984553	0.66457774	-0.02048417	0.04017524	703
Asp	0.84792642	-0.00287398	0.88849665	-0.0322858	0.02653784	754
Cit	0.01212612	0.0388182	0.0606306	0.00851299	0.06912342	754
Gln	0.03685347	0.03271863	0.13900872	0.00200299	0.06343428	703
Glu	5.38E-04	0.05436862	1.16E-02	0.02366604	0.0850712	754
Gly	0.21521914	0.01891179	0.42904566	-0.01101971	0.04884328	754
His	0.50854299	-0.00992545	0.66457774	-0.03938551	0.0195346	743
Ile	5.68E-02	0.03659249	0.17503636	-0.00105962	0.0742446	543
Leu	1.73E-02	0.03968019	7.45E-02	0.00702324	0.07233714	703
Lys	0.27521162	0.01729578	0.46785408	-0.01380178	0.04839334	703
Met	0.31965188	0.01670207	0.50907522	-0.01622623	0.04963037	703
Orn	0.00568177	0.04540156	0.03806114	0.01327029	0.07753284	703
Phe	3.13E-02	0.03496018	0.12218347	0.00315547	0.06676489	703
Pro	0.0001398	0.05960106	0.01001919	0.02903936	0.09016276	754

Trp	0.23955419	0.01792611	0.44400131	-0.01197245	0.04782466	754
Ser	0.03332565	0.03175415	0.12794669	0.00251614	0.06099217	754
Thr	0.89895195	-0.00198274	0.9204962	-0.03262741	0.02866192	714
Tyr	8.55E-06	0.07103014	1.84E-03	0.03993294	0.10212735	703
Val	2.65E-03	0.04889033	2.38E-02	0.01706575	0.08071491	703
NEFA_12_0	0.48037704	-0.01197181	0.64956644	-0.04526898	0.02132536	602
NEFA_14_0	0.06063717	-0.02953543	0.17503636	-0.06039407	0.00132321	731
NEFA_14_1	0.01055953	-0.03922189	0.05615233	-0.06925888	-0.0091849	750
NEFA_15_0	0.52330141	-0.00987893	0.66457774	-0.04025046	0.02049259	747
NEFA_15_1	0.17804868	-0.02472054	0.3769847	-0.06073313	0.01129205	506
NEFA_16_0	0.17795559	-0.02283863	0.3769847	-0.0560952	0.01041793	641
NEFA_16_1	0.00094178	-0.0499315	0.01446312	-0.0794498	-0.02041319	750
NEFA_17_0	0.69487864	0.0064503	0.80756166	-0.02582453	0.03872513	692
NEFA_17_1	0.17239644	-0.02250487	0.3769847	-0.05485386	0.00984412	679
NEFA_18_0	0.88812743	-0.00244323	0.91801633	-0.03653625	0.0316498	636
NEFA_18_1	0.04007118	-0.03318354	0.14602209	-0.06485872	-0.00150836	694
NEFA_18_2	0.00670552	-0.04421779	0.04119106	-0.07613968	-0.01229591	643
NEFA_18_3	0.12563211	-0.02311908	0.30012116	-0.0527201	0.00648195	750
NEFA_20_1	0.08322791	-0.02871247	0.21559037	-0.06120975	0.0037848	665
NEFA_20_2	0.07657873	-0.03007674	0.20326454	-0.06337418	0.0032207	633
NEFA_20_3	0.06108417	-0.03026067	0.17503636	-0.06193249	0.00141115	643
NEFA_20_4	0.31600565	-0.01632499	0.50907522	-0.04827125	0.01562128	643
NEFA_22_6	0.12885271	-0.02541341	0.30443224	-0.05823058	0.00740376	694
NEFA_24_1	0.81614427	-0.00353959	0.88244232	-0.03341576	0.02633658	749
NEFA_12_1	0.00694101	-0.04325247	0.04145327	-0.07461373	-0.01189122	688
NEFA_13_1	0.02322737	0.05356561	0.09603623	0.0073493	0.09978191	393
NEFA_14_2	0.31884009	-0.01680812	0.50907522	-0.04989567	0.01627943	603
NEFA_16_2	0.00943614	-0.04084698	0.05338868	-0.07165354	-0.01004043	659
NEFA_18_4	0.50148389	-0.01190055	0.66457774	-0.04665908	0.02285799	527
NEFA_19_0	0.59063203	0.00999879	0.71996623	-0.02649035	0.04648794	577
NEFA_19_1	0.48721172	-0.0118633	0.65469074	-0.04537499	0.02164838	653
NEFA_20_5	6.61E-01	0.00737676	7.86E-01	-0.02559134	0.04034487	653
NEFA_22_4	0.22241637	-0.02181827	0.43472291	-0.05690293	0.0132664	577
NEFA_22_5	0.23951314	-0.01973201	0.44400131	-0.05264404	0.01318002	653
NEFA_24_4	0.24829672	-0.02650359	0.44675349	-0.07157169	0.01856451	399
NEFA_24_5	0.00358238	-0.05290223	0.02750754	-0.08840598	-0.01739848	456
NEFA_26_1	0.01774046	0.04596038	0.07478821	0.00799914	0.08392163	549

Systolic Blood Pressure

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	5.7026E-06	2.21258792	0.00036583	1.26217353	3.16300232	757
Carn.a.C10.0	0.34664531	0.55201832	0.53234815	-0.599436	1.70347264	480
Carn.a.C10.1	0.13102304	0.90271907	0.31651633	-0.26995066	2.0753888	467
Carn.a.C12.0	0.04560953	1.17742309	0.14008641	0.02308334	2.33176284	474
Carn.a.C12.1	0.1419973	0.94982089	0.33342572	-0.31932857	2.21897034	408
Carn.a.C14.0	0.00208886	1.57865146	0.0154864	0.57549124	2.58181168	630
Carn.a.C14.1	0.17578764	0.68036105	0.38579273	-0.30533702	1.66605912	689
Carn.a.C14.2	0.0445267	0.99855484	0.1387426	0.02449173	1.97261796	683
Carn.a.C16.0	0.00128697	1.57724458	0.01064227	0.61898058	2.53550859	754
Carn.a.C16.1	0.35053944	0.47216848	0.53373802	-0.52023951	1.46457648	687
Carn.a.C18.0	0.25442995	0.62964056	0.44473528	-0.4543719	1.71365301	606
Carn.a.C18.1	0.01111888	1.20923282	0.04980329	0.27657206	2.14189358	756
Carn.a.C2.0	0.80030261	0.12402796	0.87788296	-0.83828621	1.08634212	706
Carn.a.C3.0	8.04E-06	2.1969757	3.66E-04	1.23763386	3.15631754	756
Carn.a.C4.0	0.00580509	1.43831928	0.03284458	0.41790112	2.45873745	656
Carn.a.C4.0.DC	0.00133943	2.02249066	0.01066587	0.79153288	3.25344844	417
Carn.a.C5.0	0.00084477	2.01001171	0.00789676	0.83409245	3.18593097	503
Carn.a.C6.0	0.00733899	1.37410474	0.03735667	0.37092181	2.37728768	640
Carn.a.C8.1	0.20916346	-0.65056685	0.3971382	-1.6668946	0.3657609	576
lyso.PC.a.C14.0	0.02993016	1.01683404	0.09899975	0.09911965	1.93454843	754
lyso.PC.a.C16.0	0.0024289	1.48338306	0.01740711	0.52636109	2.44040503	706
lyso.PC.a.C16.1	3.3922E-05	2.00027743	0.00072932	1.05878643	2.94176843	757
lyso.PC.a.C18.0	0.00461278	1.30407853	0.02858585	0.40311322	2.20504384	757
lyso.PC.a.C18.1	7.41E-03	1.32887236	3.74E-02	0.35743806	2.30030666	706
lyso.PC.a.C18.2	1.96E-02	1.13884765	7.33E-02	0.18336954	2.09432577	706
lyso.PC.a.C18.3	0.00019736	2.02970064	0.00265198	0.96552302	3.09387826	605
lyso.PC.a.C18.6	0.92881529	-0.05104452	0.96471153	-1.17294344	1.0708544	548
lyso.PC.a.C20.2	0.21370852	0.7409079	0.3971382	-0.4283325	1.91014831	499
lyso.PC.a.C20.3	3.5104E-10	3.27427324	7.5473E-08	2.26583237	4.28271411	646
lyso.PC.a.C20.4	8.5077E-06	2.11122134	0.00036583	1.18676816	3.03567452	757
lyso.PC.a.C20.5	2.3528E-05	2.02796936	0.00063231	1.09279355	2.96314517	698
lyso.PC.a.C22.5	0.00010985	1.98136967	0.00196811	0.98159541	2.98114393	666
lyso.PC.a.C22.6	0.00571547	1.30493678	0.03284458	0.3807423	2.22913126	717
lyso.PC.e.C16.0	0.01532139	1.12727608	0.06334807	0.21668538	2.03786679	756
lyso.PC.e.C18.0	0.02241174	1.10414147	0.07899218	0.1568117	2.05147124	740
lyso.PC.e.C18.1	0.0074601	1.55131867	0.03735667	0.41668495	2.68595238	548
PC.aa.C30.0	0.69271025	0.18436602	0.81633185	-0.73117183	1.09990386	753
PC.aa.C30.1	0.35311556	-0.53421973	0.53373802	-1.66342702	0.59498757	538
PC.aa.C30.2	0.51397201	-0.39107864	0.67380477	-1.56755363	0.78539635	501
PC.aa.C32.0	0.82147428	0.10770802	0.88752246	-0.82902714	1.04444319	757
PC.aa.C32.1	0.18333616	0.66141873	0.38579273	-0.31365691	1.63649437	665
PC.aa.C32.2	0.50170441	-0.34704133	0.66997794	-1.36086831	0.66678566	648
PC.aa.C32.3	0.81924615	0.11561533	0.88752246	-0.87745757	1.10868822	666

PC.aa.C34.0	0.31709442	0.5453412	0.50500222	-0.52445734	1.61513974	547
PC.aa.C34.1	0.17621381	0.65306669	0.38579273	-0.29399514	1.60012852	716
PC.aa.C34.2	0.21077409	-0.62280379	0.3971382	-1.59902188	0.3534143	706
PC.aa.C34.3	0.62085178	0.24286689	0.754142	-0.72071589	1.20644966	706
PC.aa.C34.4	0.35499784	0.45941351	0.53373802	-0.51521152	1.43403855	665
PC.aa.C34.5	0.00261238	1.4673154	0.01811811	0.51376647	2.42086432	674
PC.aa.C36.0	0.53253945	0.3131698	0.68973483	-0.67150534	1.29784494	705
PC.aa.C36.1	0.0395263	1.04782032	0.12497287	0.05038045	2.04526019	705
PC.aa.C36.2	0.58688981	0.26855949	0.73361227	-0.70143006	1.23854903	706
PC.aa.C36.3	0.71709362	0.17443842	0.82332948	-0.77036489	1.11924172	716
PC.aa.C36.4	0.47012708	0.36379476	0.64793155	-0.62466252	1.35225204	665
PC.aa.C36.5	0.00423413	1.46862358	0.02796198	0.4640222	2.47322496	625
PC.aa.C36.6	0.08757141	0.81578902	0.23244262	-0.12044716	1.7520252	750
PC.aa.C38.0	0.38627405	-0.46147941	0.56495864	-1.50668333	0.58372451	665
PC.aa.C38.1	0.79702926	0.13898946	0.87788296	-0.9218824	1.19986131	605
PC.aa.C38.2	0.86670325	-0.08364732	0.92248118	-1.06173205	0.89443741	715
PC.aa.C38.3	3.60E-04	1.85235751	4.52E-03	0.83830764	2.86640737	648
PC.aa.C38.4	0.01258157	1.2768113	0.05410076	0.2749086	2.27871399	648
PC.aa.C38.5	0.00107686	1.63599687	0.00964685	0.65796011	2.61403363	648
PC.aa.C38.6	0.75391166	-0.17049512	0.85053326	-1.23803483	0.89704459	648
PC.aa.C40.0	0.97388429	0.01803497	0.98302874	-1.06347182	1.09954175	605
PC.aa.C40.1	0.94189036	0.04513659	0.97358859	-1.17122764	1.26150083	439
PC.aa.C40.3	0.53653902	0.396874	0.69075383	-0.86424123	1.65798923	440
PC.aa.C40.4	0.00037827	1.68335057	0.0045182	0.75817511	2.60852602	706
PC.aa.C40.5	3.92E-05	2.09711852	7.66E-04	1.10274436	3.09149269	648
PC.aa.C40.6	0.05328467	1.00507942	0.161355	-0.01426743	2.02442626	696
PC.aa.C42.0	0.33747619	-0.52730297	0.52577811	-1.60613051	0.55152457	606
PC.aa.C42.1	0.35953075	-0.57099691	0.53679938	-1.79430668	0.65231286	498
PC.aa.C42.2	0.69483129	0.23630039	0.81633185	-0.94660656	1.41920734	477
PC.aa.C42.4	0.18426729	-0.87388232	0.38579273	-2.16551847	0.41775383	425
PC.aa.C42.5	0.07284473	-1.02843022	0.20607392	-2.15244891	0.09558846	555
PC.aa.C42.6	0.91177049	-0.06391066	0.9562471	-1.19644828	1.06862696	538
PC.aa.C43.4	0.13342025	0.93491432	0.31872615	-0.28711766	2.15694631	479
PC.aa.C43.6	0.42894683	-0.39698868	0.60536159	-1.38181017	0.58783282	706
PC.aa.C44.12	0.9639442	0.02202084	0.98153972	-0.93407634	0.97811802	706
PC.ae.C30.0	0.65175909	0.23134944	0.78283913	-0.7748032	1.23750208	639
PC.ae.C30.1	0.99045356	0.00672163	0.99045356	-1.09620688	1.10965014	581
PC.ae.C32.0	0.76640873	0.13772181	0.85377139	-0.77205049	1.0474941	757
PC.ae.C32.1	0.76360209	0.14149121	0.85377139	-0.78174921	1.06473163	757
PC.ae.C32.2	0.50508464	-0.31127587	0.67032839	-1.22767348	0.60512175	756
PC.ae.C34.0	0.25972357	0.54360154	0.44952625	-0.40260461	1.48980769	716
PC.ae.C34.1	0.75559001	-0.15072006	0.85053326	-1.10100054	0.79956041	716
PC.ae.C34.2	2.82E-02	-1.08648265	9.49E-02	-2.05678946	-0.11617585	716
PC.ae.C34.3	5.13E-01	-0.32890034	6.74E-01	-1.31629372	0.65849303	716
PC.ae.C34.4	0.22728868	0.61097635	0.41412768	-0.38175072	1.60370343	663

PC.ae.C36.0	0.95130315	0.02927984	0.97861329	-0.91171871	0.97027839	705
PC.ae.C36.1	0.15834337	0.70291124	0.36216834	-0.27436089	1.68018338	706
PC.ae.C36.2	0.29075437	-0.53340526	0.48086299	-1.52395679	0.45714627	706
PC.ae.C36.3	2.46E-01	-0.55472559	0.4347573	-1.49218443	0.38273325	757
PC.ae.C36.4	0.09721806	0.83724355	0.254901	-0.15260451	1.82709161	665
PC.ae.C36.5	0.00746407	1.36108029	0.03735667	0.36524093	2.35691965	665
PC.ae.C36.6	0.00197849	1.71945926	0.01519196	0.63287346	2.80604506	564
PC.ae.C38.0	0.07698002	0.88055586	0.21152857	-0.09559297	1.8567047	706
PC.ae.C38.2	0.41856909	-0.40983923	0.59994902	-1.40401703	0.58433857	706
PC.ae.C38.3	0.21426991	0.61336289	0.3971382	-0.35544301	1.5821688	706
PC.ae.C38.4	0.4069766	0.41935462	0.58724811	-0.5730375	1.41174674	665
PC.ae.C38.5	0.19362722	0.66005102	0.38906405	-0.33596695	1.656069	665
PC.ae.C38.6	0.20479072	0.6234639	0.3971382	-0.34098472	1.58791253	716
PC.ae.C40.0	0.61694631	-0.25520525	0.75365601	-1.25652538	0.74611488	706
PC.ae.C40.1	0.26135247	0.55110534	0.44952625	-0.4114613	1.51367199	706
PC.ae.C40.2	0.30133606	-0.53763353	0.4871222	-1.55823593	0.48296887	665
PC.ae.C40.3	0.98181056	0.01167173	0.98639846	-0.99319155	1.01653502	666
PC.ae.C40.4	0.79124442	0.12940489	0.87689459	-0.83009601	1.0889058	706
PC.ae.C40.5	0.66475412	0.21523546	0.79401187	-0.75950314	1.18997406	706
PC.ae.C40.6	0.54108859	-0.32763575	0.69246457	-1.37977597	0.72450446	648
PC.ae.C42.0	0.07012034	-0.94787746	0.20101163	-1.97386871	0.0781138	665
PC.ae.C42.1	0.33422044	0.51859273	0.52450653	-0.53529328	1.57247874	601
PC.ae.C42.2	0.00075	1.69719318	0.00732957	0.71314891	2.68123745	666
PC.ae.C42.3	2.10E-01	-0.62389363	0.3971382	-1.60055825	0.352771	714
PC.ae.C42.4	0.89222604	-0.06630791	0.94033627	-1.02684258	0.89422676	706
PC.ae.C42.5	0.23461606	-0.61135878	0.42388615	-1.62045152	0.39773397	666
PC.ae.C42.6	0.30677264	-0.49358884	0.49220983	-1.44105744	0.45387976	756
SM.a.C30.1	0.64676111	-0.24676467	0.78120021	-1.30365029	0.81012095	655
SM.a.C32.0	0.96784381	-0.02610382	0.98153972	-1.29808672	1.24587908	443
SM.a.C32.1	0.74017499	-0.16545057	0.841998	-1.144624	0.81372285	706
SM.a.C32.2	9.94E-02	-0.82525727	2.57E-01	-1.80731743	0.1568029	716
SM.a.C33.1	0.95626721	0.02684843	0.97903548	-0.9340668	0.98776365	706
SM.a.C33.2	4.34E-01	-0.41699714	6.06E-01	-1.46380592	0.62981164	615
SM.a.C34.0	0.01680983	-1.47113934	0.06692801	-2.67597017	-0.2663085	493
SM.a.C34.1	0.21964351	-0.60113826	0.40361842	-1.5617995	0.35952298	717
SM.a.C34.2	3.44E-02	-1.01697093	1.10E-01	-1.95877867	-0.07516318	757
SM.a.C34.3	0.20484054	-0.74818205	0.3971382	-1.90610046	0.40973636	498
SM.a.C35.0	0.06620612	-1.00862345	0.19235562	-2.08497533	0.06772842	564
SM.a.C35.1	0.28654212	-0.52161959	0.48086299	-1.48185248	0.4386133	706
SM.a.C36.0	1.87E-01	0.81775411	3.86E-01	-0.39717634	2.03268457	498
SM.a.C36.1	0.40394504	-0.41499807	0.58681206	-1.39067036	0.56067422	717
SM.a.C36.2	2.76E-02	-1.03925869	9.49E-02	-1.96344129	-0.11507609	757
SM.a.C36.3	7.39E-02	-0.86701737	0.20625064	-1.81793898	0.08390424	716
SM.a.C37.1	0.18381513	-0.67877092	0.38579273	-1.68052197	0.32298013	666
SM.a.C38.1	0.45645199	-0.35584114	0.63314309	-1.29341167	0.58172938	755

SM.a.C38.2	0.01930858	-1.128939	0.0732979	-2.07420295	-0.18367504	757
SM.a.C39.1	0.70379565	0.20014755	0.82236991	-0.83309091	1.233386	666
SM.a.C39.2	0.07772445	-0.89625375	0.21152857	-1.89230721	0.09979972	715
SM.a.C40.1	0.10756446	0.81528206	0.27011783	-0.17816851	1.80873262	661
SM.a.C40.2	0.24669949	-0.61245963	0.4347573	-1.64977438	0.42485513	625
SM.a.C40.3	0.50021849	0.38492463	0.66997794	-0.73599378	1.50584304	536
SM.a.C40.4	0.55348488	0.28041678	0.70413756	-0.64820832	1.20904188	757
SM.a.C40.5	0.02124338	1.13954754	0.07612211	0.17054132	2.10855376	675
SM.a.C41.1	0.16769157	0.68373704	0.37951249	-0.28827088	1.65574496	706
SM.a.C41.2	0.03410783	-1.05821075	0.11023	-2.03686572	-0.07955577	706
SM.a.C42.1	0.00429184	1.37776055	0.02796198	0.43369037	2.32183074	706
SM.a.C42.2	0.4910439	-0.3413129	0.6676299	-1.3139067	0.6312809	706
SM.a.C42.3	0.00551323	-1.39598899	0.03284458	-2.38044433	-0.41153365	706
SM.a.C42.4	0.29453101	0.52861368	0.48339059	-0.46081941	1.51804677	665
SM.a.C42.5	0.60371521	-0.31925664	0.74170726	-1.52697855	0.88846526	498
SM.a.C42.6	0.28784068	-0.55820771	0.48086299	-1.58863279	0.47221736	665
SM.a.C43.1	0.18993005	0.65231089	0.38890439	-0.32381194	1.62843372	706
SM.a.C43.2	0.59139827	0.26555843	0.73497473	-0.70527564	1.23639249	706
SM.a.C44.2	0.83524353	0.11575178	0.89341969	-0.97697571	1.20847928	556
SM.a.C44.6	0.17917535	0.7357175	0.38579273	-0.33864084	1.81007584	624
SM.a.C31.1	0.3672153	-0.47098547	0.54076226	-1.4959253	0.55395436	665
SM.a.C33.3	0.34494793	-0.46632422	0.53234815	-1.43509676	0.50244833	715
SM.a.C35.2	0.4937356	-0.3329153	0.6676299	-1.28748232	0.62165172	717
SM.a.C37.3	1.22E-01	-0.76044835	0.29897344	-1.72570432	0.20480762	717
SM.a.C39.5	0.00966771	1.41384012	0.04544578	0.34419827	2.48348197	598
SM.a.C41.0	0.24045504	-0.62745272	0.43081527	-1.67619713	0.42129168	605
SM.a.C41.3	0.19261166	-0.72810109	0.38906405	-1.82449234	0.36829016	550
SM.a.C43.0	0.42236489	-0.47831074	0.60138047	-1.64853437	0.69191288	539
SM.a.C43.3	0.36326761	-0.49618405	0.53863818	-1.56719989	0.5748318	616
Ala	0.15154026	0.67585744	0.350335	-0.24837723	1.6000921	754
Arg	0.71819935	0.17535667	0.82332948	-0.77825274	1.12896608	752
Asn	0.68109641	-0.19672152	0.80903717	-1.13616771	0.74272466	703
Asp	0.7169262	0.16910607	0.82332948	-0.74618756	1.08439971	754
Cit	0.4307922	0.3801581	0.60536159	-0.56662209	1.3269383	754
Gln	0.58268469	0.26711796	0.73261525	-0.68692423	1.22116015	703
Glu	1.60E-04	1.84410504	2.65E-03	0.89004829	2.7981618	754
Gly	0.14267519	-0.69602167	0.33342572	-1.62716124	0.2351179	754
His	0.71993462	0.16737111	0.82332948	-0.74871656	1.08345877	743
Ile	1.02E-02	1.4170657	0.04683518	0.33679555	2.49733584	543
Leu	1.21E-05	2.24818285	4.35E-04	1.24667718	3.24968852	703
Lys	0.82757321	-0.10696879	0.8896412	-1.07083289	0.8568953	703
Met	0.17386688	0.70658859	0.38579273	-0.31253635	1.72571352	703
Orn	0.10804713	0.81852652	0.27011783	-0.18021868	1.81727172	703
Phe	1.99E-02	1.17018518	0.0732979	0.18578097	2.15458939	703
Pro	0.00747133	1.30609932	0.03735667	0.35022293	2.26197571	754

Trp	0.02805673	1.04071569	0.09488424	0.11237786	1.96905351	754
Ser	1.8235E-05	-1.98079504	0.00056007	-2.88226503	-1.07932505	754
Thr	0.00937316	-1.25425395	0.04544578	-2.19944549	-0.30906241	714
Tyr	6.35E-02	0.92247799	1.89E-01	-0.05209077	1.89704675	703
Val	5.28E-04	1.74433749	5.98E-03	0.76088975	2.72778524	703
NEFA_12_0	0.56035284	0.31402746	0.70868153	-0.74450048	1.37255541	602
NEFA_14_0	0.331686	0.47666016	0.52435654	-0.48672716	1.44004747	731
NEFA_14_1	0.48067738	0.33867654	0.65825246	-0.60366086	1.28101395	750
NEFA_15_0	0.00972328	1.24645927	0.04544578	0.30249247	2.19042607	747
NEFA_15_1	0.9191503	-0.05899804	0.95930735	-1.20042217	1.08242609	506
NEFA_16_0	0.01180602	1.30282152	0.05180193	0.28969709	2.31594594	641
NEFA_16_1	0.89063238	0.06510059	0.94033627	-0.864041	0.99424217	750
NEFA_17_0	0.00070361	1.71857546	0.00720366	0.72722858	2.70992234	692
NEFA_17_1	0.02011431	1.18704509	0.0732979	0.18661916	2.18747102	679
NEFA_18_0	0.00125791	1.72837287	0.01064227	0.68087815	2.77586758	636
NEFA_18_1	0.20247565	0.63920407	0.3971382	-0.34456237	1.6229705	694
NEFA_18_2	0.2113166	0.66029171	0.3971382	-0.3760049	1.69658832	643
NEFA_18_3	0.29049015	0.49874649	0.48086299	-0.4268804	1.42437337	750
NEFA_20_1	0.18609718	0.66713793	0.38579273	-0.32258088	1.65685673	665
NEFA_20_2	0.27526854	0.56073154	0.46970426	-0.44768519	1.56914827	633
NEFA_20_3	0.00019448	1.93743292	0.00265198	0.92239099	2.95247486	643
NEFA_20_4	0.00017549	1.96371003	0.00265198	0.94206563	2.98535443	643
NEFA_22_6	0.06430537	0.95931102	0.18939254	-0.05714699	1.97576903	694
NEFA_24_1	0.01588222	1.14319716	0.06442787	0.21472296	2.07167136	749
NEFA_12_1	0.5984068	0.26162555	0.7394107	-0.71324169	1.23649279	688
NEFA_13_1	0.10055058	1.19188817	0.2573616	-0.23171193	2.61548827	393
NEFA_14_2	0.29833994	0.56067192	0.48593248	-0.4971978	1.61854165	603
NEFA_16_2	0.0810752	0.8848408	0.21788959	-0.10960536	1.87928696	659
NEFA_18_4	0.11715628	0.87134261	0.28952415	-0.21937111	1.96205634	527
NEFA_19_0	0.00465351	1.57740236	0.02858585	0.48700509	2.66779962	577
NEFA_19_1	0.01756341	1.23992596	0.06865696	0.21726944	2.26258249	653
NEFA_20_5	2.99E-05	2.1336946	7.15E-04	1.13709241	3.13029679	653
NEFA_22_4	0.01518172	1.30382038	0.06334807	0.25230031	2.35534044	577
NEFA_22_5	0.00063243	1.74949359	0.00679861	0.74916939	2.7498178	653
NEFA_24_4	0.80667395	-0.15449859	0.8803802	-1.39493143	1.08593425	399
NEFA_24_5	0.53107318	-0.38053029	0.68973483	-1.57356786	0.81250728	456
NEFA_26_1	5.7666E-06	2.78385994	0.00036583	1.59004471	3.97767516	549

Supplemental Table 2: Results of the Regression model with Metabolite concentration as outcome and two level sex variable as predictor (males versus *non-HC* females), adjusted for ethnicity. P-values, beta coefficient, Confidence interval (CI), number of observations per metabolite and FDR corrected p-values reported for all metabolites.

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	1.6204E-11	0.51486761	1.8336E-10	0.36721336	0.66252186	729
Carn.a.C10.0	0.41465796	0.0818381	0.48569664	-0.11513698	0.27881319	463
Carn.a.C10.1	0.67508678	0.04402226	0.72936511	-0.16223299	0.25027751	455
Carn.a.C12.0	0.00018506	0.39132833	0.00054503	0.18732518	0.59533149	455
Carn.a.C12.1	0.1605976	0.15643801	0.21992665	-0.06234493	0.37522094	410
Carn.a.C14.0	0.00010919	0.34570584	0.00035038	0.17139747	0.52001421	605
Carn.a.C14.1	0.62256791	0.04366527	0.68291888	-0.13044692	0.21777746	656
Carn.a.C14.2	0.00753527	0.2367752	0.0152838	0.06333122	0.41021917	651
Carn.a.C16.0	2.2591E-07	0.4243559	1.3127E-06	0.2649633	0.58374849	726
Carn.a.C16.1	0.69319375	-0.0342714	0.74268608	-0.20477019	0.13622738	654
Carn.a.C18.0	3.4979E-05	0.37630792	0.0001213	0.19909279	0.55352306	591
Carn.a.C18.1	0.01429501	0.19930348	0.0262686	0.03996699	0.35863996	729
Carn.a.C2.0	0.97854091	-0.00236796	0.97854091	-0.17515767	0.17042175	677
Carn.a.C3.0	7.12E-12	0.56523561	9.00E-11	0.40603322	0.72443799	728
Carn.a.C4.0	5.7536E-07	0.44225488	2.8768E-06	0.27032362	0.61418614	634
Carn.a.C4.0.DC	9.0029E-07	0.53090569	4.3014E-06	0.32175834	0.74005304	404
Carn.a.C5.0	1.9794E-08	0.56056177	1.3728E-07	0.36760213	0.75352141	495
Carn.a.C6.0	0.81177217	0.02078841	0.84723794	-0.15056569	0.19214252	628
Carn.a.C8.1	0.12965276	-0.14784304	0.18339042	-0.33918207	0.043496	558
lyso.PC.a.C14.0	0.02085729	0.19722468	0.03706047	0.03001298	0.36443638	724
lyso.PC.a.C16.0	8.8787E-09	0.45802507	7.342E-08	0.3036167	0.61243345	677
lyso.PC.a.C16.1	0.01230301	0.21154712	0.02320305	0.04605647	0.37703777	729
lyso.PC.a.C18.0	0.19965924	0.08878915	0.26174839	-0.04700208	0.22458037	729
lyso.PC.a.C18.1	1.27E-06	0.37503013	5.88E-06	0.22441359	0.52564667	677
lyso.PC.a.C18.2	2.70E-07	0.40307232	1.49E-06	0.25075373	0.5553909	677
lyso.PC.a.C18.3	0.00012675	0.36056744	0.00039764	0.17703909	0.54409578	586
lyso.PC.a.C18.6	0.35220332	-0.08733358	0.42471371	-0.2715873	0.09692013	524
lyso.PC.a.C20.2	0.03933678	0.21838272	0.06456036	0.01071474	0.4260507	475
lyso.PC.a.C20.3	1.0055E-18	0.74212995	3.0884E-17	0.58232517	0.90193473	632
lyso.PC.a.C20.4	4.5443E-18	0.65903702	1.2213E-16	0.51360126	0.80447279	729
lyso.PC.a.C20.5	4.3059E-07	0.41588448	2.258E-06	0.25592093	0.57584804	682
lyso.PC.a.C22.5	3.8013E-12	0.54388878	5.108E-11	0.39303258	0.69474498	645
lyso.PC.a.C22.6	0.00239835	0.26177957	0.00560484	0.09310663	0.43045252	688
lyso.PC.e.C16.0	0.01087397	0.20447917	0.02068942	0.0472552	0.36170314	728
lyso.PC.e.C18.0	5.4501E-06	0.3555589	2.2976E-05	0.20320093	0.50791687	708
lyso.PC.e.C18.1	2.5182E-06	0.4502694	1.1279E-05	0.26441475	0.63612406	524
PC.aa.C30.0	0.69432512	-0.02743206	0.74268608	-0.1644192	0.10955507	722
PC.aa.C30.1	0.00304598	-0.2825186	0.00696687	-0.4689533	-0.09608389	526
PC.aa.C30.2	0.00050146	-0.33729719	0.00134768	-0.52643908	-0.1481553	478

PC.aa.C32.0	0.0959692	-0.12118355	0.14428935	-0.26391234	0.02154523	729
PC.aa.C32.1	0.47097521	0.05581522	0.53141885	-0.09613654	0.20776698	630
PC.aa.C32.2	0.02151993	-0.16983956	0.03792448	-0.31456314	-0.02511598	610
PC.aa.C32.3	0.02519722	-0.19184909	0.04299526	-0.35975886	-0.02393932	636
PC.aa.C34.0	0.41566597	-0.08296139	0.48569664	-0.28303234	0.11710956	523
PC.aa.C34.1	0.24218451	0.09603368	0.30810455	-0.06504984	0.25711719	682
PC.aa.C34.2	0.00518204	-0.20967746	0.01114139	-0.35646861	-0.06288631	677
PC.aa.C34.3	0.01704651	-0.18555695	0.03054166	-0.3378957	-0.03321821	677
PC.aa.C34.4	0.53041809	0.04639658	0.59088025	-0.09875059	0.19154375	631
PC.aa.C34.5	0.12420133	0.13688735	0.17921669	-0.03772866	0.31150336	639
PC.aa.C36.0	0.35002188	-0.0816972	0.42471371	-0.25322463	0.08983023	676
PC.aa.C36.1	0.08330375	-0.1564101	0.12978483	-0.33347952	0.02065932	676
PC.aa.C36.2	5.564E-07	-0.43267175	2.8482E-06	-0.60074704	-0.26459647	677
PC.aa.C36.3	0.39634553	-0.06173581	0.47079718	-0.20456054	0.08108893	683
PC.aa.C36.4	0.0590595	0.14099062	0.09475964	-0.00540966	0.28739089	631
PC.aa.C36.5	0.4016055	0.07635169	0.47442408	-0.10230184	0.25500522	590
PC.aa.C36.6	0.10599907	-0.11342146	0.15609452	-0.25100622	0.02416331	718
PC.aa.C38.0	0.00078772	-0.28760871	0.00204047	-0.45502957	-0.12018786	635
PC.aa.C38.1	0.00923782	-0.23703514	0.01822138	-0.41527844	-0.05879184	581
PC.aa.C38.2	0.00084879	-0.25387491	0.00217251	-0.40261624	-0.10513358	686
PC.aa.C38.3	2.04E-01	-0.11096327	2.66E-01	-0.28236799	0.06044146	610
PC.aa.C38.4	0.18515446	-0.12125664	0.24656309	-0.30076921	0.05825593	610
PC.aa.C38.5	0.5181322	-0.05916493	0.58020012	-0.23886173	0.12053188	610
PC.aa.C38.6	0.00204826	-0.22772466	0.00494804	-0.37215172	-0.0832976	610
PC.aa.C40.0	6.9274E-05	-0.34918432	0.00022566	-0.52032727	-0.17804137	598
PC.aa.C40.1	0.07004762	-0.18617754	0.10992875	-0.38766826	0.01531318	430
PC.aa.C40.3	0.18578242	-0.13630429	0.24656309	-0.3384535	0.06584491	435
PC.aa.C40.4	0.42775723	0.06669274	0.48660214	-0.09833321	0.2317187	677
PC.aa.C40.5	4.27E-01	-0.07225017	4.87E-01	-0.25081546	0.10631512	610
PC.aa.C40.6	3.1886E-05	-0.3345521	0.00011619	-0.49138075	-0.17772346	658
PC.aa.C42.0	2.5201E-07	-0.45087552	1.4258E-06	-0.62060359	-0.28114745	591
PC.aa.C42.1	0.01639478	-0.23203877	0.02962083	-0.42134257	-0.04273496	481
PC.aa.C42.2	0.05518348	-0.19305496	0.08920638	-0.39041004	0.00430013	469
PC.aa.C42.4	0.08843204	-0.17135001	0.13484319	-0.36858665	0.02588662	403
PC.aa.C42.5	0.00051949	-0.28958109	0.0013789	-0.45250472	-0.12665746	547
PC.aa.C42.6	0.00640882	-0.24323847	0.01350879	-0.41781741	-0.06865953	526
PC.aa.C43.4	0.00117374	-0.31972389	0.00293434	-0.51212423	-0.12732355	465
PC.aa.C43.6	0.00023236	-0.30320551	0.0006658	-0.46406837	-0.14234265	677
PC.aa.C44.12	0.00696233	-0.22755659	0.01453302	-0.39261475	-0.06249843	677
PC.ae.C30.0	0.26705841	-0.09530203	0.33495341	-0.26377579	0.07317172	632
PC.ae.C30.1	0.00293161	-0.28577639	0.00677737	-0.47363894	-0.09791384	563
PC.ae.C32.0	0.04768224	-0.154197	0.07766425	-0.30681484	-0.00157915	729
PC.ae.C32.1	0.0003551	-0.29355356	0.00097881	-0.45415999	-0.13294714	729
PC.ae.C32.2	2.0205E-07	-0.41365037	1.2411E-06	-0.56839199	-0.25890875	728
PC.ae.C34.0	0.93782274	0.00659284	0.95109381	-0.1592906	0.17247628	682

PC.ae.C34.1	0.00330055	-0.24968616	0.00746966	-0.41594505	-0.08342727	683
PC.ae.C34.2	8.42E-07	-0.41860614	4.12E-06	-0.58393424	-0.25327804	683
PC.ae.C34.3	1.16E-01	-0.13714074	1.69E-01	-0.30809536	0.03381388	683
PC.ae.C34.4	0.76947552	-0.02669058	0.81515968	-0.20545781	0.15207665	641
PC.ae.C36.0	0.12618186	-0.13572948	0.18086067	-0.30977401	0.03831506	683
PC.ae.C36.1	0.30724848	0.09268287	0.37964611	-0.08541877	0.27078451	677
PC.ae.C36.2	0.01340784	-0.20648479	0.02506684	-0.37001176	-0.04295783	677
PC.ae.C36.3	3.59E-03	-0.2430993	0.00795097	-0.40643932	-0.07975928	729
PC.ae.C36.4	0.0848855	0.1597354	0.13035988	-0.02202986	0.34150067	631
PC.ae.C36.5	0.00862864	0.24721842	0.01733792	0.06295719	0.43147964	631
PC.ae.C36.6	0.1016493	0.16351584	0.15072137	-0.03237638	0.35940805	543
PC.ae.C38.0	0.00175147	-0.25651742	0.00432835	-0.41681945	-0.09621539	677
PC.ae.C38.2	3.3318E-05	-0.34996048	0.00011939	-0.51443845	-0.18548251	677
PC.ae.C38.3	0.31581809	-0.08408315	0.38800508	-0.24854872	0.08038243	677
PC.ae.C38.4	0.42237303	0.07320862	0.48660214	-0.10586066	0.2522779	631
PC.ae.C38.5	0.66152707	0.04025444	0.71832485	-0.1402185	0.22072737	631
PC.ae.C38.6	0.16983607	-0.11866622	0.22965255	-0.28821834	0.05088589	682
PC.ae.C40.0	1.5769E-05	-0.32254933	6.1641E-05	-0.46816315	-0.17693551	677
PC.ae.C40.1	0.35359886	-0.07886957	0.42471371	-0.24569526	0.08795612	677
PC.ae.C40.2	3.9732E-05	-0.31971248	0.00013347	-0.47142445	-0.16800051	635
PC.ae.C40.3	9.2018E-06	-0.38283891	3.6637E-05	-0.55096416	-0.21471366	636
PC.ae.C40.4	0.014083	-0.20997866	0.02610211	-0.37747074	-0.04248658	677
PC.ae.C40.5	0.08431679	-0.14978541	0.13035988	-0.31991231	0.0203415	677
PC.ae.C40.6	0.00748821	-0.23855522	0.0152838	-0.41314991	-0.06396052	610
PC.ae.C42.0	0.00019958	-0.24828239	0.00057987	-0.37859866	-0.11796611	641
PC.ae.C42.1	0.84317135	-0.01769917	0.87154731	-0.19332494	0.1579266	595
PC.ae.C42.2	0.00559658	-0.24829825	0.01191351	-0.42368644	-0.07291005	636
PC.ae.C42.3	6.39E-10	-0.49610012	5.7227E-09	-0.65144237	-0.34075787	685
PC.ae.C42.4	7.7141E-08	-0.44743747	4.8781E-07	-0.60911741	-0.28575753	677
PC.ae.C42.5	5.738E-06	-0.38998801	2.3724E-05	-0.55739071	-0.22258531	636
PC.ae.C42.6	1.2855E-06	-0.38546483	5.8806E-06	-0.54043899	-0.23049067	727
SM.a.C30.1	2.106E-10	-0.53994475	2.0581E-09	-0.70409635	-0.37579315	632
SM.a.C32.0	0.0043747	-0.30723929	0.00950062	-0.51799752	-0.09648106	417
SM.a.C32.1	1.9095E-05	-0.36146314	7.2024E-05	-0.52628701	-0.19663927	677
SM.a.C32.2	6.08E-47	-1.07588652	1.31E-44	-1.2116507	-0.94012234	685
SM.a.C33.1	0.00015081	-0.33145334	0.00046322	-0.50220437	-0.1607023	677
SM.a.C33.2	6.53E-19	-0.79690495	2.34E-17	-0.96716187	-0.62664804	592
SM.a.C34.0	0.0001789	-0.38961121	0.00053421	-0.59225117	-0.18697125	455
SM.a.C34.1	1.9489E-08	-0.48152309	1.3728E-07	-0.64785985	-0.31518632	688
SM.a.C34.2	3.82E-36	-0.98463219	4.11E-34	-1.13029229	-0.8389721	729
SM.a.C34.3	3.1335E-11	-0.68027448	3.3685E-10	-0.87684892	-0.48370003	481
SM.a.C35.0	7.5252E-06	-0.42756756	3.0527E-05	-0.61329702	-0.24183811	545
SM.a.C35.1	3.4092E-05	-0.35847217	0.00012016	-0.52716714	-0.1897772	677
SM.a.C36.0	3.22E-02	-0.21120004	5.37E-02	-0.40443049	-0.01796959	481
SM.a.C36.1	6.3109E-14	-0.63082239	1.2335E-12	-0.79249373	-0.46915106	688

SM.a.C36.2	2.84E-33	-0.9592641	2.04E-31	-1.10818067	-0.81034754	729
SM.a.C36.3	3.29E-20	-0.77252776	1.4155E-18	-0.93206222	-0.6129933	682
SM.a.C37.1	2.5532E-08	-0.48929131	1.7154E-07	-0.65962674	-0.31895589	636
SM.a.C38.1	0.02455595	-0.16645439	0.04223623	-0.31149969	-0.02140909	728
SM.a.C38.2	2.26E-12	-0.51270391	3.4708E-11	-0.6536659	-0.37174193	729
SM.a.C39.1	0.00056436	-0.30997957	0.00147972	-0.48561243	-0.13434671	636
SM.a.C39.2	1.4557E-13	-0.61802788	2.6081E-12	-0.77886418	-0.45719157	684
SM.a.C40.1	0.47209767	-0.06327228	0.53141885	-0.2359617	0.10941715	631
SM.a.C40.2	2.0517E-10	-0.55660132	2.0581E-09	-0.72552817	-0.38767447	590
SM.a.C40.3	0.95648615	-0.00437606	0.96546725	-0.1618559	0.15310378	527
SM.a.C40.4	0.23812878	0.08592209	0.30474814	-0.05695322	0.2287974	728
SM.a.C40.5	0.82621686	0.01904813	0.85814795	-0.15124658	0.18934284	641
SM.a.C41.1	0.26685284	-0.09359704	0.33495341	-0.25897409	0.07178001	677
SM.a.C41.2	1.0562E-12	-0.60193619	1.7468E-11	-0.76468841	-0.43918396	677
SM.a.C42.1	0.15486829	0.11860865	0.21518774	-0.04491925	0.28213656	677
SM.a.C42.2	0.00023535	-0.28688108	0.0006658	-0.43921978	-0.13454239	677
SM.a.C42.3	2.9292E-17	-0.65798966	6.9975E-16	-0.8068072	-0.50917212	677
SM.a.C42.4	0.0021795	-0.27220008	0.00518158	-0.44589951	-0.09850066	631
SM.a.C42.5	0.03635016	-0.18609124	0.06011758	-0.36030578	-0.0118767	481
SM.a.C42.6	0.00346855	-0.20921891	0.00776811	-0.34925158	-0.06918625	631
SM.a.C43.1	0.26796273	-0.09702099	0.33495341	-0.26884635	0.07480438	677
SM.a.C43.2	0.13238256	-0.12406133	0.18602778	-0.28574571	0.03762305	677
SM.a.C44.2	0.27512524	-0.10514852	0.34191865	-0.29421815	0.08392111	548
SM.a.C44.6	0.00024874	-0.32032558	0.00069454	-0.49100248	-0.14964868	595
SM.a.C31.1	1.2719E-08	-0.49941967	1.0128E-07	-0.66951336	-0.32932598	635
SM.a.C33.3	0.02371688	-0.19613451	0.041122	-0.36602438	-0.02624465	687
SM.a.C35.2	8.755E-12	-0.59766112	1.0457E-10	-0.76660408	-0.42871816	688
SM.a.C37.3	1.13E-03	-0.27511233	0.00286829	-0.4403596	-0.10986507	687
SM.a.C39.5	0.00416069	0.27914793	0.00912805	0.08859725	0.46969861	570
SM.a.C41.0	0.02725751	-0.19659471	0.0461446	-0.37103988	-0.02214955	567
SM.a.C41.3	1.4727E-08	-0.529182	1.1308E-07	-0.70985591	-0.34850809	537
SM.a.C43.0	2.3327E-05	-0.39303935	8.6469E-05	-0.5739137	-0.21216499	527
SM.a.C43.3	6.3176E-08	-0.4814201	4.116E-07	-0.65396654	-0.30887366	593
Ala	0.89769934	0.01048302	0.91471733	-0.14953727	0.1705033	727
Arg	0.0236808	0.1882706	0.041122	0.02523052	0.35131069	726
Asn	0.01058107	0.20760179	0.02031187	0.0485873	0.36661628	667
Asp	0.11942417	0.12158818	0.17348781	-0.03152379	0.27470015	727
Cit	0.01451697	0.19387798	0.02645041	0.03852569	0.34923026	727
Gln	0.00017439	0.30332249	0.00052809	0.14554762	0.46109735	667
Glu	1.61E-05	0.3569722	6.18E-05	0.19557964	0.51836475	727
Gly	0.00012761	-0.29191078	0.00039764	-0.44069429	-0.14312727	727
His	4.8465E-05	0.31031205	0.00016031	0.16127787	0.45934622	720
Ile	1.97E-08	0.53678334	1.3728E-07	0.35186299	0.72170368	530
Leu	3.12E-27	0.85605618	1.68E-25	0.70739359	1.00471877	667
Lys	0.00219313	0.26396676	0.00518158	0.09539764	0.43253589	667

Met	3.0259E-09	0.5042704	2.6022E-08	0.33957079	0.66897001	667
Orn	0.00947631	0.20849545	0.01852189	0.05115565	0.36583525	667
Phe	2.09E-07	0.43511709	1.2464E-06	0.27227277	0.59796141	667
Pro	3.617E-05	0.33857064	0.00012344	0.17865625	0.49848504	727
Trp	2.4907E-10	0.53073706	2.3283E-09	0.36839439	0.69307974	727
Ser	3.2158E-12	-0.56508323	4.6094E-11	-0.7215802	-0.40858627	727
Thr	0.22254267	-0.09472602	0.28650703	-0.24706296	0.05761092	686
Tyr	1.80E-01	0.10592403	2.42E-01	-0.04915976	0.26100782	667
Val	1.43E-16	0.67806802	3.08E-15	0.52110497	0.83503107	667
NEFA_12_0	0.12872382	-0.14181924	0.18328226	-0.32491112	0.04127264	583
NEFA_14_0	0.16018635	-0.11813737	0.21992665	-0.28311278	0.04683805	707
NEFA_14_1	4.0344E-07	-0.3928251	2.1685E-06	-0.54361632	-0.24203388	726
NEFA_15_0	0.64606011	-0.03914263	0.70509099	-0.20640668	0.12812143	725
NEFA_15_1	0.09778682	-0.15398842	0.14600115	-0.33637613	0.02839929	511
NEFA_16_0	0.61457996	-0.04537687	0.6776138	-0.22225003	0.1314963	633
NEFA_16_1	2.756E-06	-0.36260487	1.2093E-05	-0.51324512	-0.21196462	726
NEFA_17_0	0.21784852	0.11245562	0.2821532	-0.06656259	0.29147384	679
NEFA_17_1	0.06842475	-0.15948663	0.10817148	-0.33106466	0.01209141	668
NEFA_18_0	0.77509864	0.02736771	0.81689318	-0.16066028	0.2153957	618
NEFA_18_1	0.03003947	-0.18801509	0.05045692	-0.35781153	-0.01821865	682
NEFA_18_2	0.09147474	-0.14761028	0.13850049	-0.31910456	0.023884	630
NEFA_18_3	0.06311443	-0.15013727	0.10051558	-0.30850235	0.00822782	725
NEFA_20_1	0.61442569	-0.04408619	0.6776138	-0.21584603	0.12767365	653
NEFA_20_2	0.41961533	-0.07015856	0.48660214	-0.24075375	0.10043663	623
NEFA_20_3	0.34099702	0.08127689	0.41655885	-0.0862163	0.24877007	630
NEFA_20_4	0.00705337	0.24170065	0.01458149	0.06611678	0.41728453	630
NEFA_22_6	0.42382792	-0.06488363	0.48660214	-0.22407355	0.09430629	682
NEFA_24_1	0.0019585	0.2662345	0.00478496	0.09805168	0.43441732	725
NEFA_12_1	0.00043549	-0.3002665	0.0011852	-0.46702407	-0.13350892	655
NEFA_13_1	0.87295633	0.01804671	0.89801728	-0.20370044	0.23979385	390
NEFA_14_2	0.76966239	-0.02638902	0.81515968	-0.20330533	0.15052728	593
NEFA_16_2	0.01029817	-0.21420624	0.01994691	-0.37766637	-0.0507461	637
NEFA_18_4	0.00886	-0.25027169	0.01763795	-0.43740701	-0.06313637	521
NEFA_19_0	0.15513535	0.14210216	0.21518774	-0.0539704	0.33817472	564
NEFA_19_1	0.39012711	-0.07736206	0.46598516	-0.25401478	0.09929065	636
NEFA_20_5	1.99E-01	0.11677439	2.62E-01	-0.0616783	0.29522707	636
NEFA_22_4	0.96821588	-0.00369174	0.97274026	-0.18559427	0.17821079	564
NEFA_22_5	0.88150882	-0.01342194	0.90249713	-0.19017529	0.1633314	636
NEFA_24_4	0.16241188	0.12720676	0.22100351	-0.05147742	0.30589095	394
NEFA_24_5	0.80941033	-0.01855343	0.84723794	-0.16964537	0.13253851	449
NEFA_26_1	4.1678E-06	0.46983262	1.7921E-05	0.27141406	0.66825117	531

Supplemental Table 3: Results of the Regression model with Metabolite concentration as outcome and two level sex variable as predictor (*HC* females versus *non-HC* females), adjusted for ethnicity P-values, beta coefficient, Confidence interval (CI), number of observations per metabolite and FDR corrected p-values reported for all metabolites.

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	1.6431E-13	-0.59971081	2.5234E-12	-0.75469173	-0.4447299	460
Carn.a.C10.0	0.73911453	-0.04323946	0.84079167	-0.29858104	0.21210211	279
Carn.a.C10.1	0.29023533	-0.13444234	0.40967023	-0.38420696	0.11532229	280
Carn.a.C12.0	0.95177317	0.00701418	0.97443443	-0.22108869	0.23511704	278
Carn.a.C12.1	0.41440139	-0.10498396	0.53997757	-0.35793488	0.14796697	242
Carn.a.C14.0	0.34303802	-0.09827177	0.46385644	-0.30181043	0.10526689	375
Carn.a.C14.1	0.30815556	-0.09724181	0.42744158	-0.28458236	0.09009873	411
Carn.a.C14.2	0.0860842	-0.16414299	0.15553028	-0.35168065	0.02339467	404
Carn.a.C16.0	0.00021211	-0.30911317	0.00080005	-0.47178041	-0.14644593	456
Carn.a.C16.1	0.01195185	-0.25612421	0.02920054	-0.45553391	-0.05671451	410
Carn.a.C18.0	2.6082E-07	-0.48094426	1.3677E-06	-0.6610643	-0.30082423	358
Carn.a.C18.1	2.1641E-08	-0.47850833	1.2575E-07	-0.64350761	-0.31350904	459
Carn.a.C2.0	0.00591225	-0.27226306	0.0162966	-0.46569499	-0.07883112	425
Carn.a.C3.0	1.58E-05	-0.32276194	6.52E-05	-0.46808432	-0.17743955	459
Carn.a.C4.0	0.0816398	0.16793197	0.15002185	-0.02119189	0.35705582	393
Carn.a.C4.0.DC	0.442284	-0.09542507	0.56940754	-0.33966309	0.14881296	246
Carn.a.C5.0	0.01441672	-0.25140445	0.03406147	-0.45242505	-0.05038386	296
Carn.a.C6.0	0.08412088	-0.18451251	0.1532711	-0.39400245	0.02497742	381
Carn.a.C8.1	0.03368159	-0.22875525	0.07151714	-0.43975257	-0.01775794	341
lyso.PC.a.C14.0	0.09139777	0.15236859	0.162401	-0.02463855	0.32937572	457
lyso.PC.a.C16.0	0.00030309	-0.34434189	0.00112353	-0.53013646	-0.15854732	425
lyso.PC.a.C16.1	0.00601924	-0.23720214	0.01638148	-0.4061171	-0.06828718	460
lyso.PC.a.C18.0	8.3976E-25	-0.97527479	1.8055E-22	-1.15087906	-0.79967052	460
lyso.PC.a.C18.1	2.13E-16	-0.73058288	6.77E-15	-0.89835929	-0.56280647	425
lyso.PC.a.C18.2	2.64E-14	-0.67367587	5.17E-13	-0.84153088	-0.50582085	425
lyso.PC.a.C18.3	6.069E-07	-0.43524129	3.1067E-06	-0.60367857	-0.26680401	356
lyso.PC.a.C18.6	1.329E-09	-0.70137774	9.2172E-09	-0.92208413	-0.48067134	314
lyso.PC.a.C20.2	0.00676923	-0.29809328	0.01802125	-0.51319533	-0.08299124	294
lyso.PC.a.C20.3	6.5002E-05	-0.32638429	0.00025881	-0.48528709	-0.16748148	386
lyso.PC.a.C20.4	2.5587E-11	-0.51209966	2.3918E-10	-0.65923888	-0.36496045	460
lyso.PC.a.C20.5	4.051E-13	-0.62147198	5.1233E-12	-0.78447005	-0.45847392	418
lyso.PC.a.C22.5	1.4207E-16	-0.70962573	6.109E-15	-0.87113097	-0.54812049	399
lyso.PC.a.C22.6	3.1142E-09	-0.49210035	2.0289E-08	-0.65190814	-0.33229256	432
lyso.PC.e.C16.0	6.9595E-05	-0.36261767	0.00027205	-0.5401197	-0.18511565	459
lyso.PC.e.C18.0	8.1931E-10	-0.54858678	6.0742E-09	-0.72032623	-0.37684734	446
lyso.PC.e.C18.1	4.3245E-09	-0.55355601	2.7346E-08	-0.73379943	-0.37331259	314
PC.aa.C30.0	4.4076E-11	0.69779766	3.9484E-10	0.49476972	0.9008256	457
PC.aa.C30.1	0.00571399	0.32193251	0.01595465	0.09433448	0.54953054	311

PC.aa.C30.2	0.15713321	0.16783795	0.24480898	-0.06505842	0.40073432	284
PC.aa.C32.0	1.0358E-12	0.71081736	1.1458E-11	0.52031123	0.90132349	460
PC.aa.C32.1	3.4466E-12	0.76801781	3.5286E-11	0.55782099	0.97821464	395
PC.aa.C32.2	3.9077E-14	0.84945943	6.4627E-13	0.63709412	1.06182474	381
PC.aa.C32.3	0.00413455	0.30392561	0.01201253	0.09678359	0.51106763	397
PC.aa.C34.0	0.24091089	0.13092207	0.35700875	-0.08832436	0.35016849	314
PC.aa.C34.1	1.0658E-12	0.70203293	1.1458E-11	0.51411775	0.8899481	430
PC.aa.C34.2	3.2411E-14	0.75127356	5.807E-13	0.56338814	0.93915897	425
PC.aa.C34.3	1.2119E-09	0.60219245	8.6852E-09	0.41183058	0.79255432	425
PC.aa.C34.4	8.6049E-13	0.81063225	1.0278E-11	0.5951417	1.02612279	395
PC.aa.C34.5	0.51602448	0.06653458	0.6413021	-0.13468163	0.2677508	400
PC.aa.C36.0	0.94952819	0.00624117	0.97443443	-0.18744761	0.19992995	425
PC.aa.C36.1	0.13518943	-0.1405112	0.21530168	-0.32502924	0.04400683	425
PC.aa.C36.2	0.0067894	-0.26480674	0.01802125	-0.45613926	-0.07347421	425
PC.aa.C36.3	3.7284E-16	0.84609506	1.002E-14	0.64997065	1.04221946	430
PC.aa.C36.4	2.2561E-19	0.99296538	1.6169E-17	0.78730171	1.19862906	395
PC.aa.C36.5	0.28393175	0.12058696	0.40427368	-0.10039142	0.34156534	367
PC.aa.C36.6	1.2574E-06	0.52037661	6.1441E-06	0.31221953	0.72853369	454
PC.aa.C38.0	0.59837295	0.05362524	0.71472325	-0.14636262	0.25361311	397
PC.aa.C38.1	0.9849656	0.00200629	0.98956824	-0.20721803	0.21123061	369
PC.aa.C38.2	1.7049E-07	0.53205608	9.3986E-07	0.33536966	0.7287425	430
PC.aa.C38.3	4.87E-03	0.30571859	1.40E-02	0.09347655	0.51796063	381
PC.aa.C38.4	0.09309386	0.17231427	0.16272503	-0.02893557	0.3735641	381
PC.aa.C38.5	0.93163989	-0.00900284	0.97443443	-0.21522538	0.1972197	381
PC.aa.C38.6	1.595E-10	0.70760191	1.2701E-09	0.49607529	0.91912853	381
PC.aa.C40.0	0.67411938	0.04672714	0.79199818	-0.17163136	0.26508564	359
PC.aa.C40.1	0.31157646	0.13476261	0.42941627	-0.12698898	0.39651419	255
PC.aa.C40.3	0.06042287	0.25385763	0.11918272	-0.01120352	0.51891879	262
PC.aa.C40.4	0.05038007	0.19793386	0.10123098	-0.00032936	0.39619709	425
PC.aa.C40.5	2.21E-02	-0.24044791	4.90E-02	-0.44621024	-0.03468558	381
PC.aa.C40.6	0.02995516	0.22148963	0.06571796	0.02160774	0.42137152	412
PC.aa.C42.0	0.59407516	0.05726372	0.71355396	-0.15386131	0.26838874	358
PC.aa.C42.1	0.01692359	0.30106447	0.03954968	0.05441564	0.54771331	282
PC.aa.C42.2	0.50115277	0.08194299	0.62644096	-0.15754324	0.32142921	281
PC.aa.C42.4	0.00259616	0.41110365	0.0078616	0.14496943	0.67723788	256
PC.aa.C42.5	7.2053E-09	0.67317147	4.3031E-08	0.45036951	0.89597343	326
PC.aa.C42.6	0.0015092	0.38695229	0.00506057	0.14913189	0.62477269	312
PC.aa.C43.4	0.62989152	0.06192617	0.74410262	-0.19076918	0.31462152	281
PC.aa.C43.6	0.72146765	-0.03631406	0.82949489	-0.23640302	0.1637749	425
PC.aa.C44.12	0.98137106	0.00234573	0.98956824	-0.19500029	0.19969175	425
PC.ae.C30.0	0.00221133	0.32120179	0.00689038	0.11623428	0.5261693	384
PC.ae.C30.1	0.85601819	-0.01965648	0.93899954	-0.2325889	0.19327595	339
PC.ae.C32.0	0.00383486	0.29292083	0.01129445	0.09485579	0.49098586	460
PC.ae.C32.1	0.27875966	0.10500804	0.40223709	-0.08528952	0.2953056	460
PC.ae.C32.2	0.24243385	0.11431719	0.35700875	-0.07762189	0.30625628	459

PC.ae.C34.0	0.00252079	0.30490038	0.00774244	0.10768949	0.50211126	430
PC.ae.C34.1	0.00199691	0.30457652	0.00631377	0.11207613	0.49707692	430
PC.ae.C34.2	9.28E-01	0.00888595	9.74E-01	-0.18557704	0.20334894	430
PC.ae.C34.3	6.86E-01	-0.0388682	7.98E-01	-0.22792392	0.15018752	430
PC.ae.C34.4	0.76078399	-0.03101717	0.86088714	-0.23117497	0.16914063	395
PC.ae.C36.0	0.16316678	-0.13706501	0.25238026	-0.3299254	0.05579538	427
PC.ae.C36.1	0.29153277	0.0988744	0.40967023	-0.08515181	0.28290061	425
PC.ae.C36.2	0.55465454	0.05916068	0.68534901	-0.13751066	0.25583202	425
PC.ae.C36.3	9.71E-01	0.00340971	0.98483328	-0.18138851	0.18820793	460
PC.ae.C36.4	0.92289842	0.0096937	0.97443443	-0.18709504	0.20648244	395
PC.ae.C36.5	0.25017281	-0.11105842	0.36589901	-0.30065369	0.07853686	395
PC.ae.C36.6	0.00163268	-0.3323651	0.00523919	-0.53819619	-0.126534	328
PC.ae.C38.0	0.10042796	0.16908901	0.1727361	-0.03278393	0.37096195	425
PC.ae.C38.2	0.98977107	0.00126013	0.98977107	-0.19182671	0.19434698	425
PC.ae.C38.3	7.9295E-05	0.39136178	0.00030443	0.19835234	0.58437123	425
PC.ae.C38.4	0.11315168	0.15999178	0.18430008	-0.03811972	0.35810328	395
PC.ae.C38.5	0.00901771	-0.25431217	0.02254428	-0.44482196	-0.06380238	395
PC.ae.C38.6	0.37675448	-0.0878546	0.49826733	-0.28301555	0.10730636	430
PC.ae.C40.0	5.4256E-06	0.46442876	2.4819E-05	0.26626451	0.66259302	425
PC.ae.C40.1	0.79624768	0.02603489	0.88701167	-0.1720311	0.22410089	425
PC.ae.C40.2	5.6641E-06	0.48226543	2.537E-05	0.27621665	0.68831421	397
PC.ae.C40.3	0.09258156	0.17688714	0.16272503	-0.02937286	0.38314714	397
PC.ae.C40.4	0.68209045	0.04117452	0.79700787	-0.15627251	0.23862154	425
PC.ae.C40.5	0.03123393	-0.21193171	0.06783125	-0.40467366	-0.01918976	425
PC.ae.C40.6	0.72985542	0.03589601	0.83467508	-0.16834667	0.24013869	381
PC.ae.C42.0	1.6071E-14	0.84657407	3.8392E-13	0.63803952	1.05510862	396
PC.ae.C42.1	0.03392906	0.22941487	0.07151714	0.01750823	0.44132151	357
PC.ae.C42.2	0.03942273	-0.21124631	0.08149892	-0.41220764	-0.01028498	397
PC.ae.C42.3	9.69E-01	0.00401931	0.98483328	-0.19773687	0.20577548	427
PC.ae.C42.4	0.47752414	-0.0723218	0.60750112	-0.27228108	0.12763748	425
PC.ae.C42.5	0.90863556	0.01170282	0.97443443	-0.18865486	0.2120605	397
PC.ae.C42.6	0.37775616	-0.08559382	0.49826733	-0.27611085	0.10492321	459
SM.a.C30.1	0.14329377	0.14970268	0.22653059	-0.05098483	0.35039018	392
SM.a.C32.0	0.11000755	0.19533026	0.18054675	-0.04452538	0.4351859	257
SM.a.C32.1	0.06904539	0.17416492	0.12933315	-0.01364728	0.36197713	425
SM.a.C32.2	4.64E-01	-0.07246321	5.94E-01	-0.26685753	0.1219311	432
SM.a.C33.1	0.17686876	-0.13200513	0.26969349	-0.32381796	0.05980771	425
SM.a.C33.2	1.33E-02	-0.27371323	3.21E-02	-0.490007	-0.05741946	364
SM.a.C34.0	0.06216968	0.24292483	0.12010721	-0.01243962	0.49828928	288
SM.a.C34.1	0.5781177	-0.05144257	0.70622332	-0.23311334	0.1302282	432
SM.a.C34.2	4.58E-02	-0.18521545	9.31E-02	-0.36698073	-0.00345018	460
SM.a.C34.3	0.56874383	-0.06759535	0.69874242	-0.3007997	0.16560899	282
SM.a.C35.0	0.12038674	-0.18211872	0.19315784	-0.41219347	0.04795602	327
SM.a.C35.1	0.00148438	-0.31633427	0.00506057	-0.5107194	-0.12194914	425
SM.a.C36.0	1.10E-05	0.52349765	4.85E-05	0.29331414	0.75368115	282

SM.a.C36.1	0.86460299	0.01612633	0.94360225	-0.16964585	0.20189852	432
SM.a.C36.2	1.62E-03	-0.30013612	5.24E-03	-0.48612846	-0.11414378	460
SM.a.C36.3	4.59E-02	-0.19809485	0.09305846	-0.39254848	-0.00364123	430
SM.a.C37.1	0.93649389	0.00826593	0.97443443	-0.195562	0.21209385	397
SM.a.C38.1	1.7842E-13	0.70868783	2.5574E-12	0.52527735	0.89209831	458
SM.a.C38.2	4.8766E-09	0.53671481	2.9956E-08	0.35992439	0.71350523	460
SM.a.C39.1	0.36451958	0.08708403	0.4867808	-0.10150444	0.27567251	397
SM.a.C39.2	0.28188568	-0.10230252	0.40403614	-0.28892618	0.08432114	431
SM.a.C40.1	0.00070114	0.3374036	0.00247124	0.14323575	0.53157145	394
SM.a.C40.2	0.03273975	0.22805849	0.07039047	0.01882619	0.43729078	367
SM.a.C40.3	2.2044E-16	0.97748121	6.7705E-15	0.75566446	1.19929797	323
SM.a.C40.4	2.6181E-17	0.83747431	1.4072E-15	0.65067046	1.02427817	460
SM.a.C40.5	0.08746144	0.17953447	0.15670175	-0.02649063	0.38555956	401
SM.a.C41.1	0.00265235	0.29168698	0.00792022	0.10204994	0.48132402	425
SM.a.C41.2	0.34802358	0.08963036	0.46765669	-0.09789701	0.27715772	425
SM.a.C42.1	1.4483E-05	0.43086925	6.1058E-05	0.23785322	0.62388529	425
SM.a.C42.2	5.7405E-08	0.53421762	3.2479E-07	0.3442008	0.72423444	425
SM.a.C42.3	0.00152994	0.30331033	0.00506057	0.11640596	0.49021471	425
SM.a.C42.4	0.1069006	0.16750305	0.18054675	-0.0362831	0.37128919	395
SM.a.C42.5	6.4221E-07	0.64158446	3.211E-06	0.39372244	0.88944648	282
SM.a.C42.6	5.1518E-12	0.75553399	5.0347E-11	0.54694293	0.96412505	395
SM.a.C43.1	0.85174981	0.01799847	0.93899954	-0.17118683	0.20718378	425
SM.a.C43.2	0.00778991	0.27396347	0.0199337	0.07256656	0.47536037	425
SM.a.C44.2	0.30467741	0.11829817	0.42536132	-0.10807551	0.34467186	326
SM.a.C44.6	0.05570498	0.21181547	0.11089418	-0.00518887	0.42881981	367
SM.a.C31.1	0.76761145	0.02977384	0.86406524	-0.16817863	0.2277263	397
SM.a.C33.3	0.78377881	0.02592394	0.87766898	-0.15965545	0.21150333	429
SM.a.C35.2	2.357E-05	-0.40875431	9.5615E-05	-0.59668489	-0.22082373	432
SM.a.C37.3	5.89E-01	-0.05314783	0.71355396	-0.24650108	0.14020542	432
SM.a.C39.5	0.948018	-0.00674996	0.97443443	-0.21023307	0.19673316	351
SM.a.C41.0	0.00039186	0.4023508	0.00142798	0.18132773	0.62337387	351
SM.a.C41.3	0.33699322	0.11336813	0.45856672	-0.11859102	0.34532727	321
SM.a.C43.0	0.00762973	0.30153275	0.01976376	0.08061257	0.52245293	312
SM.a.C43.3	0.25839949	0.1212249	0.37537763	-0.08937702	0.33182681	365
Ala	0.2139074	-0.12562591	0.32160903	-0.3239802	0.07272837	459
Arg	2.2128E-06	-0.41941842	1.0572E-05	-0.59133182	-0.24750501	458
Asn	0.01810903	0.24697814	0.04186496	0.04236513	0.45159115	435
Asp	0.00788077	0.27061857	0.0199337	0.07135713	0.46988001	459
Cit	1.1142E-10	-0.58656999	9.2135E-10	-0.76110923	-0.41203075	459
Gln	3.4176E-10	-0.58207105	2.6242E-09	-0.76003827	-0.40410383	435
Glu	1.10E-01	-0.14739377	1.81E-01	-0.32828148	0.03349394	459
Gly	9.7984E-21	-0.94181783	1.0533E-18	-1.13051047	-0.75312519	459
His	3.521E-06	0.48000191	1.6457E-05	0.27914331	0.6808605	453
Ile	9.75E-03	-0.27244294	0.0240871	-0.47858247	-0.06630342	327
Leu	7.42E-03	-0.21546191	1.94E-02	-0.37287521	-0.05804861	435

Lys	0.15599938	-0.13601802	0.24480898	-0.32413505	0.05209901	435
Met	0.01866668	-0.20943614	0.04269507	-0.38378287	-0.03508941	435
Orn	2.1575E-14	-0.72744147	4.6386E-13	-0.90816607	-0.54671687	435
Phe	1.98E-02	-0.21539626	0.04484496	-0.39643121	-0.03436131	435
Pro	1.0893E-10	-0.54846583	9.2135E-10	-0.71157622	-0.38535544	459
Trp	0.92021203	0.00854758	0.97443443	-0.15905553	0.1761507	459
Ser	2.3042E-07	-0.5349294	1.2385E-06	-0.73506005	-0.33479874	459
Thr	0.01429038	0.27423388	0.03406147	0.05511756	0.4933502	431
Tyr	2.56E-09	-0.60172185	1.72E-08	-0.79606028	-0.40738342	435
Val	1.10E-01	-0.1395368	1.81E-01	-0.31055566	0.03148207	435
NEFA_12_0	0.32190329	0.10796853	0.44082298	-0.10609802	0.32203509	356
NEFA_14_0	0.06247953	0.17948683	0.12010721	-0.00939433	0.368368	441
NEFA_14_1	0.20704474	0.12884212	0.31348323	-0.07154959	0.32923383	455
NEFA_15_0	0.22491911	0.11054057	0.33581673	-0.06822568	0.28930682	452
NEFA_15_1	0.10562747	0.19413247	0.18023735	-0.04124274	0.42950769	308
NEFA_16_0	0.16807064	0.14610507	0.25810848	-0.06190731	0.35411745	380
NEFA_16_1	0.07398219	0.18518877	0.13712216	-0.01802899	0.38840652	455
NEFA_17_0	0.89833755	-0.0117474	0.97443443	-0.19238427	0.16888947	412
NEFA_17_1	0.61807872	0.05109236	0.7341819	-0.15020964	0.25239437	404
NEFA_18_0	0.43062291	-0.07659655	0.55773449	-0.26748994	0.11429685	380
NEFA_18_1	0.48094369	0.07138609	0.60815663	-0.12753918	0.27031136	414
NEFA_18_2	0.10853032	0.17421316	0.18054675	-0.03873083	0.38715716	379
NEFA_18_3	0.06710034	0.18103728	0.1276688	-0.0128035	0.37487806	455
NEFA_20_1	0.06256748	0.19084905	0.12010721	-0.01006158	0.39175969	396
NEFA_20_2	0.00503559	0.30560415	0.01424543	0.09261715	0.51859114	381
NEFA_20_3	0.00069211	0.37605395	0.00247124	0.15991654	0.59219136	379
NEFA_20_4	0.02103224	0.24315966	0.04710345	0.03681831	0.449501	379
NEFA_22_6	0.00130334	0.33375779	0.00451965	0.13110954	0.53640604	414
NEFA_24_1	0.59287208	-0.04685965	0.71355396	-0.21897114	0.12525183	455
NEFA_12_1	0.69284312	0.04178228	0.80086705	-0.16601069	0.24957525	409
NEFA_13_1	0.92733806	0.01242856	0.97443443	-0.25578731	0.28064443	237
NEFA_14_2	0.11633447	0.17811014	0.18805948	-0.04441047	0.40063076	352
NEFA_16_2	0.09994012	0.1842588	0.1727361	-0.03542051	0.4039381	393
NEFA_18_4	0.81689142	-0.02763587	0.90531781	-0.26228791	0.20701616	311
NEFA_19_0	0.93886035	-0.00792797	0.97443443	-0.21108372	0.19522778	343
NEFA_19_1	0.48369666	0.07342064	0.60815663	-0.13249816	0.27933945	384
NEFA_20_5	3.83E-01	-0.08934692	5.02E-01	-0.29056693	0.11187308	384
NEFA_22_4	0.0691782	0.21132179	0.12933315	-0.01668582	0.4393294	343
NEFA_22_5	0.94469198	-0.00739849	0.97443443	-0.21694972	0.20215274	384
NEFA_24_4	1.286E-05	0.69670479	5.5297E-05	0.38877924	1.00463034	237
NEFA_24_5	2.0579E-13	1.04529056	2.7653E-12	0.77963771	1.31094341	265
NEFA_26_1	0.03821412	-0.2010012	0.07976734	-0.39101363	-0.01098877	313

Supplemental Table 4: Results of the Regression model with Metabolite concentration as outcome and two level sex variable as predictor (*HC* females versus males), adjusted for ethnicity. ethnicity P-values, beta coefficient, Confidence interval (CI), number of observations per metabolite and FDR corrected p-values reported for all metabolites.

Analytes	P-Value	BETA	FDR P-Value	CI lower	CI upper	Number of observations
Carn	1.7197E-56	1.11821164	1.2324E-54	0.99037235	1.24605092	803
Carn.a.C10.0	0.21466905	0.11928261	0.23790642	-0.06934927	0.30791449	502
Carn.a.C10.1	0.05654552	0.17954105	0.06607221	-0.00502403	0.36410614	505
Carn.a.C12.0	9.1134E-05	0.38031595	0.00014261	0.19092678	0.56970512	499
Carn.a.C12.1	0.01542059	0.25198316	0.0189453	0.04833281	0.4556335	446
Carn.a.C14.0	8.1043E-08	0.44132664	1.6134E-07	0.28160933	0.60104396	666
Carn.a.C14.1	0.08344544	0.13692624	0.09593995	-0.01815385	0.29200633	725
Carn.a.C14.2	6.4182E-07	0.39603272	1.1499E-06	0.24125095	0.55081448	719
Carn.a.C16.0	6.126E-23	0.72337079	2.9934E-22	0.58379499	0.86294659	800
Carn.a.C16.1	0.0045534	0.21587838	0.00600602	0.066957	0.36479976	724
Carn.a.C18.0	8.1421E-25	0.8430312	4.6067E-24	0.68875965	0.99730275	643
Carn.a.C18.1	4.0508E-20	0.6701725	1.6128E-19	0.53078542	0.80955958	802
Carn.a.C2.0	0.00033662	0.27075073	0.00050611	0.12319052	0.41831094	748
Carn.a.C3.0	1.84E-33	0.88290796	1.89E-32	0.74567122	1.0201447	801
Carn.a.C4.0	0.00186733	0.260081	0.00259017	0.09654976	0.42361223	695
Carn.a.C4.0.DC	6.4862E-10	0.62663076	1.4679E-09	0.43171973	0.82154178	442
Carn.a.C5.0	2.1899E-18	0.80301093	7.98E-18	0.62913156	0.9768903	541
Carn.a.C6.0	0.01300024	0.20249261	0.01634533	0.04284044	0.36214478	683
Carn.a.C8.1	0.30174474	0.08725418	0.32765212	-0.07853969	0.25304805	597
lyso.PC.a.C14.0	0.53365424	0.04690767	0.56520031	-0.10095775	0.19477309	801
lyso.PC.a.C16.0	1.8898E-25	0.7925615	1.1286E-24	0.64878511	0.93633789	748
lyso.PC.a.C16.1	2.0844E-09	0.44773272	4.6681E-09	0.30272512	0.59274033	803
lyso.PC.a.C18.0	2.6918E-48	1.05676389	8.2677E-47	0.924113	1.18941478	803
lyso.PC.a.C18.1	8.82E-49	1.10336405	3.16E-47	0.96638248	1.24034561	748
lyso.PC.a.C18.2	8.76E-46	1.07302326	2.09E-44	0.93468152	1.211365	748
lyso.PC.a.C18.3	1.2737E-20	0.79315097	5.3695E-20	0.63155518	0.95474676	644
lyso.PC.a.C18.6	8.7589E-12	0.59889707	2.1159E-11	0.4301262	0.76766793	576
lyso.PC.a.C20.2	1.7126E-08	0.51528173	3.5747E-08	0.33859264	0.69197082	521
lyso.PC.a.C20.3	1.7041E-43	1.06794706	3.3307E-42	0.9268294	1.20906472	688
lyso.PC.a.C20.4	1.1525E-60	1.17094149	1.2389E-58	1.04272039	1.2991626	803
lyso.PC.a.C20.5	4.1755E-42	1.03083341	7.4811E-41	0.89127971	1.17038712	740
lyso.PC.a.C22.5	1.7227E-61	1.24327595	3.7037E-59	1.10994708	1.37660482	704
lyso.PC.a.C22.6	8.1557E-23	0.74079789	3.8966E-22	0.59765256	0.88394322	758
lyso.PC.e.C16.0	3.6712E-14	0.56493189	1.1439E-13	0.42114639	0.70871739	803
lyso.PC.e.C18.0	1.7671E-33	0.90067921	1.8883E-32	0.76089806	1.04046036	780
lyso.PC.e.C18.1	9.2416E-30	1.00417967	7.6421E-29	0.83984436	1.16851498	576
PC.aa.C30.0	1.0235E-21	-0.7202644	4.7839E-21	-0.86364394	-0.57688485	797
PC.aa.C30.1	3.3291E-12	-0.61276178	8.4208E-12	-0.78182159	-0.44370197	565

PC.aa.C30.2	3.5451E-08	-0.5239015	7.1905E-08	-0.70776786	-0.34003514	514
PC.aa.C32.0	1.9557E-29	-0.83026535	1.5017E-28	-0.96919679	-0.6913339	803
PC.aa.C32.1	2.1224E-18	-0.70451337	7.8677E-18	-0.85822414	-0.55080259	703
PC.aa.C32.2	1.6383E-37	-1.01169964	2.3482E-36	-1.15755476	-0.86584452	681
PC.aa.C32.3	2.2648E-10	-0.49644644	5.2926E-10	-0.64787335	-0.34501953	703
PC.aa.C34.0	0.01590565	-0.21605409	0.0194302	-0.39153305	-0.04057512	575
PC.aa.C34.1	3.8235E-15	-0.60220211	1.2461E-14	-0.74947995	-0.45492427	758
PC.aa.C34.2	1.1461E-36	-0.95619066	1.5401E-35	-1.09666056	-0.81572077	748
PC.aa.C34.3	7.0364E-24	-0.77961525	3.6898E-23	-0.92631081	-0.63291969	748
PC.aa.C34.4	4.4771E-21	-0.75746381	1.9644E-20	-0.91029741	-0.60463022	704
PC.aa.C34.5	0.35616517	0.07316526	0.38480157	-0.08241447	0.22874499	711
PC.aa.C36.0	0.21691758	-0.09221918	0.23916554	-0.23871429	0.05427594	747
PC.aa.C36.1	0.82264253	-0.01731509	0.84625907	-0.1689128	0.13428263	747
PC.aa.C36.2	0.03174219	-0.16387333	0.03834029	-0.31338736	-0.01435931	748
PC.aa.C36.3	5.9268E-33	-0.90558126	5.6074E-32	-1.0472307	-0.76393181	759
PC.aa.C36.4	2.4338E-27	-0.84920743	1.6352E-26	-0.9966834	-0.70173146	704
PC.aa.C36.5	0.55279374	-0.04871113	0.58260125	-0.20976676	0.1123445	659
PC.aa.C36.6	4.5511E-17	-0.6325701	1.6041E-16	-0.77710226	-0.48803794	794
PC.aa.C38.0	8.1425E-06	-0.34766804	1.3466E-05	-0.49952616	-0.19580992	702
PC.aa.C38.1	0.00318356	-0.23907648	0.00430482	-0.39764571	-0.08050724	642
PC.aa.C38.2	1.1808E-25	-0.78751093	7.2536E-25	-0.92977192	-0.64524994	756
PC.aa.C38.3	2.30E-07	-0.41953622	4.26E-07	-0.57713455	-0.26193788	681
PC.aa.C38.4	0.00023901	-0.29629555	0.00036188	-0.45380719	-0.13878391	681
PC.aa.C38.5	0.50533866	-0.05368613	0.53786046	-0.21184981	0.10447756	681
PC.aa.C38.6	1.1157E-32	-0.94266512	9.9952E-32	-1.09002852	-0.79530171	681
PC.aa.C40.0	1.1082E-06	-0.40641499	1.9215E-06	-0.56866218	-0.2441678	643
PC.aa.C40.1	0.0009838	-0.33182419	0.00139156	-0.52843884	-0.13520954	461
PC.aa.C40.3	6.7535E-05	-0.39229636	0.00010676	-0.58400871	-0.200584	471
PC.aa.C40.4	0.09184418	-0.13219182	0.10447883	-0.28593847	0.02155484	748
PC.aa.C40.5	4.54E-02	0.16271897	5.37E-02	0.00331571	0.32212222	681
PC.aa.C40.6	3.0511E-13	-0.56733791	8.9862E-13	-0.71724991	-0.41742592	732
PC.aa.C42.0	4.4152E-10	-0.5207031	1.0207E-09	-0.68205103	-0.35935517	643
PC.aa.C42.1	9.7797E-09	-0.53835006	2.0818E-08	-0.71978135	-0.35691877	523
PC.aa.C42.2	0.00409303	-0.27532258	0.00543211	-0.46287509	-0.08777007	508
PC.aa.C42.4	7.0965E-09	-0.58049196	1.5569E-08	-0.77369829	-0.38728562	439
PC.aa.C42.5	1.4436E-29	-0.97424536	1.1495E-28	-1.13449773	-0.81399299	589
PC.aa.C42.6	2.7819E-12	-0.63105866	7.294E-12	-0.80451627	-0.45760105	566
PC.aa.C43.4	3.6655E-05	-0.39635791	6.0159E-05	-0.58332972	-0.20938611	506
PC.aa.C43.6	0.0004252	-0.27102689	0.00063009	-0.42133437	-0.12071941	748
PC.aa.C44.12	0.00234146	-0.23365663	0.00320646	-0.38387297	-0.0834403	748
PC.ae.C30.0	7.5441E-07	-0.41100615	1.3405E-06	-0.57261285	-0.24939944	682
PC.ae.C30.1	0.00147485	-0.26858844	0.0020725	-0.43372678	-0.10345009	614
PC.ae.C32.0	3.4232E-09	-0.44208454	7.5875E-09	-0.5872741	-0.29689497	803
PC.ae.C32.1	1.0631E-07	-0.38955734	2.0969E-07	-0.53209882	-0.24701585	803
PC.ae.C32.2	9.6015E-13	-0.51335249	2.6466E-12	-0.65227513	-0.37442985	803

PC.ae.C34.0	0.00014367	-0.2932575	0.00022223	-0.44391212	-0.14260287	758
PC.ae.C34.1	4.4513E-13	-0.55016065	1.276E-12	-0.69668458	-0.40363672	759
PC.ae.C34.2	8.75E-09	-0.42002531	1.88E-08	-0.56172969	-0.27832093	759
PC.ae.C34.3	1.94E-01	-0.09605148	2.16E-01	-0.24105956	0.0489566	759
PC.ae.C34.4	0.90571099	0.00918878	0.91852766	-0.14306409	0.16144166	702
PC.ae.C36.0	0.99313774	-0.00065797	0.99313774	-0.15079198	0.14947605	748
PC.ae.C36.1	0.97972539	-0.00195603	0.98430355	-0.15300738	0.14909532	748
PC.ae.C36.2	0.00080065	-0.25981699	0.0011553	-0.41133252	-0.10830147	748
PC.ae.C36.3	8.28E-04	-0.24151727	0.00118619	-0.38277416	-0.10026038	803
PC.ae.C36.4	0.05342619	0.15042534	0.06276848	-0.00222599	0.30307666	704
PC.ae.C36.5	3.6534E-06	0.35513532	6.2339E-06	0.2057499	0.50452073	704
PC.ae.C36.6	1.0658E-08	0.48235753	2.2465E-08	0.31908277	0.6456323	597
PC.ae.C38.0	1.7668E-08	-0.42669797	3.6526E-08	-0.57376452	-0.27963143	748
PC.ae.C38.2	7.6235E-06	-0.34430475	1.2706E-05	-0.49426742	-0.19434207	748
PC.ae.C38.3	6.0603E-10	-0.4765883	1.3861E-09	-0.62577585	-0.32740074	748
PC.ae.C38.4	0.25701839	-0.0879311	0.28050231	-0.24011838	0.06425619	704
PC.ae.C38.5	0.00019393	0.29146024	0.00029575	0.13872792	0.44419256	704
PC.ae.C38.6	0.6140228	-0.03733831	0.64084904	-0.18261507	0.10793844	758
PC.ae.C40.0	3.081E-25	-0.79490377	1.7903E-24	-0.93980022	-0.65000731	748
PC.ae.C40.1	0.15091741	-0.10923547	0.16899606	-0.25838662	0.03991567	748
PC.ae.C40.2	1.6401E-24	-0.80161844	8.8157E-24	-0.94987012	-0.65336676	702
PC.ae.C40.3	3.512E-13	-0.55956756	1.0204E-12	-0.70772148	-0.41141364	703
PC.ae.C40.4	0.00084365	-0.2505344	0.00120122	-0.39727649	-0.10379232	748
PC.ae.C40.5	0.44244222	0.0581532	0.47562538	-0.09040344	0.20670985	748
PC.ae.C40.6	0.00042787	-0.2847924	0.00063009	-0.44276403	-0.12682077	681
PC.ae.C42.0	7.3311E-45	-1.09297986	1.5762E-43	-1.23498368	-0.95097604	703
PC.ae.C42.1	0.00363294	-0.25102883	0.00485144	-0.41989013	-0.08216753	640
PC.ae.C42.2	0.59638746	-0.04112992	0.62547953	-0.19353825	0.11127841	703
PC.ae.C42.3	9.25E-12	-0.50556097	2.2101E-11	-0.64883979	-0.36228216	754
PC.ae.C42.4	8.0832E-07	-0.37733684	1.4245E-06	-0.52621717	-0.22845651	748
PC.ae.C42.5	1.9652E-07	-0.40819159	3.7392E-07	-0.56069313	-0.25569005	703
PC.ae.C42.6	4.4964E-05	-0.30274643	7.2687E-05	-0.44758446	-0.15790839	802
SM.a.C30.1	3.6847E-19	-0.69701321	1.4146E-18	-0.84552417	-0.54850225	694
SM.a.C32.0	2.0517E-07	-0.51783762	3.8695E-07	-0.71071545	-0.32495979	454
SM.a.C32.1	1.5516E-12	-0.54128247	4.2226E-12	-0.68902185	-0.39354308	748
SM.a.C32.2	7.83E-52	-1.00856617	4.21E-50	-1.12939425	-0.88773809	755
SM.a.C33.1	0.00562113	-0.2093568	0.00728039	-0.35734865	-0.06136494	748
SM.a.C33.2	3.06E-12	-0.53264705	7.83E-12	-0.67973244	-0.38556166	650
SM.a.C34.0	1.0094E-13	-0.63602275	3.014E-13	-0.79936048	-0.47268503	513
SM.a.C34.1	8.0112E-09	-0.4391508	1.7398E-08	-0.58691451	-0.29138709	758
SM.a.C34.2	6.00E-33	-0.80314363	5.61E-32	-0.92911017	-0.67717708	803
SM.a.C34.3	2.958E-12	-0.62337188	7.6622E-12	-0.79465003	-0.45209373	523
SM.a.C35.0	0.00203161	-0.2655004	0.00279997	-0.43374399	-0.09725682	598
SM.a.C35.1	0.45410072	-0.05625062	0.48572962	-0.20368764	0.0911864	748
SM.a.C36.0	3.83E-15	-0.73688537	1.25E-14	-0.91551779	-0.55825295	523

SM.a.C36.1	1.7307E-19	-0.66260572	6.7653E-19	-0.80274996	-0.52246148	758
SM.a.C36.2	2.06E-23	-0.66808788	1.03E-22	-0.79551776	-0.540658	803
SM.a.C36.3	7.19E-16	-0.57535461	2.4168E-15	-0.71231144	-0.43839779	758
SM.a.C37.1	5.8885E-11	-0.50300114	1.3912E-10	-0.65149768	-0.35450459	703
SM.a.C38.1	8.0511E-34	-0.88421957	9.1104E-33	-1.02080733	-0.7476318	800
SM.a.C38.2	6.1698E-50	-1.0560113	2.653E-48	-1.18597172	-0.92605088	803
SM.a.C39.1	2.6427E-07	-0.40802163	4.8562E-07	-0.56212912	-0.25391414	703
SM.a.C39.2	3.8101E-12	-0.51723149	9.5253E-12	-0.66106904	-0.37339395	755
SM.a.C40.1	1.6152E-07	-0.42353559	3.1285E-07	-0.58063558	-0.26643561	695
SM.a.C40.2	1.082E-23	-0.79565068	5.539E-23	-0.94536113	-0.64594024	659
SM.a.C40.3	2.6844E-28	-0.97708766	1.9901E-27	-1.14178918	-0.81238614	574
SM.a.C40.4	1.3063E-24	-0.75517977	7.2017E-24	-0.89516711	-0.61519244	802
SM.a.C40.5	0.04243758	-0.1609679	0.05097251	-0.31642817	-0.00550762	712
SM.a.C41.1	5.9602E-07	-0.39188312	1.0768E-06	-0.54464046	-0.23912578	748
SM.a.C41.2	2.6503E-21	-0.69942644	1.1871E-20	-0.83993926	-0.55891362	748
SM.a.C42.1	3.768E-05	-0.32322233	6.1372E-05	-0.4762598	-0.17018486	748
SM.a.C42.2	9.0653E-28	-0.83255676	6.4968E-27	-0.97620519	-0.68890833	748
SM.a.C42.3	1.024E-39	-0.96768137	1.6935E-38	-1.10335472	-0.83200802	748
SM.a.C42.4	2.2779E-08	-0.44034735	4.6643E-08	-0.59324837	-0.28744633	704
SM.a.C42.5	4.5113E-19	-0.82937905	1.7016E-18	-1.00493237	-0.65382574	523
SM.a.C42.6	1.6839E-35	-0.97487981	2.0114E-34	-1.12033807	-0.82942154	704
SM.a.C43.1	0.11435646	-0.12244128	0.12940336	-0.27450131	0.02961875	748
SM.a.C43.2	1.3515E-07	-0.40270678	2.6415E-07	-0.551225	-0.25418855	748
SM.a.C44.2	0.00482521	-0.24428212	0.00629857	-0.41385825	-0.07470599	590
SM.a.C44.6	5.8063E-12	-0.55615156	1.4349E-11	-0.71185889	-0.40044422	658
SM.a.C31.1	6.0192E-12	-0.53234549	1.4706E-11	-0.681661	-0.38302997	702
SM.a.C33.3	0.00483379	-0.21836452	0.00629857	-0.37003806	-0.06669097	754
SM.a.C35.2	0.00768958	-0.19547306	0.00984084	-0.33905569	-0.05189044	758
SM.a.C37.3	2.51E-03	-0.22726257	0.00341471	-0.3743883	-0.08013683	757
SM.a.C39.5	0.00048953	0.28764314	0.00071598	0.12647944	0.44880683	625
SM.a.C41.0	5.7211E-13	-0.59878733	1.6185E-12	-0.75853162	-0.43904304	634
SM.a.C41.3	2.2123E-14	-0.6428205	7.0993E-14	-0.80393429	-0.48170671	586
SM.a.C43.0	7.1606E-16	-0.70400492	2.4168E-15	-0.87040442	-0.53760543	567
SM.a.C43.3	5.1423E-14	-0.60434399	1.5794E-13	-0.75847755	-0.45021043	650
Ala	0.06673713	0.13431169	0.07714238	-0.00929035	0.27791374	800
Arg	2.3014E-16	0.60628679	7.9805E-16	0.46434977	0.74822382	798
Asn	0.64648637	-0.0351624	0.67147135	-0.18560982	0.11528502	736
Asp	0.04413234	-0.14876988	0.05242239	-0.29362271	-0.00391705	800
Cit	2.2069E-26	0.77693074	1.3955E-25	0.63853484	0.91532663	800
Gln	6.2421E-32	0.88141753	5.3682E-31	0.74121491	1.02162014	736
Glu	1.93E-12	0.50411869	5.18E-12	0.36577434	0.64246303	800
Gly	2.248E-21	0.64067093	1.0283E-20	0.51196102	0.76938085	800
His	0.01969992	-0.17733271	0.02392929	-0.32629789	-0.02836753	789
Ile	1.75E-20	0.79095177	7.1844E-20	0.62979976	0.95210378	577
Leu	3.97E-47	1.06545948	1.07E-45	0.93059428	1.20032468	736

Lys	2.1362E-07	0.39528675	3.9938E-07	0.24710067	0.54347282	736
Met	1.0866E-20	0.71410333	4.6726E-20	0.56828756	0.8599191	736
Orn	1.4182E-38	0.9378877	2.1779E-37	0.80425274	1.07152266	736
Phe	3.00E-17	0.64665659	1.0735E-16	0.50005359	0.79325958	736
Pro	1.2505E-35	0.88885076	1.5815E-34	0.75561524	1.02208628	800
Trp	2.5064E-12	0.52197152	6.6529E-12	0.37795257	0.66599048	800
Ser	0.68724488	-0.02746728	0.71037332	-0.16134097	0.1064064	800
Thr	9.8726E-07	-0.36281366	1.7257E-06	-0.50713791	-0.21848941	755
Tyr	1.77E-20	0.70372633	7.18E-20	0.55917638	0.84827628	736
Val	5.58E-27	0.81181427	3.64E-26	0.66949194	0.95413661	736
NEFA_12_0	0.00151499	-0.26299656	0.00211508	-0.42511229	-0.10088084	637
NEFA_14_0	9.1534E-05	-0.30080598	0.00014261	-0.45095749	-0.15065446	780
NEFA_14_1	9.5859E-13	-0.52860527	2.6466E-12	-0.67163487	-0.38557566	797
NEFA_15_0	0.0432231	-0.15305257	0.05162759	-0.30143109	-0.00467404	795
NEFA_15_1	0.00019396	-0.35293253	0.00029575	-0.53768099	-0.16818406	543
NEFA_16_0	0.01334658	-0.20050326	0.01658679	-0.35918998	-0.04181654	689
NEFA_16_1	3.4903E-14	-0.55525313	1.1036E-13	-0.69643033	-0.41407592	797
NEFA_17_0	0.11591144	0.12364807	0.13047622	-0.0305708	0.27786694	743
NEFA_17_1	0.00675345	-0.21406449	0.00869456	-0.36876793	-0.05936104	732
NEFA_18_0	0.23332995	0.09607024	0.25594867	-0.06205941	0.25419989	680
NEFA_18_1	0.00065049	-0.26338283	0.00094497	-0.41438633	-0.11237933	746
NEFA_18_2	4.9032E-05	-0.32953459	7.8088E-05	-0.48787831	-0.17119087	691
NEFA_18_3	5.9862E-06	-0.3387941	1.0134E-05	-0.48470866	-0.19287955	796
NEFA_20_1	0.0033917	-0.23556539	0.00455759	-0.39289105	-0.07823972	719
NEFA_20_2	2.7308E-06	-0.37874033	4.6969E-06	-0.5359645	-0.22151616	688
NEFA_20_3	0.00035212	-0.29431193	0.00052573	-0.45520537	-0.13341848	691
NEFA_20_4	0.87825468	-0.01257945	0.89490405	-0.17375717	0.14859826	691
NEFA_22_6	1.854E-07	-0.40588124	3.559E-07	-0.5572725	-0.25448997	746
NEFA_24_1	4.5783E-05	0.30512779	7.3458E-05	0.15900309	0.45125248	796
NEFA_12_1	7.0499E-06	-0.35305992	1.1842E-05	-0.50623139	-0.19988845	726
NEFA_13_1	0.83727316	0.02175302	0.85720823	-0.18629989	0.22980592	429
NEFA_14_2	0.01401852	-0.21096239	0.01732173	-0.37911973	-0.04280504	649
NEFA_16_2	4.6118E-07	-0.4048169	8.4029E-07	-0.56096849	-0.2486653	700
NEFA_18_4	0.01079396	-0.22827449	0.01365119	-0.40356934	-0.05297964	564
NEFA_19_0	0.09124277	0.14425938	0.10434679	-0.02322295	0.31174171	617
NEFA_19_1	0.06606061	-0.14969838	0.07677315	-0.30935572	0.00995895	702
NEFA_20_5	1.31E-02	0.19949817	1.64E-02	0.04197567	0.35702068	702
NEFA_22_4	0.01044799	-0.21772434	0.01329182	-0.38419035	-0.05125833	617
NEFA_22_5	0.93802931	-0.00623756	0.9468371	-0.16369956	0.15122444	702
NEFA_24_4	6.851E-08	-0.55534149	1.3766E-07	-0.75416915	-0.35651384	439
NEFA_24_5	1.0436E-27	-1.05692264	7.2377E-27	-1.23568146	-0.87816382	490
NEFA_26_1	7.9944E-14	0.65967971	2.4209E-13	0.49046599	0.82889343	584

Supplemental Table 5: Results for the ANOVA for the five MetS Factors: waist circumference, HDL, triglyceride, glucose and systolic blood pressure as outcome and three level sex variable (males, *nh*females and *h*females) * single metabolite concentration interaction as predictor. Adjusted for ethnicity. P-value, FDR corrected P-values and number of observations per metabolite reported.

Waist circumference

Analytes	P-VALUE	FDR P-Value	Number of observations
Carn	0.77398611	0.8667032	996
Carn.a.C10.0	0.03523295	0.23127167	622
Carn.a.C10.1	0.00242669	0.06521739	620
Carn.a.C12.0	0.47176932	0.69472879	616
Carn.a.C12.1	0.00222942	0.06521739	549
Carn.a.C14.0	0.51226552	0.71595464	823
Carn.a.C14.1	0.09132989	0.32726545	896
Carn.a.C14.2	0.01781328	0.18237404	887
Carn.a.C16.0	0.83065243	0.89295136	991
Carn.a.C16.1	0.02039473	0.19931214	894
Carn.a.C18.0	0.20680037	0.47576811	796
Carn.a.C18.1	0.52507409	0.71905051	995
Carn.a.C2.0	0.48857185	0.70028632	925
Carn.a.C3.0	0.22476303	0.49818609	994
Carn.a.C4.0	0.28477498	0.56083487	861
Carn.a.C4.0.DC	0.04530252	0.25365456	546
Carn.a.C5.0	0.84041154	0.89449743	666
Carn.a.C6.0	0.00184859	0.06521739	846
Carn.a.C8.1	0.14478298	0.40426415	748
lyso.PC.a.C14.0	0.32363704	0.59217599	991
lyso.PC.a.C16.0	0.05315145	0.25537361	925
lyso.PC.a.C16.1	0.02971777	0.2206473	996
lyso.PC.a.C18.0	0.13834298	0.39658322	996
lyso.PC.a.C18.1	0.00060259	0.04925788	925
lyso.PC.a.C18.2	0.00114824	0.0617177	925
lyso.PC.a.C18.3	0.0002935	0.04925788	793
lyso.PC.a.C18.6	0.15949197	0.40822348	707
lyso.PC.a.C20.2	0.35719494	0.62269079	645
lyso.PC.a.C20.3	0.03757021	0.23485644	853
lyso.PC.a.C20.4	0.02143166	0.20033944	996
lyso.PC.a.C20.5	0.00526096	0.10282794	920
lyso.PC.a.C22.5	0.0538154	0.25537361	874
lyso.PC.a.C22.6	0.0131902	0.15941669	939
lyso.PC.e.C16.0	0.86108617	0.91198781	995
lyso.PC.e.C18.0	0.17982862	0.43718715	967
lyso.PC.e.C18.1	0.06414035	0.25537361	707
PC.aa.C30.0	0.8370785	0.89449743	988

PC.aa.C30.1	0.61504077	0.77329687	701
PC.aa.C30.2	0.37197764	0.63980155	638
PC.aa.C32.0	0.28816244	0.56083487	996
PC.aa.C32.1	0.5915076	0.77212557	864
PC.aa.C32.2	0.64118373	0.78774001	836
PC.aa.C32.3	0.89375697	0.9282983	868
PC.aa.C34.0	0.93710018	0.95414791	706
PC.aa.C34.1	0.59726536	0.77212557	935
PC.aa.C34.2	0.11201829	0.35298249	925
PC.aa.C34.3	0.95121941	0.95566436	925
PC.aa.C34.4	0.60780788	0.77212557	865
PC.aa.C34.5	0.72411614	0.84332531	875
PC.aa.C36.0	0.46930562	0.69472879	924
PC.aa.C36.1	0.2120075	0.47576811	924
PC.aa.C36.2	0.5977104	0.77212557	925
PC.aa.C36.3	0.20982862	0.47576811	936
PC.aa.C36.4	0.0313645	0.22477892	865
PC.aa.C36.5	0.65949576	0.80563403	808
PC.aa.C36.6	0.29589153	0.56297946	983
PC.aa.C38.0	0.44453232	0.69264427	867
PC.aa.C38.1	0.04601176	0.25365456	796
PC.aa.C38.2	0.13012886	0.37807711	936
PC.aa.C38.3	0.28715347	0.56083487	836
PC.aa.C38.4	0.2779238	0.56083487	836
PC.aa.C38.5	0.94083422	0.95414791	836
PC.aa.C38.6	0.09973281	0.32988546	836
PC.aa.C40.0	0.60674132	0.77212557	800
PC.aa.C40.1	0.73936926	0.85136572	573
PC.aa.C40.3	0.80747237	0.87549435	584
PC.aa.C40.4	0.38695398	0.64513119	925
PC.aa.C40.5	0.5945548	0.77212557	836
PC.aa.C40.6	0.29369305	0.56297946	901
PC.aa.C42.0	0.61920578	0.77400723	796
PC.aa.C42.1	0.20006089	0.47576811	643
PC.aa.C42.2	0.06281939	0.25537361	629
PC.aa.C42.4	0.68243904	0.81824972	549
PC.aa.C42.5	0.05787381	0.25537361	731
PC.aa.C42.6	0.44401015	0.69264427	702
PC.aa.C43.4	0.88359119	0.92219469	626
PC.aa.C43.6	0.60609525	0.77212557	925
PC.aa.C44.12	0.31678888	0.59217599	925
PC.ae.C30.0	0.38125164	0.64513119	849
PC.ae.C30.1	0.56589347	0.76520186	758
PC.ae.C32.0	0.61051789	0.77212557	996
PC.ae.C32.1	0.02846963	0.2206473	996

PC.ae.C32.2	0.01539496	0.17420607	995
PC.ae.C34.0	0.87135207	0.9143225	935
PC.ae.C34.1	0.41841128	0.67637914	936
PC.ae.C34.2	0.27072025	0.56083487	936
PC.ae.C34.3	0.05207227	0.25537361	936
PC.ae.C34.4	0.74445003	0.85136572	869
PC.ae.C36.0	0.28691523	0.56083487	929
PC.ae.C36.1	0.60215585	0.77212557	925
PC.ae.C36.2	0.3591333	0.62269079	925
PC.ae.C36.3	0.4458454	0.69264427	996
PC.ae.C36.4	0.27864875	0.56083487	865
PC.ae.C36.5	0.11492453	0.35298249	865
PC.ae.C36.6	0.2895473	0.56083487	734
PC.ae.C38.0	0.67910953	0.81824972	925
PC.ae.C38.2	0.75680504	0.85703577	925
PC.ae.C38.3	0.48150009	0.69478201	925
PC.ae.C38.4	0.09010539	0.32726545	865
PC.ae.C38.5	0.32818325	0.59293613	865
PC.ae.C38.6	0.27094996	0.56083487	935
PC.ae.C40.0	0.23832678	0.52285978	925
PC.ae.C40.1	0.72565201	0.84332531	925
PC.ae.C40.2	0.63283724	0.78302605	867
PC.ae.C40.3	0.91196767	0.93814856	868
PC.ae.C40.4	0.09378981	0.32937578	925
PC.ae.C40.5	0.44786083	0.69264427	925
PC.ae.C40.6	0.34552708	0.61395307	836
PC.ae.C42.0	0.06068161	0.25537361	870
PC.ae.C42.1	0.45489275	0.69264427	796
PC.ae.C42.2	0.66521515	0.8080297	868
PC.ae.C42.3	0.87179587	0.9143225	933
PC.ae.C42.4	0.63370481	0.78302605	925
PC.ae.C42.5	0.43650716	0.69264427	868
PC.ae.C42.6	0.53674249	0.73037744	994
SM.a.C30.1	0.34352729	0.61395307	859
SM.a.C32.0	0.17582849	0.43451868	564
SM.a.C32.1	0.47825161	0.6947574	925
SM.a.C32.2	0.10395123	0.338629	936
SM.a.C33.1	0.25492286	0.54808415	925
SM.a.C33.2	0.0991646	0.32988546	803
SM.a.C34.0	0.00737644	0.12199494	628
SM.a.C34.1	0.74079852	0.85136572	939
SM.a.C34.2	0.16350566	0.41357314	996
SM.a.C34.3	0.30388884	0.57312368	643
SM.a.C35.0	0.94829666	0.95566436	735
SM.a.C35.1	0.1292237	0.37807711	925

SM.a.C36.0	0.01104045	0.14835599	643
SM.a.C36.1	0.46391058	0.69264427	939
SM.a.C36.2	0.69301687	0.82319683	996
SM.a.C36.3	0.02891279	0.2206473	935
SM.a.C37.1	0.16933278	0.42333196	868
SM.a.C38.1	0.5147577	0.71595464	993
SM.a.C38.2	0.08540733	0.31659613	996
SM.a.C39.1	0.07829457	0.30606061	868
SM.a.C39.2	0.15770475	0.40822348	935
SM.a.C40.1	0.1431269	0.40426415	860
SM.a.C40.2	0.18097514	0.43718715	808
SM.a.C40.3	0.80479537	0.87549435	712
SM.a.C40.4	0.01764229	0.18237404	995
SM.a.C40.5	0.09763053	0.32988546	877
SM.a.C41.1	0.05701775	0.25537361	925
SM.a.C41.2	0.15924515	0.40822348	925
SM.a.C42.1	0.0347592	0.23127167	925
SM.a.C42.2	0.00968891	0.14835599	925
SM.a.C42.3	0.03549751	0.23127167	925
SM.a.C42.4	0.40248977	0.65777907	865
SM.a.C42.5	0.21091277	0.47576811	643
SM.a.C42.6	0.0449503	0.25365456	865
SM.a.C43.1	0.15267651	0.40822348	925
SM.a.C43.2	0.00325711	0.07780884	925
SM.a.C44.2	0.51446839	0.71595464	732
SM.a.C44.6	0.72019223	0.84332531	810
SM.a.C31.1	0.05074338	0.25537361	867
SM.a.C33.3	0.50242837	0.71537815	935
SM.a.C35.2	0.08008315	0.3074621	939
SM.a.C37.3	0.35329482	0.62260972	938
SM.a.C39.5	0.51615335	0.71595464	773
SM.a.C41.0	0.00068732	0.04925788	776
SM.a.C41.3	0.11383027	0.35298249	722
SM.a.C43.0	0.26792022	0.56083487	703
SM.a.C43.3	0.02660774	0.2206473	804
Ala	0.58929707	0.77212557	993
Arg	0.75804756	0.85703577	991
Asn	0.39007932	0.64513119	919
Asp	0.00228689	0.06521739	993
Cit	0.05693872	0.25537361	993
Gln	0.46169429	0.69264427	919
Glu	0.58957647	0.77212557	993
Gly	0.28082589	0.56083487	993
His	0.14901793	0.40822348	981
Ile	0.45358272	0.69264427	717

Leu	0.1202809	0.35917214	919
Lys	0.52101904	0.71807111	919
Met	0.78422708	0.87197092	919
Orn	0.01056954	0.14835599	919
Phe	0.90815454	0.93814856	919
Pro	0.04801358	0.25537361	993
Trp	0.81034128	0.87549435	993
Ser	0.38752911	0.64513119	993
Thr	0.15053725	0.40822348	936
Tyr	0.68504628	0.81824972	919
Val	0.04919648	0.25537361	919
NEFA_12_0	0.11211635	0.35298249	788
NEFA_14_0	0.4766036	0.6947574	964
NEFA_14_1	0.06352635	0.25537361	989
NEFA_15_0	0.24301687	0.52776392	986
NEFA_15_1	0.78837464	0.87197092	681
NEFA_16_0	0.03823244	0.23485644	851
NEFA_16_1	0.04129889	0.24664618	989
NEFA_17_0	0.32500822	0.59217599	917
NEFA_17_1	0.06312138	0.25537361	902
NEFA_18_0	0.32409617	0.59217599	839
NEFA_18_1	0.157475	0.40822348	921
NEFA_18_2	0.0045128	0.09702515	850
NEFA_18_3	0.21243599	0.47576811	988
NEFA_20_1	0.40384576	0.65777907	884
NEFA_20_2	0.43232109	0.69264427	846
NEFA_20_3	0.01334651	0.15941669	850
NEFA_20_4	0.00736963	0.12199494	850
NEFA_22_6	0.45796742	0.69264427	921
NEFA_24_1	0.20196243	0.47576811	988
NEFA_12_1	0.11786807	0.35692442	895
NEFA_13_1	0.72060871	0.84332531	528
NEFA_14_2	0.79579993	0.8729438	797
NEFA_16_2	0.02690606	0.2206473	865
NEFA_18_4	0.93671918	0.95414791	698
NEFA_19_0	0.98692902	0.98692902	762
NEFA_19_1	0.09498278	0.32937578	861
NEFA_20_5	0.76136666	0.85703577	861
NEFA_22_4	0.02976173	0.2206473	762
NEFA_22_5	0.06086855	0.25537361	861
NEFA_24_4	0.79085734	0.87197092	535
NEFA_24_5	0.08518219	0.31659613	602
NEFA_26_1	0.38858143	0.64513119	714

HDL

Analytes	P-VALUE	FDR P-Value	Number of observations
Carn	0.12195434	0.30006152	996
Carn.a.C10.0	0.43709287	0.63928549	622
Carn.a.C10.1	0.67915471	0.81574448	620
Carn.a.C12.0	0.48202167	0.67295233	616
Carn.a.C12.1	0.71287955	0.83975885	549
Carn.a.C14.0	0.87503648	0.92221982	823
Carn.a.C14.1	0.71774772	0.83975885	896
Carn.a.C14.2	0.82256132	0.88425342	887
Carn.a.C16.0	0.58141078	0.74476503	991
Carn.a.C16.1	0.99341285	0.99803328	894
Carn.a.C18.0	0.00971136	0.0699686	796
Carn.a.C18.1	0.31346057	0.49192718	995
Carn.a.C2.0	0.73011038	0.83975885	925
Carn.a.C3.0	0.42245797	0.62211276	994
Carn.a.C4.0	0.38355672	0.58073729	861
Carn.a.C4.0.DC	0.53488739	0.72221702	546
Carn.a.C5.0	0.12845926	0.30687491	666
Carn.a.C6.0	0.09878997	0.25902248	846
Carn.a.C8.1	0.31726141	0.49428407	748
lyso.PC.a.C14.0	0.65448851	0.79500016	991
lyso.PC.a.C16.0	0.000261	0.00431655	925
lyso.PC.a.C16.1	0.00254676	0.02488882	996
lyso.PC.a.C18.0	0.00195285	0.01999345	996
lyso.PC.a.C18.1	4.1348E-11	8.8898E-09	925
lyso.PC.a.C18.2	1.1866E-10	1.2756E-08	925
lyso.PC.a.C18.3	1.403E-07	1.0055E-05	793
lyso.PC.a.C18.6	0.02648707	0.11713616	707
lyso.PC.a.C20.2	0.0905876	0.24044856	645
lyso.PC.a.C20.3	0.00140696	0.01512483	853
lyso.PC.a.C20.4	4.38E-05	0.00104633	996
lyso.PC.a.C20.5	9.2092E-06	0.00037877	920
lyso.PC.a.C22.5	0.00300005	0.02804393	874
lyso.PC.a.C22.6	0.00042079	0.00532178	939
lyso.PC.e.C16.0	0.16256523	0.33603926	995
lyso.PC.e.C18.0	0.00527726	0.04727541	967
lyso.PC.e.C18.1	3.5189E-05	0.00104633	707
PC.aa.C30.0	0.83924477	0.89769963	988
PC.aa.C30.1	0.00994152	0.0699686	701
PC.aa.C30.2	0.48933823	0.67626216	638
PC.aa.C32.0	0.14386364	0.3221946	996
PC.aa.C32.1	0.36401363	0.55902093	864
PC.aa.C32.2	0.1344658	0.31424072	836
PC.aa.C32.3	0.04249277	0.15602973	868

PC.aa.C34.0	0.06037754	0.19374882	706
PC.aa.C34.1	0.03656497	0.14558275	935
PC.aa.C34.2	0.04991124	0.1652193	925
PC.aa.C34.3	0.07354386	0.21562249	925
PC.aa.C34.4	0.07930068	0.22548008	865
PC.aa.C34.5	0.15703909	0.3326802	875
PC.aa.C36.0	0.00584575	0.04833987	924
PC.aa.C36.1	0.44855869	0.64724912	924
PC.aa.C36.2	0.31984359	0.4947221	925
PC.aa.C36.3	0.28148934	0.46943244	936
PC.aa.C36.4	0.15782967	0.3326802	865
PC.aa.C36.5	0.11741962	0.29354905	808
PC.aa.C36.6	0.04924331	0.1652193	983
PC.aa.C38.0	0.01368172	0.08171028	867
PC.aa.C38.1	0.07421425	0.21562249	796
PC.aa.C38.2	0.89584769	0.93046983	936
PC.aa.C38.3	0.00032519	0.00474555	836
PC.aa.C38.4	6.7979E-05	0.00146156	836
PC.aa.C38.5	0.02669615	0.11713616	836
PC.aa.C38.6	0.00117329	0.01327672	836
PC.aa.C40.0	0.12281588	0.30006152	800
PC.aa.C40.1	0.08531539	0.2292851	573
PC.aa.C40.3	0.53746383	0.72221702	584
PC.aa.C40.4	0.08353669	0.2273467	925
PC.aa.C40.5	0.0211735	0.10116226	836
PC.aa.C40.6	7.6632E-06	0.00037877	901
PC.aa.C42.0	0.1552321	0.3326802	796
PC.aa.C42.1	0.03048563	0.12851786	643
PC.aa.C42.2	0.07195124	0.21485441	629
PC.aa.C42.4	0.89427452	0.93046983	549
PC.aa.C42.5	0.11151357	0.28542165	731
PC.aa.C42.6	0.04092925	0.15602973	702
PC.aa.C43.4	0.74035854	0.84220681	626
PC.aa.C43.6	0.53336648	0.72221702	925
PC.aa.C44.12	0.97811644	0.98923943	925
PC.ae.C30.0	0.12676308	0.30622542	849
PC.ae.C30.1	0.25088218	0.43878729	758
PC.ae.C32.0	0.80806539	0.87378174	996
PC.ae.C32.1	0.25264733	0.43878729	996
PC.ae.C32.2	0.0442378	0.15851879	995
PC.ae.C34.0	0.30519163	0.48604593	935
PC.ae.C34.1	0.1457496	0.32305325	936
PC.ae.C34.2	0.49068324	0.67626216	936
PC.ae.C34.3	0.0100885	0.0699686	936
PC.ae.C34.4	0.27957876	0.46943244	869

PC.ae.C36.0	0.01506234	0.08303599	929
PC.ae.C36.1	0.06650257	0.2042579	925
PC.ae.C36.2	0.01362602	0.08171028	925
PC.ae.C36.3	0.17413223	0.34433571	996
PC.ae.C36.4	0.01479947	0.08303599	865
PC.ae.C36.5	0.01870377	0.09437143	865
PC.ae.C36.6	0.29069969	0.48077257	734
PC.ae.C38.0	0.04138972	0.15602973	925
PC.ae.C38.2	0.19824221	0.38055425	925
PC.ae.C38.3	0.08184751	0.2273467	925
PC.ae.C38.4	0.01807826	0.09437143	865
PC.ae.C38.5	0.04841621	0.1652193	865
PC.ae.C38.6	0.03990986	0.15601126	935
PC.ae.C40.0	0.00571917	0.04833987	925
PC.ae.C40.1	0.07077904	0.21433088	925
PC.ae.C40.2	0.15635708	0.3326802	867
PC.ae.C40.3	0.55940634	0.74162973	868
PC.ae.C40.4	0.28165947	0.46943244	925
PC.ae.C40.5	0.24275493	0.43641903	925
PC.ae.C40.6	0.00033108	0.00474555	836
PC.ae.C42.0	0.14132279	0.3221946	870
PC.ae.C42.1	0.01430976	0.08303599	796
PC.ae.C42.2	0.76410419	0.85563751	868
PC.ae.C42.3	0.11112541	0.28542165	933
PC.ae.C42.4	0.68940253	0.82345302	925
PC.ae.C42.5	0.77002011	0.85779443	868
PC.ae.C42.6	0.38859325	0.58424859	994
SM.a.C30.1	0.44134153	0.64113803	859
SM.a.C32.0	0.30232177	0.48514849	564
SM.a.C32.1	0.1774492	0.34683253	925
SM.a.C32.2	0.16840709	0.33838808	936
SM.a.C33.1	0.99803328	0.99803328	925
SM.a.C33.2	0.92402722	0.94672563	803
SM.a.C34.0	0.62622194	0.77233203	628
SM.a.C34.1	0.16792586	0.33838808	939
SM.a.C34.2	0.62864235	0.77233203	996
SM.a.C34.3	0.73039491	0.83975885	643
SM.a.C35.0	0.80576053	0.87378174	735
SM.a.C35.1	0.86442836	0.92005989	925
SM.a.C36.0	0.00100442	0.01199726	643
SM.a.C36.1	0.56302313	0.74162973	939
SM.a.C36.2	0.7037088	0.8358972	996
SM.a.C36.3	0.54136759	0.72294429	935
SM.a.C37.1	0.86915256	0.92053104	868
SM.a.C38.1	0.04281746	0.15602973	993

SM.a.C38.2	0.13356045	0.31424072	996
SM.a.C39.1	0.25286688	0.43878729	868
SM.a.C39.2	0.88342096	0.92651466	935
SM.a.C40.1	0.00878719	0.06747303	860
SM.a.C40.2	0.18581481	0.35991156	808
SM.a.C40.3	0.21543171	0.40276364	712
SM.a.C40.4	0.05216853	0.16994294	995
SM.a.C40.5	0.01288056	0.08145062	877
SM.a.C41.1	0.08259372	0.2273467	925
SM.a.C41.2	0.75338181	0.852511	925
SM.a.C42.1	0.02565014	0.11713616	925
SM.a.C42.2	0.07970459	0.22548008	925
SM.a.C42.3	0.31120067	0.49192718	925
SM.a.C42.4	0.00025198	0.00431655	865
SM.a.C42.5	0.035858	0.14546168	643
SM.a.C42.6	0.00012463	0.00243594	865
SM.a.C43.1	0.20258239	0.38544437	925
SM.a.C43.2	0.4583246	0.64828809	925
SM.a.C44.2	0.79284699	0.87378174	732
SM.a.C44.6	4.2721E-05	0.00104633	810
SM.a.C31.1	0.80547934	0.87378174	867
SM.a.C33.3	0.59159885	0.7463702	935
SM.a.C35.2	0.72792101	0.83975885	939
SM.a.C37.3	0.22896318	0.42001121	938
SM.a.C39.5	0.17457019	0.34433571	773
SM.a.C41.0	0.00041257	0.00532178	776
SM.a.C41.3	0.06192302	0.19578602	722
SM.a.C43.0	0.1641122	0.33603926	703
SM.a.C43.3	0.98003721	0.98923943	804
Ala	0.97642131	0.98923943	993
Arg	0.5705069	0.74338778	991
Asn	0.25306802	0.43878729	919
Asp	0.21949214	0.40681732	993
Cit	0.58195593	0.74476503	993
Gln	0.30237162	0.48514849	919
Glu	0.36889398	0.56249791	993
Gly	0.04995002	0.1652193	993
His	0.28012995	0.46943244	981
Ile	0.45217674	0.64812	717
Leu	0.59709616	0.7463702	919
Lys	0.41786504	0.61959299	919
Met	0.39992268	0.59710677	919
Orn	0.02074036	0.10116226	919
Phe	0.91864026	0.94672563	919
Pro	0.76393817	0.85563751	993

Trp	0.66385533	0.80184773	993
Ser	0.00674615	0.05371932	993
Thr	0.03370955	0.13937601	936
Tyr	0.21517213	0.40276364	919
Val	0.72905045	0.83975885	919
NEFA_12_0	0.80083712	0.87378174	788
NEFA_14_0	0.15951085	0.33295953	964
NEFA_14_1	0.45738038	0.64828809	989
NEFA_15_0	0.14791088	0.32449835	986
NEFA_15_1	0.0165769	0.08910083	681
NEFA_16_0	0.14020763	0.3221946	851
NEFA_16_1	0.64399976	0.78670425	989
NEFA_17_0	0.06532522	0.2035496	917
NEFA_17_1	0.2611189	0.44912451	902
NEFA_18_0	0.01278717	0.08145062	839
NEFA_18_1	0.59640892	0.7463702	921
NEFA_18_2	0.29407254	0.48263814	850
NEFA_18_3	0.59615959	0.7463702	988
NEFA_20_1	0.92470876	0.94672563	884
NEFA_20_2	0.56570826	0.74162973	846
NEFA_20_3	0.01231655	0.08145062	850
NEFA_20_4	0.01887429	0.09437143	850
NEFA_22_6	0.025984	0.11713616	921
NEFA_24_1	0.80875613	0.87378174	988
NEFA_12_1	0.5359882	0.72221702	895
NEFA_13_1	0.73795211	0.84220681	528
NEFA_14_2	0.5785479	0.74476503	797
NEFA_16_2	0.11607744	0.29354905	865
NEFA_18_4	0.46778972	0.65735156	698
NEFA_19_0	0.23051778	0.42001121	762
NEFA_19_1	0.30008243	0.48514849	861
NEFA_20_5	0.61034971	0.75852709	861
NEFA_22_4	0.02882554	0.12394983	762
NEFA_22_5	0.04633526	0.16331281	861
NEFA_24_4	0.24358272	0.43641903	535
NEFA_24_5	1.057E-05	0.00037877	602
NEFA_26_1	0.14293069	0.3221946	714

Triglycerides

Analytes	P-VALUE	FDR P-Value	Number of observations
Carn	0.01874481	0.09829596	996
Carn.a.C10.0	0.01732255	0.09549612	622
Carn.a.C10.1	0.30960322	0.50812742	620
Carn.a.C12.0	0.40949425	0.58694177	616
Carn.a.C12.1	0.43974209	0.60605481	549
Carn.a.C14.0	0.73544913	0.82172871	823
Carn.a.C14.1	0.37578033	0.58356624	896
Carn.a.C14.2	0.67483522	0.78237493	887
Carn.a.C16.0	0.13033494	0.31843195	991
Carn.a.C16.1	0.54538702	0.67752908	894
Carn.a.C18.0	0.16344971	0.37112977	796
Carn.a.C18.1	0.07703438	0.2270739	995
Carn.a.C2.0	0.68048424	0.78237493	925
Carn.a.C3.0	0.00262166	0.04185712	994
Carn.a.C4.0	0.01284157	0.07888392	861
Carn.a.C4.0.DC	0.97832597	0.98791317	546
Carn.a.C5.0	0.06750425	0.2201648	666
Carn.a.C6.0	0.07464465	0.2270739	846
Carn.a.C8.1	0.86826424	0.92414263	748
lyso.PC.a.C14.0	0.21611467	0.41860049	991
lyso.PC.a.C16.0	0.00183248	0.03283196	925
lyso.PC.a.C16.1	0.03026333	0.1275807	996
lyso.PC.a.C18.0	3.9036E-06	0.00065519	996
lyso.PC.a.C18.1	0.02469751	0.11062426	925
lyso.PC.a.C18.2	0.40824183	0.58694177	925
lyso.PC.a.C18.3	0.00447167	0.04704518	793
lyso.PC.a.C18.6	0.01633446	0.09241865	707
lyso.PC.a.C20.2	0.76258969	0.82806456	645
lyso.PC.a.C20.3	0.18993923	0.4003621	853
lyso.PC.a.C20.4	0.16447693	0.37112977	996
lyso.PC.a.C20.5	0.42354091	0.59327914	920
lyso.PC.a.C22.5	0.48984161	0.63063441	874
lyso.PC.a.C22.6	0.40757922	0.58694177	939
lyso.PC.e.C16.0	0.94632067	0.97348778	995
lyso.PC.e.C18.0	0.37798277	0.58356624	967
lyso.PC.e.C18.1	0.00672234	0.05181116	707
PC.aa.C30.0	0.10454658	0.27750018	988
PC.aa.C30.1	0.07604941	0.2270739	701
PC.aa.C30.2	0.09998743	0.27120066	638
PC.aa.C32.0	0.06847063	0.2201648	996
PC.aa.C32.1	0.02434591	0.11062426	864
PC.aa.C32.2	0.07775537	0.2270739	836
PC.aa.C32.3	0.00100687	0.0216477	868

PC.aa.C34.0	0.01051487	0.0706468	706
PC.aa.C34.1	0.00045042	0.01795475	935
PC.aa.C34.2	0.01109832	0.07230726	925
PC.aa.C34.3	0.00146627	0.02865891	925
PC.aa.C34.4	0.01455015	0.08689674	865
PC.aa.C34.5	0.03157971	0.13056994	875
PC.aa.C36.0	0.00589769	0.04876932	924
PC.aa.C36.1	1.7406E-05	0.00124744	924
PC.aa.C36.2	6.0948E-06	0.00065519	925
PC.aa.C36.3	0.00070875	0.01795475	936
PC.aa.C36.4	0.00468327	0.04704518	865
PC.aa.C36.5	0.01172118	0.07411925	808
PC.aa.C36.6	0.04412678	0.16357343	983
PC.aa.C38.0	0.00527651	0.0483465	867
PC.aa.C38.1	0.02017241	0.10086203	796
PC.aa.C38.2	0.01874236	0.09829596	936
PC.aa.C38.3	0.00051215	0.01795475	836
PC.aa.C38.4	0.00292026	0.04185712	836
PC.aa.C38.5	0.0031881	0.04284015	836
PC.aa.C38.6	0.05736005	0.20217068	836
PC.aa.C40.0	0.01552205	0.09019568	800
PC.aa.C40.1	0.03634957	0.14209376	573
PC.aa.C40.3	0.15895259	0.36999968	584
PC.aa.C40.4	0.00562169	0.0483465	925
PC.aa.C40.5	0.00065492	0.01795475	836
PC.aa.C40.6	0.29489465	0.49149109	901
PC.aa.C42.0	0.00757551	0.05429115	796
PC.aa.C42.1	0.07750005	0.2270739	643
PC.aa.C42.2	0.48590036	0.62932879	629
PC.aa.C42.4	0.08090081	0.23191565	549
PC.aa.C42.5	0.4957282	0.63066014	731
PC.aa.C42.6	0.18151406	0.39025523	702
PC.aa.C43.4	0.27286042	0.47310476	626
PC.aa.C43.6	0.04508107	0.16427846	925
PC.aa.C44.12	0.59560409	0.71860803	925
PC.ae.C30.0	0.02289409	0.10800894	849
PC.ae.C30.1	0.65709886	0.77200139	758
PC.ae.C32.0	0.09946639	0.27120066	996
PC.ae.C32.1	0.0686095	0.2201648	996
PC.ae.C32.2	0.22503965	0.42817278	995
PC.ae.C34.0	0.058679	0.20348364	935
PC.ae.C34.1	0.0067475	0.05181116	936
PC.ae.C34.2	0.49289936	0.63066014	936
PC.ae.C34.3	0.74168531	0.82197084	936
PC.ae.C34.4	0.03243762	0.13158658	869

PC.ae.C36.0	0.01942353	0.09942996	929
PC.ae.C36.1	0.00545587	0.0483465	925
PC.ae.C36.2	0.02691501	0.11573454	925
PC.ae.C36.3	0.10858099	0.28126402	996
PC.ae.C36.4	0.16004637	0.36999968	865
PC.ae.C36.5	0.31940028	0.51632376	865
PC.ae.C36.6	0.07204092	0.2270739	734
PC.ae.C38.0	0.00345506	0.04369629	925
PC.ae.C38.2	0.07815567	0.2270739	925
PC.ae.C38.3	0.11251316	0.28798012	925
PC.ae.C38.4	0.17976755	0.39025523	865
PC.ae.C38.5	0.33925272	0.54432339	865
PC.ae.C38.6	0.04389214	0.16357343	935
PC.ae.C40.0	0.2723	0.47310476	925
PC.ae.C40.1	0.10091187	0.27120066	925
PC.ae.C40.2	0.18369802	0.39104035	867
PC.ae.C40.3	0.17566083	0.38537836	868
PC.ae.C40.4	0.30442444	0.50347119	925
PC.ae.C40.5	0.21994227	0.42221061	925
PC.ae.C40.6	0.14024581	0.33503165	836
PC.ae.C42.0	0.71419856	0.8124481	870
PC.ae.C42.1	0.21580315	0.41860049	796
PC.ae.C42.2	0.03403659	0.13551606	868
PC.ae.C42.3	0.55079074	0.67752908	933
PC.ae.C42.4	0.71994067	0.81466971	925
PC.ae.C42.5	0.36126178	0.57111237	868
PC.ae.C42.6	0.04085878	0.15686852	994
SM.a.C30.1	0.38381718	0.58356624	859
SM.a.C32.0	0.96647437	0.98541795	564
SM.a.C32.1	0.25490313	0.44921454	925
SM.a.C32.2	0.446449	0.60750972	936
SM.a.C33.1	0.76894314	0.83076772	925
SM.a.C33.2	0.93061923	0.96658519	803
SM.a.C34.0	0.68008857	0.78237493	628
SM.a.C34.1	0.41498234	0.5908689	939
SM.a.C34.2	0.51364033	0.64503838	996
SM.a.C34.3	0.22727303	0.42830481	643
SM.a.C35.0	0.02665232	0.11573454	735
SM.a.C35.1	0.20318632	0.4121232	925
SM.a.C36.0	0.00056238	0.01795475	643
SM.a.C36.1	0.38740072	0.58356624	939
SM.a.C36.2	0.20578338	0.41348996	996
SM.a.C36.3	0.36459439	0.57217369	935
SM.a.C37.1	0.21092104	0.41603692	868
SM.a.C38.1	0.00389523	0.04652634	993

SM.a.C38.2	0.11857461	0.29992401	996
SM.a.C39.1	0.19537363	0.40389741	868
SM.a.C39.2	0.19343437	0.40377078	935
SM.a.C40.1	0.85669688	0.91636731	860
SM.a.C40.2	0.22909327	0.42830481	808
SM.a.C40.3	0.00481393	0.04704518	712
SM.a.C40.4	0.00705253	0.05228598	995
SM.a.C40.5	0.00075159	0.01795475	877
SM.a.C41.1	0.40531096	0.58694177	925
SM.a.C41.2	0.23339573	0.42971922	925
SM.a.C42.1	0.61377993	0.73020605	925
SM.a.C42.2	0.4575654	0.6148535	925
SM.a.C42.3	0.94383816	0.97348778	925
SM.a.C42.4	0.002827	0.04185712	865
SM.a.C42.5	0.06729215	0.2201648	643
SM.a.C42.6	0.2787232	0.47559911	865
SM.a.C43.1	0.35252207	0.56142404	925
SM.a.C43.2	0.28173526	0.47695339	925
SM.a.C44.2	0.16787432	0.37209258	732
SM.a.C44.6	0.12826096	0.31696673	810
SM.a.C31.1	0.47910884	0.62568599	867
SM.a.C33.3	0.99532922	0.99532922	935
SM.a.C35.2	0.75600211	0.82806456	939
SM.a.C37.3	0.64880705	0.76644789	938
SM.a.C39.5	0.39030327	0.58356624	773
SM.a.C41.0	0.23944191	0.43260513	776
SM.a.C41.3	0.87914102	0.93110995	722
SM.a.C43.0	0.51273319	0.64503838	703
SM.a.C43.3	0.89929466	0.94778604	804
Ala	0.31849315	0.51632376	993
Arg	0.58706814	0.71310537	991
Asn	0.24605865	0.43721164	919
Asp	0.61473161	0.73020605	993
Cit	0.39628219	0.58356624	993
Gln	0.59828297	0.71860803	919
Glu	0.09251456	0.25831986	993
Gly	0.83068253	0.89298372	993
His	0.47611411	0.62568599	981
Ile	0.20883297	0.41573231	717
Leu	0.99180961	0.99532922	919
Lys	0.75947537	0.82806456	919
Met	0.47830421	0.62568599	919
Orn	0.1466698	0.34652754	919
Phe	0.97872328	0.98791317	919
Pro	0.23460648	0.42971922	993

Trp	0.1083533	0.28126402	993
Ser	0.73764484	0.82172871	993
Thr	0.06567541	0.2201648	936
Tyr	0.13765639	0.33254071	919
Val	0.91890493	0.96372956	919
NEFA_12_0	0.55147716	0.67752908	788
NEFA_14_0	0.3956079	0.58356624	964
NEFA_14_1	0.29228344	0.49094484	989
NEFA_15_0	0.39050532	0.58356624	986
NEFA_15_1	0.48017762	0.62568599	681
NEFA_16_0	0.44324632	0.60699337	851
NEFA_16_1	0.05065627	0.1815183	989
NEFA_17_0	0.27527221	0.47346821	917
NEFA_17_1	0.96708459	0.98541795	902
NEFA_18_0	0.42495343	0.59327914	839
NEFA_18_1	0.43798076	0.60605481	921
NEFA_18_2	0.08313814	0.23519341	850
NEFA_18_3	0.73564658	0.82172871	988
NEFA_20_1	0.46549793	0.62162767	884
NEFA_20_2	0.42213742	0.59327914	846
NEFA_20_3	0.39498343	0.58356624	850
NEFA_20_4	0.45490052	0.6148535	850
NEFA_22_6	0.02310889	0.10800894	921
NEFA_24_1	0.58591132	0.71310537	988
NEFA_12_1	0.20079148	0.41114446	895
NEFA_13_1	0.51603071	0.64503838	528
NEFA_14_2	0.01044076	0.0706468	797
NEFA_16_2	0.74589133	0.822393	865
NEFA_18_4	0.70978383	0.81172087	698
NEFA_19_0	0.02275243	0.10800894	762
NEFA_19_1	0.92638575	0.96658519	861
NEFA_20_5	0.24353594	0.43633523	861
NEFA_22_4	0.67503673	0.78237493	762
NEFA_22_5	0.2358459	0.42971922	861
NEFA_24_4	0.12094549	0.30236373	535
NEFA_24_5	0.16571376	0.37112977	602
NEFA_26_1	0.00443211	0.04704518	714

Glucose

Analytes	P-VALUE	FDR P-Value	Number of observations
Carn	0.54350026	0.78720801	996
Carn.a.C10.0	0.19842684	0.63386123	622
Carn.a.C10.1	0.46343015	0.78720801	620
Carn.a.C12.0	0.52061536	0.78720801	616
Carn.a.C12.1	0.96973745	0.99084667	549
Carn.a.C14.0	0.60470174	0.8169584	823
Carn.a.C14.1	0.43143657	0.78720801	896
Carn.a.C14.2	0.8506203	0.97086412	887
Carn.a.C16.0	0.3509449	0.76027691	991
Carn.a.C16.1	0.97630415	0.99084667	894
Carn.a.C18.0	0.24450899	0.66543587	796
Carn.a.C18.1	0.1566306	0.59967778	995
Carn.a.C2.0	0.22670442	0.649886	925
Carn.a.C3.0	0.65816358	0.83238335	994
Carn.a.C4.0	0.54009496	0.78720801	861
Carn.a.C4.0.DC	0.03747665	0.40287395	546
Carn.a.C5.0	0.31693835	0.7425279	666
Carn.a.C6.0	0.77594639	0.91663996	846
Carn.a.C8.1	0.36422568	0.76027691	748
lyso.PC.a.C14.0	0.35751856	0.76027691	991
lyso.PC.a.C16.0	0.20958371	0.63386123	925
lyso.PC.a.C16.1	0.41295868	0.78571783	996
lyso.PC.a.C18.0	0.09381547	0.53317056	996
lyso.PC.a.C18.1	0.21212326	0.63386123	925
lyso.PC.a.C18.2	0.21163393	0.63386123	925
lyso.PC.a.C18.3	0.38017889	0.76391085	793
lyso.PC.a.C18.6	0.75209563	0.90662176	707
lyso.PC.a.C20.2	0.98333293	0.99084667	645
lyso.PC.a.C20.3	0.38802973	0.76537975	853
lyso.PC.a.C20.4	0.18537311	0.63386123	996
lyso.PC.a.C20.5	0.02084077	0.34467422	920
lyso.PC.a.C22.5	0.07020489	0.50313505	874
lyso.PC.a.C22.6	0.09618253	0.53317056	939
lyso.PC.e.C16.0	0.92843666	0.97086412	995
lyso.PC.e.C18.0	0.52684259	0.78720801	967
lyso.PC.e.C18.1	0.8742311	0.97086412	707
PC.aa.C30.0	0.05868508	0.46133036	988
PC.aa.C30.1	0.11679595	0.54584272	701
PC.aa.C30.2	0.62217238	0.82065682	638
PC.aa.C32.0	0.36085123	0.76027691	996
PC.aa.C32.1	0.237813	0.66402332	864
PC.aa.C32.2	0.0120761	0.23603292	836
PC.aa.C32.3	0.03148738	0.37609921	868

PC.aa.C34.0	0.41174524	0.78571783	706
PC.aa.C34.1	0.0859519	0.53317056	935
PC.aa.C34.2	0.00033547	0.03606339	925
PC.aa.C34.3	0.00092941	0.04739319	925
PC.aa.C34.4	0.00837903	0.20016574	865
PC.aa.C34.5	0.04165166	0.41024651	875
PC.aa.C36.0	0.25157975	0.66777342	924
PC.aa.C36.1	0.32423886	0.7425279	924
PC.aa.C36.2	0.05896614	0.46133036	925
PC.aa.C36.3	0.00284337	0.10188728	936
PC.aa.C36.4	0.00110217	0.04739319	865
PC.aa.C36.5	0.2688284	0.70000408	808
PC.aa.C36.6	0.03560944	0.40287395	983
PC.aa.C38.0	0.39707798	0.77610697	867
PC.aa.C38.1	0.24941034	0.66777342	796
PC.aa.C38.2	0.3765835	0.76382502	936
PC.aa.C38.3	0.54152251	0.78720801	836
PC.aa.C38.4	0.30546256	0.73791518	836
PC.aa.C38.5	0.35970614	0.76027691	836
PC.aa.C38.6	0.10090121	0.54234402	836
PC.aa.C40.0	0.92199257	0.97086412	800
PC.aa.C40.1	0.33559171	0.75885091	573
PC.aa.C40.3	0.7734801	0.91663996	584
PC.aa.C40.4	0.28740096	0.72597302	925
PC.aa.C40.5	0.73653327	0.89974235	836
PC.aa.C40.6	0.81341771	0.9460072	901
PC.aa.C42.0	0.17350577	0.6322668	796
PC.aa.C42.1	0.53987515	0.78720801	643
PC.aa.C42.2	0.91502279	0.97086412	629
PC.aa.C42.4	0.47935174	0.78720801	549
PC.aa.C42.5	0.88060563	0.97086412	731
PC.aa.C42.6	0.93403826	0.97086412	702
PC.aa.C43.4	0.05712278	0.46133036	626
PC.aa.C43.6	0.56529944	0.78777261	925
PC.aa.C44.12	0.58796118	0.81033111	925
PC.ae.C30.0	0.65071336	0.831506	849
PC.ae.C30.1	0.38435445	0.76515007	758
PC.ae.C32.0	0.4905426	0.78720801	996
PC.ae.C32.1	0.29597368	0.72597302	996
PC.ae.C32.2	0.94936035	0.97661471	995
PC.ae.C34.0	0.02789512	0.35279118	935
PC.ae.C34.1	0.44286619	0.78720801	936
PC.ae.C34.2	0.09037291	0.53317056	936
PC.ae.C34.3	0.09671466	0.53317056	936
PC.ae.C34.4	0.06008023	0.46133036	869

PC.ae.C36.0	0.85450393	0.97086412	929
PC.ae.C36.1	0.33883576	0.75885091	925
PC.ae.C36.2	0.02745126	0.35279118	925
PC.ae.C36.3	0.04197871	0.41024651	996
PC.ae.C36.4	0.05731184	0.46133036	865
PC.ae.C36.5	0.0477755	0.44659711	865
PC.ae.C36.6	0.14754653	0.59853783	734
PC.ae.C38.0	0.02363131	0.35279118	925
PC.ae.C38.2	0.19622267	0.63386123	925
PC.ae.C38.3	0.11993245	0.54584272	925
PC.ae.C38.4	0.12186256	0.54584272	865
PC.ae.C38.5	0.15898434	0.59967778	865
PC.ae.C38.6	0.1550457	0.59967778	935
PC.ae.C40.0	0.3246401	0.7425279	925
PC.ae.C40.1	0.21690081	0.63881746	925
PC.ae.C40.2	0.37493499	0.76382502	867
PC.ae.C40.3	0.48909159	0.78720801	868
PC.ae.C40.4	0.4778674	0.78720801	925
PC.ae.C40.5	0.93380227	0.97086412	925
PC.ae.C40.6	0.48236	0.78720801	836
PC.ae.C42.0	0.61071622	0.8169584	870
PC.ae.C42.1	0.54553892	0.78720801	796
PC.ae.C42.2	0.48931652	0.78720801	868
PC.ae.C42.3	0.34741729	0.76027691	933
PC.ae.C42.4	0.93851882	0.97086412	925
PC.ae.C42.5	0.53350265	0.78720801	868
PC.ae.C42.6	0.91259584	0.97086412	994
SM.a.C30.1	0.08560011	0.53317056	859
SM.a.C32.0	0.29654109	0.72597302	564
SM.a.C32.1	0.24373563	0.66543587	925
SM.a.C32.2	0.56792909	0.78777261	936
SM.a.C33.1	0.20279503	0.63386123	925
SM.a.C33.2	0.81840623	0.9460072	803
SM.a.C34.0	0.27023413	0.70000408	628
SM.a.C34.1	0.20392242	0.63386123	939
SM.a.C34.2	0.01846357	0.33080559	996
SM.a.C34.3	0.1671035	0.6194354	643
SM.a.C35.0	0.986988	0.99084667	735
SM.a.C35.1	0.91060299	0.97086412	925
SM.a.C36.0	0.36911069	0.76306538	643
SM.a.C36.1	0.53340662	0.78720801	939
SM.a.C36.2	0.18934932	0.63386123	996
SM.a.C36.3	0.10718406	0.54584272	935
SM.a.C37.1	0.50557523	0.78720801	868
SM.a.C38.1	0.00515269	0.1582612	993

SM.a.C38.2	0.0010913	0.04739319	996
SM.a.C39.1	0.11312355	0.54584272	868
SM.a.C39.2	0.02544055	0.35279118	935
SM.a.C40.1	0.55958018	0.78720801	860
SM.a.C40.2	0.14310389	0.59853783	808
SM.a.C40.3	0.12507565	0.54797586	712
SM.a.C40.4	9.8432E-05	0.02116283	995
SM.a.C40.5	0.18159952	0.63386123	877
SM.a.C41.1	0.00934715	0.20096376	925
SM.a.C41.2	0.35690969	0.76027691	925
SM.a.C42.1	0.00670386	0.18016619	925
SM.a.C42.2	0.11116544	0.54584272	925
SM.a.C42.3	0.63931534	0.83059324	925
SM.a.C42.4	0.21226981	0.63386123	865
SM.a.C42.5	0.59866636	0.8169584	643
SM.a.C42.6	0.31461999	0.7425279	865
SM.a.C43.1	0.43262395	0.78720801	925
SM.a.C43.2	0.74328155	0.90285613	925
SM.a.C44.2	0.75481532	0.90662176	732
SM.a.C44.6	0.89968469	0.97086412	810
SM.a.C31.1	0.44636006	0.78720801	867
SM.a.C33.3	0.62124972	0.82065682	935
SM.a.C35.2	0.14674182	0.59853783	939
SM.a.C37.3	0.15278316	0.59967778	938
SM.a.C39.5	0.10342747	0.54236355	773
SM.a.C41.0	0.07300624	0.50633363	776
SM.a.C41.3	0.19667767	0.63386123	722
SM.a.C43.0	0.32414748	0.7425279	703
SM.a.C43.3	0.67271018	0.8458052	804
Ala	0.29714245	0.72597302	993
Arg	0.07862266	0.528246	991
Asn	0.56019919	0.78720801	919
Asp	0.46379091	0.78720801	993
Cit	0.55503406	0.78720801	993
Gln	0.89608969	0.97086412	919
Glu	0.51459353	0.78720801	993
Gly	0.52940115	0.78720801	993
His	0.55406102	0.78720801	981
Ile	0.1986045	0.63386123	717
Leu	0.71972373	0.89863821	919
Lys	0.64807844	0.831506	919
Met	0.98852141	0.99084667	919
Orn	0.12743625	0.54797586	919
Phe	0.99084667	0.99084667	919
Pro	0.48735998	0.78720801	993

Trp	0.40321011	0.78099255	993
Ser	0.77227108	0.91663996	993
Thr	0.27634248	0.70730516	936
Tyr	0.78115359	0.91774875	919
Val	0.91221811	0.97086412	919
NEFA_12_0	0.21992454	0.63896994	788
NEFA_14_0	0.73144971	0.89863821	964
NEFA_14_1	0.54354517	0.78720801	989
NEFA_15_0	0.45219323	0.78720801	986
NEFA_15_1	0.47822192	0.78720801	681
NEFA_16_0	0.61135583	0.8169584	851
NEFA_16_1	0.54246767	0.78720801	989
NEFA_17_0	0.93320653	0.97086412	917
NEFA_17_1	0.65360239	0.831506	902
NEFA_18_0	0.55215539	0.78720801	839
NEFA_18_1	0.64129524	0.83059324	921
NEFA_18_2	0.6335306	0.83054316	850
NEFA_18_3	0.4543347	0.78720801	988
NEFA_20_1	0.83081223	0.95521192	884
NEFA_20_2	0.87234865	0.97086412	846
NEFA_20_3	0.45750809	0.78720801	850
NEFA_20_4	0.48619003	0.78720801	850
NEFA_22_6	0.72695353	0.89863821	921
NEFA_24_1	0.23184868	0.65588773	988
NEFA_12_1	0.88851184	0.97086412	895
NEFA_13_1	0.09278505	0.53317056	528
NEFA_14_2	0.46134443	0.78720801	797
NEFA_16_2	0.61176885	0.8169584	865
NEFA_18_4	0.1149839	0.54584272	698
NEFA_19_0	0.45301266	0.78720801	762
NEFA_19_1	0.93925459	0.97086412	861
NEFA_20_5	0.49221758	0.78720801	861
NEFA_22_4	0.85811819	0.97086412	762
NEFA_22_5	0.81786723	0.9460072	861
NEFA_24_4	0.7310637	0.89863821	535
NEFA_24_5	0.89760707	0.97086412	602
NEFA_26_1	0.06941255	0.50313505	714

Systolic Blood Pressure

Analytes	P-VALUE	FDR P-Value	Number of observations
Carn	0.84953876	0.99864195	996
Carn.a.C10.0	0.21417809	0.99864195	622
Carn.a.C10.1	0.0747109	0.99864195	620
Carn.a.C12.0	0.99603114	0.99864195	616
Carn.a.C12.1	0.11844498	0.99864195	549
Carn.a.C14.0	0.09714141	0.99864195	823
Carn.a.C14.1	0.24774401	0.99864195	896
Carn.a.C14.2	0.04676774	0.99864195	887
Carn.a.C16.0	0.09617131	0.99864195	991
Carn.a.C16.1	0.03065515	0.99864195	894
Carn.a.C18.0	0.97286654	0.99864195	796
Carn.a.C18.1	0.07439615	0.99864195	995
Carn.a.C2.0	0.065593	0.99864195	925
Carn.a.C3.0	0.18278694	0.99864195	994
Carn.a.C4.0	0.95160942	0.99864195	861
Carn.a.C4.0.DC	0.37743518	0.99864195	546
Carn.a.C5.0	0.99286944	0.99864195	666
Carn.a.C6.0	0.53004516	0.99864195	846
Carn.a.C8.1	0.83759294	0.99864195	748
lyso.PC.a.C14.0	0.40232874	0.99864195	991
lyso.PC.a.C16.0	0.32619834	0.99864195	925
lyso.PC.a.C16.1	0.98097008	0.99864195	996
lyso.PC.a.C18.0	0.76074746	0.99864195	996
lyso.PC.a.C18.1	0.28083313	0.99864195	925
lyso.PC.a.C18.2	0.32425845	0.99864195	925
lyso.PC.a.C18.3	0.06342959	0.99864195	793
lyso.PC.a.C18.6	0.05897532	0.99864195	707
lyso.PC.a.C20.2	0.47077329	0.99864195	645
lyso.PC.a.C20.3	0.22860418	0.99864195	853
lyso.PC.a.C20.4	0.37825113	0.99864195	996
lyso.PC.a.C20.5	0.26789465	0.99864195	920
lyso.PC.a.C22.5	0.9942954	0.99864195	874
lyso.PC.a.C22.6	0.34379886	0.99864195	939
lyso.PC.e.C16.0	0.90529676	0.99864195	995
lyso.PC.e.C18.0	0.90115319	0.99864195	967
lyso.PC.e.C18.1	0.85645916	0.99864195	707
PC.aa.C30.0	0.95909051	0.99864195	988
PC.aa.C30.1	0.23709886	0.99864195	701
PC.aa.C30.2	0.30171697	0.99864195	638
PC.aa.C32.0	0.97867993	0.99864195	996
PC.aa.C32.1	0.61499848	0.99864195	864
PC.aa.C32.2	0.14261119	0.99864195	836
PC.aa.C32.3	0.32002119	0.99864195	868

PC.aa.C34.0	0.94006793	0.99864195	706
PC.aa.C34.1	0.90291239	0.99864195	935
PC.aa.C34.2	0.85359242	0.99864195	925
PC.aa.C34.3	0.26002522	0.99864195	925
PC.aa.C34.4	0.13205092	0.99864195	865
PC.aa.C34.5	0.63345491	0.99864195	875
PC.aa.C36.0	0.67039954	0.99864195	924
PC.aa.C36.1	0.78715446	0.99864195	924
PC.aa.C36.2	0.79634125	0.99864195	925
PC.aa.C36.3	0.60131406	0.99864195	936
PC.aa.C36.4	0.51730409	0.99864195	865
PC.aa.C36.5	0.42195463	0.99864195	808
PC.aa.C36.6	0.07027361	0.99864195	983
PC.aa.C38.0	0.73610674	0.99864195	867
PC.aa.C38.1	0.49002277	0.99864195	796
PC.aa.C38.2	0.42066793	0.99864195	936
PC.aa.C38.3	0.53820375	0.99864195	836
PC.aa.C38.4	0.87930177	0.99864195	836
PC.aa.C38.5	0.45134404	0.99864195	836
PC.aa.C38.6	0.83724182	0.99864195	836
PC.aa.C40.0	0.82599724	0.99864195	800
PC.aa.C40.1	0.16240932	0.99864195	573
PC.aa.C40.3	0.99442967	0.99864195	584
PC.aa.C40.4	0.40178008	0.99864195	925
PC.aa.C40.5	0.38086863	0.99864195	836
PC.aa.C40.6	0.8928542	0.99864195	901
PC.aa.C42.0	0.66363288	0.99864195	796
PC.aa.C42.1	0.68051823	0.99864195	643
PC.aa.C42.2	0.61282437	0.99864195	629
PC.aa.C42.4	0.54699278	0.99864195	549
PC.aa.C42.5	0.88688393	0.99864195	731
PC.aa.C42.6	0.98561937	0.99864195	702
PC.aa.C43.4	0.56511962	0.99864195	626
PC.aa.C43.6	0.41635186	0.99864195	925
PC.aa.C44.12	0.21597913	0.99864195	925
PC.ae.C30.0	0.3881719	0.99864195	849
PC.ae.C30.1	0.99577597	0.99864195	758
PC.ae.C32.0	0.79360045	0.99864195	996
PC.ae.C32.1	0.95605362	0.99864195	996
PC.ae.C32.2	0.45300922	0.99864195	995
PC.ae.C34.0	0.67212484	0.99864195	935
PC.ae.C34.1	0.62129945	0.99864195	936
PC.ae.C34.2	0.81655634	0.99864195	936
PC.ae.C34.3	0.74195303	0.99864195	936
PC.ae.C34.4	0.68996806	0.99864195	869

PC.ae.C36.0	0.71262107	0.99864195	929
PC.ae.C36.1	0.6438978	0.99864195	925
PC.ae.C36.2	0.65074373	0.99864195	925
PC.ae.C36.3	0.84931177	0.99864195	996
PC.ae.C36.4	0.55419165	0.99864195	865
PC.ae.C36.5	0.41251169	0.99864195	865
PC.ae.C36.6	0.59518769	0.99864195	734
PC.ae.C38.0	0.80189081	0.99864195	925
PC.ae.C38.2	0.82066283	0.99864195	925
PC.ae.C38.3	0.52257244	0.99864195	925
PC.ae.C38.4	0.48112819	0.99864195	865
PC.ae.C38.5	0.80907855	0.99864195	865
PC.ae.C38.6	0.61455678	0.99864195	935
PC.ae.C40.0	0.9183163	0.99864195	925
PC.ae.C40.1	0.93487689	0.99864195	925
PC.ae.C40.2	0.39888535	0.99864195	867
PC.ae.C40.3	0.72513992	0.99864195	868
PC.ae.C40.4	0.5292463	0.99864195	925
PC.ae.C40.5	0.33576689	0.99864195	925
PC.ae.C40.6	0.89421952	0.99864195	836
PC.ae.C42.0	0.80536068	0.99864195	870
PC.ae.C42.1	0.68737304	0.99864195	796
PC.ae.C42.2	0.64072035	0.99864195	868
PC.ae.C42.3	0.65328192	0.99864195	933
PC.ae.C42.4	0.56061093	0.99864195	925
PC.ae.C42.5	0.31272508	0.99864195	868
PC.ae.C42.6	0.36506338	0.99864195	994
SM.a.C30.1	0.60534231	0.99864195	859
SM.a.C32.0	0.37150691	0.99864195	564
SM.a.C32.1	0.59055025	0.99864195	925
SM.a.C32.2	0.79495047	0.99864195	936
SM.a.C33.1	0.41950747	0.99864195	925
SM.a.C33.2	0.02374247	0.99864195	803
SM.a.C34.0	0.37255016	0.99864195	628
SM.a.C34.1	0.97639408	0.99864195	939
SM.a.C34.2	0.59050364	0.99864195	996
SM.a.C34.3	0.18663346	0.99864195	643
SM.a.C35.0	0.97414732	0.99864195	735
SM.a.C35.1	0.56342451	0.99864195	925
SM.a.C36.0	0.47012458	0.99864195	643
SM.a.C36.1	0.98784778	0.99864195	939
SM.a.C36.2	0.66346798	0.99864195	996
SM.a.C36.3	0.60404112	0.99864195	935
SM.a.C37.1	0.9194044	0.99864195	868
SM.a.C38.1	0.72049171	0.99864195	993

SM.a.C38.2	0.72899918	0.99864195	996
SM.a.C39.1	0.60871334	0.99864195	868
SM.a.C39.2	0.14909622	0.99864195	935
SM.a.C40.1	0.66013911	0.99864195	860
SM.a.C40.2	0.53250597	0.99864195	808
SM.a.C40.3	0.62144185	0.99864195	712
SM.a.C40.4	0.08040176	0.99864195	995
SM.a.C40.5	0.61706484	0.99864195	877
SM.a.C41.1	0.666486	0.99864195	925
SM.a.C41.2	0.55730544	0.99864195	925
SM.a.C42.1	0.69698938	0.99864195	925
SM.a.C42.2	0.83552698	0.99864195	925
SM.a.C42.3	0.47628929	0.99864195	925
SM.a.C42.4	0.7801579	0.99864195	865
SM.a.C42.5	0.80234972	0.99864195	643
SM.a.C42.6	0.78231389	0.99864195	865
SM.a.C43.1	0.50289655	0.99864195	925
SM.a.C43.2	0.61983983	0.99864195	925
SM.a.C44.2	0.92561593	0.99864195	732
SM.a.C44.6	0.94259919	0.99864195	810
SM.a.C31.1	0.30838612	0.99864195	867
SM.a.C33.3	0.4006047	0.99864195	935
SM.a.C35.2	0.29071252	0.99864195	939
SM.a.C37.3	0.36872785	0.99864195	938
SM.a.C39.5	0.74039236	0.99864195	773
SM.a.C41.0	0.03548743	0.99864195	776
SM.a.C41.3	0.66975815	0.99864195	722
SM.a.C43.0	0.6048362	0.99864195	703
SM.a.C43.3	0.78907771	0.99864195	804
Ala	0.07766432	0.99864195	993
Arg	0.24126232	0.99864195	991
Asn	0.0496627	0.99864195	919
Asp	0.057378	0.99864195	993
Cit	0.95817776	0.99864195	993
Gln	0.80058337	0.99864195	919
Glu	0.29707936	0.99864195	993
Gly	0.91390672	0.99864195	993
His	0.21149009	0.99864195	981
Ile	0.64889682	0.99864195	717
Leu	0.58603961	0.99864195	919
Lys	0.99864195	0.99864195	919
Met	0.59670826	0.99864195	919
Orn	0.69980676	0.99864195	919
Phe	0.36389404	0.99864195	919
Pro	0.25235692	0.99864195	993

Trp	0.48690395	0.99864195	993
Ser	0.77467523	0.99864195	993
Thr	0.84651017	0.99864195	936
Tyr	0.11197306	0.99864195	919
Val	0.53419548	0.99864195	919
NEFA_12_0	0.26754836	0.99864195	788
NEFA_14_0	0.69122159	0.99864195	964
NEFA_14_1	0.12414599	0.99864195	989
NEFA_15_0	0.23823326	0.99864195	986
NEFA_15_1	0.53796864	0.99864195	681
NEFA_16_0	0.32733051	0.99864195	851
NEFA_16_1	0.11834472	0.99864195	989
NEFA_17_0	0.60579247	0.99864195	917
NEFA_17_1	0.33343989	0.99864195	902
NEFA_18_0	0.71528025	0.99864195	839
NEFA_18_1	0.27556411	0.99864195	921
NEFA_18_2	0.12450875	0.99864195	850
NEFA_18_3	0.54516137	0.99864195	988
NEFA_20_1	0.39977262	0.99864195	884
NEFA_20_2	0.86885784	0.99864195	846
NEFA_20_3	0.23307172	0.99864195	850
NEFA_20_4	0.36000999	0.99864195	850
NEFA_22_6	0.27377108	0.99864195	921
NEFA_24_1	0.57728438	0.99864195	988
NEFA_12_1	0.09280011	0.99864195	895
NEFA_13_1	0.13197041	0.99864195	528
NEFA_14_2	0.21802899	0.99864195	797
NEFA_16_2	0.13615573	0.99864195	865
NEFA_18_4	0.2288098	0.99864195	698
NEFA_19_0	0.79056296	0.99864195	762
NEFA_19_1	0.62326712	0.99864195	861
NEFA_20_5	0.74567523	0.99864195	861
NEFA_22_4	0.38418449	0.99864195	762
NEFA_22_5	0.35340633	0.99864195	861
NEFA_24_4	0.97053472	0.99864195	535
NEFA_24_5	0.56300254	0.99864195	602
NEFA_26_1	0.99311744	0.99864195	714

Supplemental Table 6: Results for the group testing after the Anova. MetS Factors as outcome and sex dummy (male versus *nh*female, male versus *h*female, *nh*female vs *h*female) and metabolite interaction as predictor. Adding two dummies at once allows to test for differences between two, rather than one category versus all the others. Metabolites are the 46 significant ones from the anova Models adjusted for ethnicity. P-Value, β-coefficient, FDR p-value and confidence interval reported.

Supplemental Table 6.1: Results for the testing of *h*females versus *nh*females

Waist circumference

Analytes	**P-Values**	**BETA**	**FDR P-Value**	**CI lower**	**CI upper**	**Number of observations**
lyso.PC.a.C18.1	0.0002633	4.10094985	0.00440216	1.76629501	6.4356047	925
lyso.PC.a.C18.3	0.0002871	5.11737847	0.00440216	2.49972979	7.73502715	793
SM.a.C41.0	0.00018425	-3.73901041	0.00440216	-6.07469747	-1.40332334	776
PC.aa.C34.2	0.30488143	0.66826293	0.51942763	-1.67879499	3.01532086	925
PC.aa.C34.3	0.75441892	0.31290237	0.82626835	-2.05158577	2.67739051	925
PC.aa.C36.4	0.18130063	0.67136479	0.34749288	-1.94017223	3.28290182	865
SM.a.C38.2	0.07890059	-0.16747811	0.24196182	-2.37494341	2.03998718	996
SM.a.C40.4	0.57754374	1.79168136	0.72219274	-0.48393876	4.06730147	995
lyso.PC.a.C16.0	0.07001222	2.79848239	0.24196182	0.52925797	5.06770682	925
lyso.PC.a.C16.1	0.12494594	-0.65093366	0.28932364	-2.68138995	1.37952264	996
lyso.PC.a.C18.0	0.0474519	1.61095497	0.19843523	-0.79110984	4.01301977	996
lyso.PC.a.C20.3	0.01789519	2.91100056	0.12338838	0.42428088	5.39772024	853
lyso.PC.a.C20.4	0.02688576	3.25753349	0.13741611	0.91554224	5.59952475	996
lyso.PC.a.C20.5	0.00121832	2.44007936	0.01401068	0.19940711	4.68075162	920
lyso.PC.a.C22.5	0.01877649	1.31969156	0.12338838	-1.10018142	3.73956455	874
lyso.PC.a.C22.6	0.05201866	3.13801926	0.19940485	1.04599957	5.23003895	939
lyso.PC.e.C18.0	0.07568354	1.87395808	0.24196182	-0.40323511	4.15115127	967
lyso.PC.e.C18.1	0.02510979	2.98823771	0.13741611	0.16201171	5.8144637	707
PC.aa.C36.0	0.51531451	1.19171	0.69719022	-0.7147323	3.09815231	924
PC.aa.C38.3	0.12012851	-1.43781462	0.28932364	-3.63893846	0.76330922	836
PC.aa.C38.4	0.12579289	-0.76779035	0.28932364	-2.96828676	1.43270606	836
PC.aa.C38.6	0.68608833	1.53104892	0.80923238	-1.16973172	4.23182955	836
PC.aa.C40.6	0.15213594	-0.73523654	0.32243423	-3.10455971	1.63408664	901
PC.ae.C40.0	0.37390129	0.41611327	0.5657084	-1.96555931	2.79778586	925
PC.ae.C40.6	0.92572122	1.14697525	0.93199272	-1.15738561	3.45133611	836
SM.a.C36.0	0.00355835	-1.90193128	0.03273685	-4.39947395	0.59561139	643
SM.a.C42.4	0.18967624	-0.67671011	0.34900428	-2.80060898	1.44718876	865
SM.a.C42.6	0.48601513	1.44376663	0.67747564	-1.24478351	4.13231677	865
SM.a.C44.6	0.82515983	0.50675069	0.88272912	-1.7519552	2.76545657	810
NEFA_24_5	0.03034168	-3.78640886	0.13957174	-7.45453024	-0.11828749	602
Carn.a.C3.0	0.15420768	-1.89587367	0.32243423	-4.12336292	0.33161558	994
PC.aa.C32.3	0.71716617	0.49218356	0.82065782	-1.57440891	2.55877603	868

PC.aa.C34.1	0.38123827	1.11764394	0.5657084	-1.12073446	3.35602234	935
PC.aa.C36.1	0.12292727	0.3050118	0.28932364	-1.67305662	2.28308023	924
PC.aa.C36.2	0.58089416	0.29135779	0.72219274	-1.76318954	2.34590512	925
PC.aa.C36.3	0.41885935	0.61250605	0.60211032	-1.83048543	3.05549754	936
PC.aa.C38.0	0.33431188	1.3558909	0.54922667	-0.75285139	3.46463318	867
PC.aa.C38.5	0.90651748	0.36109706	0.93199272	-1.83121586	2.55340998	836
PC.aa.C40.4	0.16885618	-0.99362795	0.33771236	-3.12325319	1.13599728	925
PC.aa.C40.5	0.36477406	-1.07653537	0.5657084	-3.27398901	1.12091827	836
PC.ae.C36.1	0.63109004	0.99178395	0.7639511	-0.96661609	2.950184	925
PC.ae.C38.0	0.93199272	0.75520871	0.93199272	-1.31370581	2.82412323	925
SM.a.C38.1	0.73145588	0.63592299	0.82065782	-1.55173527	2.82358125	993
SM.a.C40.3	0.55495586	-0.40005556	0.72219274	-3.44607983	2.64596872	712
SM.a.C40.5	0.12379529	2.35996121	0.28932364	0.21375105	4.50617136	877
NEFA_26_1	0.28516158	0.04830982	0.50451664	-2.53966981	2.63628944	714

HDL

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	4.62E-11	-0.0867251	2.13E-09	-0.14133404	-0.03211616	925
lyso.PC.a.C18.3	5.53E-08	-0.08893126	1.27E-06	-0.14979094	-0.02807158	793
SM.a.C41.0	0.00039013	0.03390509	0.00224327	-0.02209566	0.08990583	776
PC.aa.C34.2	0.01816551	-0.05515674	0.03798244	-0.1059171	-0.00439639	925
PC.aa.C34.3	0.07834794	-0.06064474	0.12871448	-0.11276393	-0.00852554	925
PC.aa.C36.4	0.9865078	-0.03790938	0.99332881	-0.09568506	0.0198663	865
SM.a.C38.2	0.05024917	-0.04054764	0.09631092	-0.08946336	0.00836809	996
SM.a.C40.4	0.32522471	-0.05825751	0.4400099	-0.10891655	-0.00759848	995
lyso.PC.a.C16.0	0.00021702	-0.03750629	0.00166381	-0.09084134	0.01582875	925
lyso.PC.a.C16.1	0.00077151	-0.03889281	0.00394329	-0.08632594	0.00854033	996
lyso.PC.a.C18.0	0.00303523	-0.02266926	0.00997291	-0.07885516	0.03351663	996
lyso.PC.a.C20.3	0.00029618	-0.0662185	0.00194631	-0.1238496	-0.00858741	853
lyso.PC.a.C20.4	7.74E-06	-0.0787238	7.23E-05	-0.13313348	-0.02431413	996
lyso.PC.a.C20.5	2.23E-06	-0.0585652	3.42E-05	-0.10993382	-0.00719657	920
lyso.PC.a.C22.5	0.00099093	-0.04185394	0.00428743	-0.09906793	0.01536005	874
lyso.PC.a.C22.6	0.01159311	-0.10055643	0.02715196	-0.1504239	-0.05068896	939
lyso.PC.e.C18.0	0.00136289	-0.05141913	0.00522442	-0.1047597	0.00192144	967
lyso.PC.e.C18.1	7.86E-06	-0.09153214	7.23E-05	-0.15892469	-0.02413958	707
PC.aa.C36.0	0.98073624	-0.05627628	0.99332881	-0.09871822	-0.01383433	924
PC.aa.C38.3	0.00332038	0.00184324	0.01018249	-0.0510574	0.05474387	836
PC.aa.C38.4	0.01232944	-0.02569531	0.02715196	-0.07618204	0.02479143	836
PC.aa.C38.6	0.8377634	-0.07162357	0.93992967	-0.13242232	-0.01082483	836
PC.aa.C40.6	0.00619387	-0.02174118	0.01780738	-0.07663438	0.03315202	901

PC.ae.C40.0	0.5168829	-0.0722637	0.59441534	-0.12602549	-0.01850191	925
PC.ae.C40.6	0.50396561	-0.06278901	0.59441534	-0.11473274	-0.01084529	836
SM.a.C36.0	0.00151924	0.02512649	0.00537579	-0.03819402	0.08844699	643
SM.a.C42.4	0.01229966	-0.01953243	0.02715196	-0.06830983	0.02924498	865
SM.a.C42.6	0.90166446	-0.08495953	0.98126784	-0.1464062	-0.02351286	865
SM.a.C44.6	0.0110437	-0.03019421	0.02715196	-0.08303527	0.02264686	810
NEFA_24_5	0.00102526	0.02362259	0.00428743	-0.06510225	0.11234742	602
Carn.a.C3.0	0.42070837	0.00712881	0.52357401	-0.04577268	0.0600303	994
PC.aa.C32.3	0.24444794	-0.02347731	0.35139391	-0.07207626	0.02512164	868
PC.aa.C34.1	0.06045595	-0.065512	0.11123895	-0.11544851	-0.01557549	935
PC.aa.C36.1	0.42113562	-0.02935705	0.52357401	-0.07484038	0.01612627	924
PC.aa.C36.2	0.22411483	-0.03418045	0.33495558	-0.07966009	0.0112992	925
PC.aa.C36.3	0.45595756	-0.04100754	0.55194863	-0.09433915	0.01232407	936
PC.aa.C38.0	0.91727211	-0.05632118	0.98126784	-0.10504602	-0.00759635	867
PC.aa.C38.5	0.99332881	-0.04976004	0.99332881	-0.09852537	-0.00099471	836
PC.aa.C40.4	0.3545582	-0.02008291	0.46599078	-0.06943685	0.02927102	925
PC.aa.C40.5	0.07516514	-0.00890155	0.12805912	-0.0608115	0.04300839	836
PC.ae.C36.1	0.22573094	-0.05269837	0.33495558	-0.09734657	-0.00805017	925
PC.ae.C38.0	0.09410905	-0.05885532	0.14927642	-0.10454477	-0.01316587	925
SM.a.C38.1	0.0483214	-0.0612674	0.09631092	-0.10965778	-0.01287701	993
SM.a.C40.3	0.30245137	-0.05825458	0.42159887	-0.12526761	0.00875846	712
SM.a.C40.5	0.01239546	-0.07342387	0.02715196	-0.12381442	-0.02303332	877
NEFA_26_1	0.06434499	-0.05438939	0.11384113	-0.1163262	0.00754742	714

Triacylglycerol

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.63309671	0.08499625	0.72832952	-0.02039728	0.19038977	925
lyso.PC.a.C18.3	0.38450627	0.1689871	0.57055769	0.05309104	0.28488317	793
SM.a.C41.0	0.84799975	0.07324598	0.91236842	-0.03321496	0.17970692	776
PC.aa.C34.2	0.12637914	0.14358522	0.2768305	0.04676306	0.24040739	925
PC.aa.C34.3	0.00749347	0.17523792	0.04924283	0.08036503	0.2701108	925
PC.aa.C36.4	0.02537304	0.18002399	0.08978152	0.07198256	0.28806542	865
SM.a.C38.2	0.41016961	0.09266532	0.58961882	0.00018237	0.18514828	996
SM.a.C40.4	0.0106752	0.14999429	0.06138238	0.05573408	0.2442545	995
lyso.PC.a.C16.0	0.92107759	0.12341607	0.94990006	0.02578373	0.2210484	925
lyso.PC.a.C16.1	0.81176993	0.09373688	0.91076626	0.00811	0.17936376	996
lyso.PC.a.C18.0	0.14723308	0.11960055	0.29446615	0.01768821	0.2215129	996
lyso.PC.a.C20.3	0.37823208	0.09846296	0.57055769	-0.0099067	0.20683261	853
lyso.PC.a.C20.4	0.92925006	0.07615229	0.94990006	-0.02578392	0.1780885	996
lyso.PC.a.C20.5	0.35843597	0.06430838	0.5685536	-0.03250523	0.16112199	920

lyso.PC.a.C22.5	0.99538609	0.05065964	0.99538609	-0.05800486	0.15932415	874
lyso.PC.a.C22.6	0.18065208	0.04057925	0.33239982	-0.05248229	0.13364079	939
lyso.PC.e.C18.0	0.42986524	0.01386012	0.59920609	-0.08468232	0.11240256	967
lyso.PC.e.C18.1	0.63333001	0.12203354	0.72832952	-0.00536317	0.24943025	707
PC.aa.C36.0	0.00249055	0.03992629	0.03892259	-0.04286135	0.12271393	924
PC.aa.C38.3	0.12597012	0.16671947	0.2768305	0.07713294	0.256306	836
PC.aa.C38.4	0.05509302	0.15843523	0.18101991	0.06681013	0.25006033	836
PC.aa.C38.6	0.0184081	0.08723885	0.07697935	-0.02771922	0.20219693	836
PC.aa.C40.6	0.14409537	0.0728372	0.29446615	-0.02612446	0.17179886	901
PC.ae.C40.0	0.10789078	0.0560332	0.27247184	-0.04530149	0.15736788	925
PC.ae.C40.6	0.08068975	0.028398	0.21833696	-0.07297938	0.12977538	836
SM.a.C36.0	0.59001758	0.18598155	0.7142318	0.07056963	0.30139347	643
SM.a.C42.4	0.1597164	0.15084971	0.3061231	0.06082083	0.24087859	865
SM.a.C42.6	0.11254271	0.07763277	0.27247184	-0.03785628	0.19312182	865
SM.a.C44.6	0.07267153	0.09539568	0.21641237	-0.00349641	0.19428777	810
NEFA_24_5	0.51624181	-0.13232397	0.65964231	-0.29578974	0.03114179	602
Carn.a.C3.0	0.50778676	0.10386546	0.65964231	0.00898762	0.1987433	994
PC.aa.C32.3	0.00487325	0.16747417	0.04111145	0.07828786	0.25666047	868
PC.aa.C34.1	0.00536236	0.17650568	0.04111145	0.08862596	0.2643854	935
PC.aa.C36.1	0.21986351	0.17643478	0.38898928	0.09618849	0.25668107	924
PC.aa.C36.2	0.85286613	0.16443371	0.91236842	0.08030414	0.24856327	925
PC.aa.C36.3	0.07527387	0.17868024	0.21641237	0.08175053	0.27560995	936
PC.aa.C38.0	0.00338457	0.04366715	0.03892259	-0.05076953	0.13810382	867
PC.aa.C38.5	0.01363422	0.15635028	0.06271742	0.06584831	0.24685226	836
PC.aa.C40.4	0.26116082	0.13249363	0.44494065	0.04424079	0.22074648	925
PC.aa.C40.5	0.50896377	0.14826344	0.65964231	0.05767435	0.23885252	836
PC.ae.C36.1	0.35449931	0.1279796	0.5685536	0.0447256	0.2112336	925
PC.ae.C38.0	0.00258787	0.13864253	0.03892259	0.05151065	0.22577441	925
SM.a.C38.1	0.02397894	0.15333515	0.08978152	0.06325509	0.24341521	993
SM.a.C40.3	0.01261094	0.20637413	0.06271742	0.08281419	0.32993406	712
SM.a.C40.5	0.00182137	0.17605855	0.03892259	0.08328367	0.26883343	877
NEFA_26_1	0.54671013	0.1646378	0.67969367	0.05170729	0.27756831	714

Glucose

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.09790958	0.03054538	0.67994194	-0.05155629	0.11264706	925
lyso.PC.a.C18.3	0.17115073	0.03672946	0.67994194	-0.05362421	0.12708314	793
SM.a.C41.0	0.6649584	0.05535571	0.83266425	-0.0262144	0.13692581	776
PC.aa.C34.2	0.52769103	0.13088367	0.83266425	0.05171355	0.21005378	925
PC.aa.C34.3	0.8632197	0.10889977	0.90245696	0.02940322	0.18839631	925

PC.aa.C36.4	0.7074776	0.12321911	0.83266425	0.03446017	0.21197805	865
SM.a.C38.2	0.25413701	0.13017382	0.81046694	0.05498814	0.2053595	996
SM.a.C40.4	0.52876253	0.13527266	0.83266425	0.05778506	0.21276027	995
lyso.PC.a.C16.0	0.16079619	0.06893584	0.67994194	-0.00832156	0.14619324	925
lyso.PC.a.C16.1	0.38178004	-0.00649576	0.83266425	-0.07624782	0.06325629	996
lyso.PC.a.C18.0	0.02966496	0.06422868	0.45486265	-0.01791823	0.14637559	996
lyso.PC.a.C20.3	0.17145104	0.03403675	0.67994194	-0.0508034	0.1188769	853
lyso.PC.a.C20.4	0.09152517	0.02489558	0.67994194	-0.05655073	0.10634189	996
lyso.PC.a.C20.5	0.00847325	0.03519201	0.38976947	-0.03955643	0.10994046	920
lyso.PC.a.C22.5	0.17255104	-0.02357982	0.67994194	-0.10656555	0.0594059	874
lyso.PC.a.C22.6	0.06652937	0.00823247	0.67994194	-0.06531655	0.08178148	939
lyso.PC.e.C18.0	0.2642827	0.0364627	0.81046694	-0.04200899	0.1149344	967
lyso.PC.e.C18.1	0.67132162	0.00452825	0.83266425	-0.09446368	0.10352019	707
PC.aa.C36.0	0.58958703	0.05214272	0.83266425	-0.01238596	0.11667141	924
PC.aa.C38.3	0.56793454	0.01137141	0.83266425	-0.06657094	0.08931376	836
PC.aa.C38.4	0.68976543	0.0530021	0.83266425	-0.0228843	0.12888851	836
PC.aa.C38.6	0.59204278	0.08360729	0.83266425	-0.00817517	0.17538975	836
PC.aa.C40.6	0.76025866	0.02570166	0.83266425	-0.05697214	0.10837545	901
PC.ae.C40.0	0.63422733	0.05444027	0.83266425	-0.02631531	0.13519585	925
PC.ae.C40.6	0.38939607	0.04842842	0.83266425	-0.03027356	0.1271304	836
SM.a.C36.0	0.41036519	0.06369863	0.83266425	-0.02567543	0.15307269	643
SM.a.C42.4	0.75407773	0.05608357	0.83266425	-0.01667765	0.12884479	865
SM.a.C42.6	0.57368172	0.06331098	0.83266425	-0.0284052	0.15502716	865
SM.a.C44.6	0.68849642	-0.01710953	0.83266425	-0.09456571	0.06034664	810
NEFA_24_5	0.64221542	0.02248229	0.83266425	-0.096753	0.14171758	602
Carn.a.C3.0	0.7372967	-0.01687137	0.83266425	-0.09412826	0.06038552	994
PC.aa.C32.3	0.49796739	0.05468669	0.83266425	-0.01674485	0.12611822	868
PC.aa.C34.1	0.68912696	0.07202816	0.83266425	-0.00482785	0.14888418	935
PC.aa.C36.1	0.1921575	0.04761617	0.67994194	-0.01931839	0.11455074	924
PC.aa.C36.2	0.14802523	0.0840374	0.67994194	0.0146849	0.1533899	925
PC.aa.C36.3	0.91130229	0.09710197	0.91130229	0.01338842	0.18081553	936
PC.aa.C38.0	0.18575322	0.04112896	0.67994194	-0.03171078	0.11396869	867
PC.aa.C38.5	0.48463523	0.05321174	0.83266425	-0.02159305	0.12801652	836
PC.aa.C40.4	0.90488901	0.04466213	0.91130229	-0.02791855	0.11724281	925
PC.aa.C40.5	0.43654999	0.02295544	0.83266425	-0.0535008	0.09941168	836
PC.ae.C36.1	0.6341794	0.04704814	0.83266425	-0.01930392	0.1134002	925
PC.ae.C38.0	0.4795929	0.08763475	0.83266425	0.01778846	0.15748103	925
SM.a.C38.1	0.3625077	0.11048289	0.83266425	0.03587617	0.18508961	993
SM.a.C40.3	0.48420088	0.03595853	0.83266425	-0.06243644	0.13435351	712
SM.a.C40.5	0.86116229	0.0565296	0.90245696	-0.01931977	0.13237896	877
NEFA_26_1	0.02719859	0.04039323	0.45486265	-0.0454873	0.12627376	714

Systolic blood pressure

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.90418004	1.30517176	0.96194237	-1.13079101	3.74113452	925
lyso.PC.a.C18.3	0.16549837	3.12920467	0.96194237	0.4857732	5.77263614	793
SM.a.C41.0	0.01064798	-1.82382746	0.48980715	-4.23841686	0.59076195	776
PC.aa.C34.2	0.81414955	0.63429629	0.96194237	-1.72722837	2.99582094	925
PC.aa.C34.3	0.43671728	1.86435491	0.96194237	-0.48558884	4.21429866	925
PC.aa.C36.4	0.89888657	1.13287962	0.96194237	-1.47718357	3.7429428	865
SM.a.C38.2	0.52531568	-0.06969687	0.96194237	-2.2553358	2.11594206	996
SM.a.C40.4	0.19101056	2.52474893	0.96194237	0.28514836	4.76434949	995
lyso.PC.a.C16.0	0.50332768	1.66633968	0.96194237	-0.62582349	3.95850285	925
lyso.PC.a.C16.1	0.85774264	0.18184569	0.96194237	-1.82947169	2.19316307	996
lyso.PC.a.C18.0	0.83323454	0.41658764	0.96194237	-1.97415782	2.80733311	996
lyso.PC.a.C20.3	0.20712735	2.16746925	0.96194237	-0.32100821	4.65594672	853
lyso.PC.a.C20.4	0.48326772	1.64396042	0.96194237	-0.72068501	4.00860586	996
lyso.PC.a.C20.5	0.39822133	0.64312381	0.96194237	-1.58478893	2.87103655	920
lyso.PC.a.C22.5	0.92011879	-0.11777006	0.96194237	-2.61098256	2.37544244	874
lyso.PC.a.C22.6	0.14410482	0.95573633	0.96194237	-1.18480045	3.0962731	939
lyso.PC.e.C18.0	0.75309797	-0.02087754	0.96194237	-2.28688653	2.24513146	967
lyso.PC.e.C18.1	0.81023855	0.77127801	0.96194237	-2.11342963	3.65598565	707
PC.aa.C36.0	0.54578241	0.86807684	0.96194237	-1.04732643	2.78348011	924
PC.aa.C38.3	0.30398743	-0.46221287	0.96194237	-2.68993457	1.76550884	836
PC.aa.C38.4	0.67492931	0.55147242	0.96194237	-1.64406677	2.7470116	836
PC.aa.C38.6	0.57104455	0.74787205	0.96194237	-1.94637394	3.44211805	836
PC.aa.C40.6	0.69610847	0.11703695	0.96194237	-2.23739409	2.47146799	901
PC.ae.C40.0	0.72763503	0.1239062	0.96194237	-2.27445828	2.52227068	925
PC.ae.C40.6	0.85344045	-0.51812718	0.96194237	-2.8261463	1.78989194	836
SM.a.C36.0	0.56347864	1.61550479	0.96194237	-1.06258011	4.29358969	643
SM.a.C42.4	0.72880579	-0.254393	0.96194237	-2.38484456	1.87605856	865
SM.a.C42.6	0.98216907	-0.61278958	0.98729003	-3.31803751	2.09245834	865
SM.a.C44.6	0.91971132	-0.36464343	0.96194237	-2.64691377	1.91762691	810
NEFA_24_5	0.42660494	-2.04450443	0.96194237	-5.80459525	1.71558639	602
Carn.a.C3.0	0.11361822	-0.35215863	0.96194237	-2.58249531	1.87817804	994
PC.aa.C32.3	0.4552316	1.60896718	0.96194237	-0.51852531	3.73645967	868
PC.aa.C34.1	0.82101206	0.1356842	0.96194237	-2.05942674	2.33079515	935
PC.aa.C36.1	0.51558006	-0.22453545	0.96194237	-2.2021036	1.7530327	924
PC.aa.C36.2	0.68459733	0.14567464	0.96194237	-1.91290593	2.20425521	925
PC.aa.C36.3	0.37468938	-0.38792461	0.96194237	-2.78880049	2.01295128	936
PC.aa.C38.0	0.74304574	-0.34993121	0.96194237	-2.52508467	1.82522226	867
PC.aa.C38.5	0.39791913	0.14593887	0.96194237	-2.01441301	2.30629076	836
PC.aa.C40.4	0.24954747	-0.32959146	0.96194237	-2.45565213	1.79646921	925
PC.aa.C40.5	0.27838198	-0.12309462	0.96194237	-2.32485959	2.07867035	836

PC.ae.C36.1	0.72489604	-0.47154102	0.96194237	-2.43952681	1.49644477	925
PC.ae.C38.0	0.88944774	0.6112458	0.96194237	-1.45232037	2.67481196	925
SM.a.C38.1	0.98729003	0.64125766	0.98729003	-1.52416934	2.80668466	993
SM.a.C40.3	0.39132128	1.45030051	0.96194237	-1.53475635	4.43535736	712
SM.a.C40.5	0.78926717	0.56071994	0.96194237	-1.60821495	2.72965483	877
NEFA_26_1	0.90753311	-0.11750057	0.96194237	-2.71244687	2.47744574	714

Supplemental Table 6.2: Results for the testing of males versus *h*females

Waist Circumference

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.45863292	-0.72527478	0.8403022	-2.64510871	1.19455916	925
lyso.PC.a.C18.3	0.56829962	-0.6483716	0.8403022	-2.87813498	1.58139179	793
SM.a.C41.0	0.30939315	0.98300338	0.7144239	-0.91411418	2.88012095	776
PC.aa.C34.2	0.0369097	1.9490703	0.24319358	0.11868708	3.77945353	925
PC.aa.C34.3	0.92792393	-0.08225636	0.97346202	-1.86639387	1.70188115	925
PC.aa.C36.4	0.00944622	2.4593435	0.14484206	0.60374198	4.31494502	865
SM.a.C38.2	0.04271622	1.94363433	0.24561829	0.06391739	3.82335127	996
SM.a.C40.4	0.00565453	2.4593741	0.14484206	0.71910283	4.19964538	995
lyso.PC.a.C16.0	0.55623371	0.54989212	0.8403022	-1.28340779	2.38319203	925
lyso.PC.a.C16.1	0.0080272	-2.52067725	0.14484206	-4.38284121	-0.65851329	996
lyso.PC.a.C18.0	0.3328171	-0.90729784	0.72670149	-2.74484067	0.93024498	996
lyso.PC.a.C20.3	0.55146484	-0.70209946	0.8403022	-3.01503927	1.61084036	853
lyso.PC.a.C20.4	0.87478356	0.16761196	0.97346202	-1.91907173	2.25429565	996
lyso.PC.a.C20.5	0.06386121	-2.10398427	0.32640176	-4.32949182	0.12152328	920
lyso.PC.a.C22.5	0.07168696	-2.07621696	0.32716414	-4.33595279	0.18351886	874
lyso.PC.a.C22.6	0.63843532	0.51316869	0.8403022	-1.62940803	2.65574541	939
lyso.PC.e.C18.0	0.67474165	-0.40183402	0.8403022	-2.28038565	1.4767176	967
lyso.PC.e.C18.1	0.51276818	-0.7971967	0.8403022	-3.18727267	1.59287926	707
PC.aa.C36.0	0.63987481	0.45062336	0.8403022	-1.43894363	2.34019034	924
PC.aa.C38.3	0.64685072	0.41530875	0.8403022	-1.3633618	2.1939793	836
PC.aa.C38.4	0.23431731	1.15451741	0.65517887	-0.74950185	3.05853667	836
PC.aa.C38.6	0.03423738	2.08237479	0.24319358	0.15508196	4.00966762	836
PC.aa.C40.6	0.24225472	1.06533715	0.65517887	-0.72149633	2.85217063	901
PC.ae.C40.0	0.0941817	1.51551428	0.36102985	-0.25966924	3.29069779	925
PC.ae.C40.6	0.18612555	1.26608977	0.57078501	-0.611988	3.14416754	836
SM.a.C36.0	0.03700772	2.22733301	0.24319358	0.13467229	4.31999373	643
SM.a.C42.4	0.34755289	0.89076116	0.72670149	-0.96943336	2.75095569	865
SM.a.C42.6	0.01291552	2.3846538	0.14852843	0.50594237	4.26336523	865
SM.a.C44.6	0.42941383	0.77830048	0.8403022	-1.15409697	2.71069793	810

NEFA_24_5	0.92509482	0.10905364	0.97346202	-2.1680211	2.38612838	602
Carn.a.C3.0	0.91890849	0.11119126	0.97346202	-2.03147938	2.25386189	994
PC.aa.C32.3	0.93228296	0.07863257	0.97346202	-1.73710966	1.89437481	868
PC.aa.C34.1	0.97346202	0.03086682	0.97346202	-1.78959554	1.85132918	935
PC.aa.C36.1	0.11081767	-1.55164633	0.39212405	-3.45957635	0.35628369	924
PC.aa.C36.2	0.31061909	0.93824725	0.7144239	-0.87682157	2.75331607	925
PC.aa.C36.3	0.0782349	1.63231914	0.32716414	-0.18476617	3.44940445	936
PC.aa.C38.0	0.82047012	0.21199086	0.9715329	-1.62088225	2.04486397	867
PC.aa.C38.5	0.82369094	0.21551513	0.9715329	-1.68253267	2.11356293	836
PC.aa.C40.4	0.48358837	0.61245438	0.8403022	-1.10262321	2.32753197	925
PC.aa.C40.5	0.96792676	0.03768935	0.97346202	-1.80160074	1.87697944	836
PC.ae.C36.1	0.67589525	0.41231328	0.8403022	-1.52259083	2.34721739	925
PC.ae.C38.0	0.46661847	0.65914579	0.8403022	-1.11706681	2.43535839	925
SM.a.C38.1	0.25637434	1.040961	0.65517887	-0.757774	2.839696	993
SM.a.C40.3	0.6266538	0.52730644	0.8403022	-1.60002835	2.65464123	712
SM.a.C40.5	0.5498992	0.54272687	0.8403022	-1.23812549	2.32357922	877
NEFA_26_1	0.18139025	-1.69042628	0.57078501	-4.17124892	0.79039635	714

HDL

Analytes	**P-Values**	**BETA**	**FDR P-Value**	**CI lower**	**CI upper**	**Number of observations**
lyso.PC.a.C18.1	2.68E-07	0.11860338	1.23E-05	0.07369734	0.16350942	925
lyso.PC.a.C18.3	2.13E-05	0.11295438	0.0001783	0.06111294	0.16479583	793
SM.a.C41.0	0.00159261	-0.07341792	0.004884	-0.11890347	-0.02793238	776
PC.aa.C34.2	0.66644942	0.00869692	0.71294589	-0.03088919	0.04828304	925
PC.aa.C34.3	0.56320228	-0.01158837	0.64768262	-0.05091519	0.02773846	925
PC.aa.C36.4	0.07403654	-0.03740923	0.1135227	-0.07846116	0.0036427	865
SM.a.C38.2	0.58526067	0.01158716	0.65663392	-0.03006592	0.05324023	996
SM.a.C40.4	0.10536667	-0.03199921	0.15635055	-0.07074051	0.00674208	995
lyso.PC.a.C16.0	0.0013309	0.07067841	0.00437297	0.02758918	0.11376765	925
lyso.PC.a.C16.1	0.01020435	0.05705529	0.02040869	0.0135536	0.10055698	996
lyso.PC.a.C18.0	0.00284569	0.06552056	0.00770011	0.02253921	0.10850191	996
lyso.PC.a.C20.3	0.02336344	0.06203673	0.03980438	0.00843308	0.11564038	853
lyso.PC.a.C20.4	0.00688891	0.06689474	0.01667842	0.01841643	0.11537305	996
lyso.PC.a.C20.5	0.00030176	0.09431066	0.00126192	0.04328969	0.14533163	920
lyso.PC.a.C22.5	0.00942191	0.07083481	0.01998153	0.017407	0.12426261	874
lyso.PC.a.C22.6	0.46056782	-0.01921145	0.57259783	-0.07028405	0.03186115	939
lyso.PC.e.C18.0	0.04568692	0.04486473	0.07246891	0.00086187	0.08886759	967
lyso.PC.e.C18.1	0.00211603	0.08954994	0.00608357	0.03255757	0.14654231	707
PC.aa.C36.0	0.00955639	-0.05566402	0.01998153	-0.09773028	-0.01359777	924
PC.aa.C38.3	0.000164	-0.08245816	0.00075439	-0.12520578	-0.03971054	836

PC.aa.C38.4	1.24E-05	-0.09787781	0.00014211	-0.14156236	-0.05419325	836
PC.aa.C38.6	0.00044711	-0.07791095	0.00171393	-0.12129729	-0.03452461	836
PC.aa.C40.6	1.71E-06	-0.10160387	3.94E-05	-0.14300177	-0.06020597	901
PC.ae.C40.0	0.00810798	-0.0541757	0.01864836	-0.09424714	-0.01410426	925
PC.ae.C40.6	0.00015305	-0.0820376	0.00075439	-0.12437226	-0.03970293	836
SM.a.C36.0	0.00106515	-0.08883169	0.00376898	-0.14188717	-0.03577621	643
SM.a.C42.4	5.39E-05	-0.08833664	0.0003107	-0.13105782	-0.04561546	865
SM.a.C42.6	5.40E-05	-0.08877292	0.0003107	-0.13171077	-0.04583507	865
SM.a.C44.6	8.14E-06	-0.10342017	0.00012488	-0.14862744	-0.05821289	810
NEFA_24_5	2.33E-05	-0.11960751	0.0001783	-0.17468559	-0.06452943	602
Carn.a.C3.0	0.18937696	0.03405655	0.27222938	-0.01683055	0.08494365	994
PC.aa.C32.3	0.01205035	-0.05473663	0.02309651	-0.09743647	-0.01203679	868
PC.aa.C34.1	0.5147071	-0.01348807	0.62306649	-0.05410119	0.02712505	935
PC.aa.C36.1	0.7507007	-0.00710429	0.78482345	-0.05097486	0.03676629	924
PC.aa.C36.2	0.89745806	-0.0026391	0.89745806	-0.04281762	0.03753943	925
PC.aa.C36.3	0.31129098	-0.02047684	0.43392076	-0.06014463	0.01919096	936
PC.aa.C38.0	0.01338671	-0.05347833	0.02463155	-0.0958289	-0.01112776	867
PC.aa.C38.5	0.02036088	-0.0499906	0.03602309	-0.09221037	-0.00777084	836
PC.aa.C40.4	0.02613031	-0.04512038	0.04292836	-0.0848672	-0.00537355	925
PC.aa.C40.5	0.0063061	-0.06061737	0.01611559	-0.1040665	-0.01716824	836
PC.ae.C36.1	0.38932088	-0.01935861	0.49772418	-0.06347114	0.02475392	925
PC.ae.C38.0	0.38952327	-0.0172066	0.49772418	-0.05643208	0.02201888	925
SM.a.C38.1	0.63348813	-0.00967069	0.69382033	-0.0494582	0.03011682	993
SM.a.C40.3	0.34324178	-0.02260826	0.46438594	-0.06940997	0.02419345	712
SM.a.C40.5	0.85036474	-0.00402018	0.86926173	-0.04583255	0.03779219	877
NEFA_26_1	0.55880116	0.01768779	0.64768262	-0.04168449	0.07706007	714

Triacylglycerol

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.01039044	0.11339743	0.04345092	0.0267302	0.20006465	925
lyso.PC.a.C18.3	0.03203564	0.10801654	0.09210247	0.00929405	0.20673903	793
SM.a.C41.0	0.15790516	0.06226474	0.27937067	-0.02420614	0.14873562	776
PC.aa.C34.2	0.09225892	0.06484324	0.21219551	-0.01066476	0.14035125	925
PC.aa.C34.3	0.27987541	0.03943968	0.39645784	-0.03214718	0.11102653	925
PC.aa.C36.4	0.1511463	0.05619616	0.2781092	-0.0205716	0.13296391	865
SM.a.C38.2	0.20202158	0.05123373	0.33189259	-0.02751803	0.1299855	996
SM.a.C40.4	0.53108713	0.02301619	0.6107502	-0.04906892	0.0951013	995
lyso.PC.a.C16.0	0.0014105	0.12870164	0.02103072	0.04982475	0.20757852	925
lyso.PC.a.C16.1	0.04194262	0.08150586	0.11349179	0.00297607	0.16003564	996
lyso.PC.a.C18.0	7.66E-07	0.19768487	3.52E-05	0.11972349	0.27564626	996
lyso.PC.a.C20.3	0.43682826	0.03994987	0.55419549	-0.06084657	0.14074631	853
lyso.PC.a.C20.4	0.12660023	0.07076346	0.25320046	-0.02006038	0.16158729	996

lyso.PC.a.C20.5	0.85891951	0.00871153	0.91884413	-0.08744685	0.10486991	920
lyso.PC.a.C22.5	0.32386565	0.0510343	0.43817117	-0.05043924	0.15250784	874
lyso.PC.a.C22.6	0.4123458	-0.03983057	0.5419402	-0.1351411	0.05547995	939
lyso.PC.e.C18.0	0.16470954	0.05759849	0.28061626	-0.02369328	0.13889025	967
lyso.PC.e.C18.1	0.00403328	0.15831553	0.02319136	0.05057899	0.26605208	707
PC.aa.C36.0	0.00863388	-0.11003974	0.03971586	-0.19209457	-0.02798491	924
PC.aa.C38.3	0.01236375	0.09246524	0.04739438	0.02007271	0.16485777	836
PC.aa.C38.4	0.15063777	0.05810672	0.2781092	-0.02117356	0.13738699	836
PC.aa.C38.6	0.2332601	-0.04985512	0.36999878	-0.13188987	0.03217963	836
PC.aa.C40.6	0.9188152	-0.00387703	0.93923331	-0.07850932	0.07075526	901
PC.ae.C40.0	0.45781366	-0.02858578	0.55419549	-0.10411575	0.04694419	925
PC.ae.C40.6	0.09731572	-0.06987143	0.21316776	-0.15249503	0.01275218	836
SM.a.C36.0	0.00228595	0.15082358	0.02103072	0.05412133	0.24752583	643
SM.a.C42.4	0.04782608	0.07961482	0.12222221	0.00076397	0.15846567	865
SM.a.C42.6	0.72473455	-0.01448362	0.79375689	-0.09518533	0.06621809	865
SM.a.C44.6	0.97599168	-0.00129753	0.97599168	-0.08590298	0.08330792	810
NEFA_24_5	0.12031239	-0.08038081	0.25156228	-0.18185613	0.0210945	602
Carn.a.C3.0	0.00207568	0.14358649	0.02103072	0.05232142	0.23485156	994
PC.aa.C32.3	0.47620575	0.02845534	0.56167858	-0.04990522	0.1068159	868
PC.aa.C34.1	0.2655737	0.04056968	0.3940771	-0.03090247	0.11204184	935
PC.aa.C36.1	0.00320626	0.11654344	0.02106969	0.03914253	0.19394436	924
PC.aa.C36.2	4.37E-05	0.15553584	0.00100412	0.08121244	0.22985924	925
PC.aa.C36.3	0.01492929	0.08958651	0.0528267	0.01749066	0.16168237	936
PC.aa.C38.0	0.00745451	-0.11217063	0.03810082	-0.19425293	-0.03008832	867
PC.aa.C38.5	0.45440389	0.02987721	0.55419549	-0.04847706	0.10823149	836
PC.aa.C40.4	0.03119571	0.07814768	0.09210247	0.00707392	0.14922144	925
PC.aa.C40.5	0.00304775	0.11479426	0.02106969	0.03897031	0.1906182	836
PC.ae.C36.1	0.05516441	0.08047275	0.13355595	-0.00178241	0.16272791	925
PC.ae.C38.0	0.9051254	-0.00454429	0.93923331	-0.07934909	0.07026052	925
SM.a.C38.1	0.24948914	0.04348999	0.38255001	-0.03057557	0.11755556	993
SM.a.C40.3	0.2844154	0.04708516	0.39645784	-0.03920875	0.13337908	712
SM.a.C40.5	0.67261088	0.01657969	0.75463659	-0.06040175	0.09356114	877
NEFA_26_1	0.02741329	0.12186489	0.09007225	0.01361034	0.23011945	714

Glucose

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.17947831	-0.04621399	0.37296471	-0.11372786	0.02129988	925
lyso.PC.a.C18.3	0.33148511	-0.03809959	0.52875353	-0.11506459	0.0388654	793
SM.a.C41.0	0.02785832	0.07436746	0.11649844	0.00811369	0.14062124	776
PC.aa.C34.2	0.0009517	0.10429573	0.01141005	0.0425539	0.16603756	925

PC.aa.C34.3	0.00092392	0.10158315	0.01141005	0.0415986	0.1615677	925
PC.aa.C36.4	0.00099218	0.10616881	0.01141005	0.04310203	0.16923559	865
SM.a.C38.2	0.01060683	0.08352927	0.07262176	0.01950661	0.14755193	996
SM.a.C40.4	0.0003001	0.10955977	0.01141005	0.05030144	0.1688181	995
lyso.PC.a.C16.0	0.76039229	0.00970187	0.81344292	-0.05271416	0.0721179	925
lyso.PC.a.C16.1	0.18648235	-0.04309476	0.37296471	-0.10706549	0.02087597	996
lyso.PC.a.C18.0	0.34483926	-0.03026504	0.52875353	-0.09310617	0.03257608	996
lyso.PC.a.C20.3	0.35662298	-0.03708106	0.52918249	-0.11599232	0.04183019	853
lyso.PC.a.C20.4	0.12360145	-0.056991	0.30273264	-0.1295586	0.0155766	996
lyso.PC.a.C20.5	0.02012936	-0.08806698	0.09780506	-0.16230954	-0.01382443	920
lyso.PC.a.C22.5	0.02126197	-0.09110757	0.09780506	-0.16860164	-0.0136135	874
lyso.PC.a.C22.6	0.04008854	-0.07890363	0.14706616	-0.15423008	-0.00357718	939
lyso.PC.e.C18.0	0.69811213	-0.01279843	0.80294968	-0.07753301	0.05193614	967
lyso.PC.e.C18.1	0.63001005	-0.02054869	0.78325573	-0.10426395	0.06316657	707
PC.aa.C36.0	0.33638938	0.03134493	0.52875353	-0.03261256	0.09530242	924
PC.aa.C38.3	0.26933675	0.03546781	0.47651886	-0.02751536	0.09845098	836
PC.aa.C38.4	0.28582422	0.03572809	0.48695978	-0.02993399	0.10139017	836
PC.aa.C38.6	0.07859245	0.05876464	0.22595329	-0.00673186	0.12426114	836
PC.aa.C40.6	0.69821712	0.01232135	0.80294968	-0.05002738	0.07467009	901
PC.ae.C40.0	0.2609753	0.03449699	0.47651886	-0.02569432	0.09468829	925
PC.ae.C40.6	0.73968328	0.01086191	0.81344292	-0.05328101	0.07500484	836
SM.a.C36.0	0.56255706	0.02209349	0.71882291	-0.05279195	0.09697893	643
SM.a.C42.4	0.18305994	0.04326338	0.37296471	-0.02046378	0.10699053	865
SM.a.C42.6	0.25250307	0.03739	0.47651886	-0.02669965	0.10147965	865
SM.a.C44.6	0.99503492	-0.00021014	0.99503492	-0.06647646	0.06605617	810
NEFA_24_5	0.90221438	-0.00463252	0.92226359	-0.07865071	0.06938566	602
Carn.a.C3.0	0.38013372	-0.03325157	0.54496533	-0.10756666	0.04106352	994
PC.aa.C32.3	0.01105114	0.08143095	0.07262176	0.01867003	0.14419188	868
PC.aa.C34.1	0.08462601	0.05498292	0.22898804	-0.0075237	0.11748955	935
PC.aa.C36.1	0.86745613	-0.00549166	0.90688595	-0.07005285	0.05906954	924
PC.aa.C36.2	0.39095339	0.02679506	0.54496533	-0.03447369	0.08806382	925
PC.aa.C36.3	0.00136227	0.10191659	0.01253292	0.03965085	0.16418233	936
PC.aa.C38.0	0.68615029	-0.01303878	0.80294968	-0.0763495	0.05027194	867
PC.aa.C38.5	0.47381137	0.023645	0.62272351	-0.04111905	0.08840905	836
PC.aa.C40.4	0.18057037	0.03991093	0.37296471	-0.01854137	0.09836323	925
PC.aa.C40.5	0.75161218	-0.01032282	0.81344292	-0.07431743	0.0536718	836
PC.ae.C36.1	0.40899374	0.02759272	0.55334447	-0.03796328	0.09314872	925
PC.ae.C38.0	0.04702653	0.06076485	0.15451573	0.00080015	0.12072956	925
SM.a.C38.1	0.01838605	0.07382522	0.09780506	0.01248213	0.13516831	993
SM.a.C40.3	0.04156217	0.07145842	0.14706616	0.00273965	0.1401772	712
SM.a.C40.5	0.12504174	0.04923626	0.30273264	-0.01370097	0.11217349	877
NEFA_26_1	0.0599739	-0.07899876	0.18391996	-0.16132336	0.00332583	714

Systolic blood pressure

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.149954	1.47070077	0.91474584	-0.53244072	3.47384226	925
lyso.PC.a.C18.3	0.42750109	0.91066062	0.91474584	-1.34106504	3.16238628	793
SM.a.C41.0	0.13315607	1.50194665	0.91474584	-0.45925785	3.46315115	776
PC.aa.C34.2	0.71790162	0.33911642	0.96161725	-1.50254887	2.18078171	925
PC.aa.C34.3	0.32605448	0.88779401	0.91474584	-0.88536895	2.66095697	925
PC.aa.C36.4	0.30835594	0.96310398	0.91474584	-0.89145031	2.81765827	865
SM.a.C38.2	0.47005359	0.68538883	0.91474584	-1.17574236	2.54652003	996
SM.a.C40.4	0.26105205	0.98149221	0.91474584	-0.73123325	2.69421768	995
lyso.PC.a.C16.0	0.38044385	0.82799638	0.91474584	-1.02383569	2.67982844	925
lyso.PC.a.C16.1	0.97081448	-0.03440006	0.98121166	-1.87901142	1.8102113	996
lyso.PC.a.C18.0	0.46411488	0.6825557	0.91474584	-1.146328	2.5114394	996
lyso.PC.a.C20.3	0.83651749	0.24341074	0.98121166	-2.07116403	2.55798551	853
lyso.PC.a.C20.4	0.54083392	0.65681345	0.92142074	-1.45005483	2.76368172	996
lyso.PC.a.C20.5	0.10683152	1.82003462	0.91474584	-0.39279977	4.03286901	920
lyso.PC.a.C22.5	0.97895161	0.03130575	0.98121166	-2.29691628	2.35952779	874
lyso.PC.a.C22.6	0.34181111	-1.06242238	0.91474584	-3.25468867	1.12984392	939
lyso.PC.e.C18.0	0.65816299	-0.42158892	0.9461093	-2.29091423	1.4477364	967
lyso.PC.e.C18.1	0.77347474	0.35777928	0.96161725	-2.08175331	2.79731186	707
PC.aa.C36.0	0.855078	0.17672703	0.98121166	-1.7217216	2.07517566	924
PC.aa.C38.3	0.39670686	0.77768372	0.91474584	-1.02247986	2.57784731	836
PC.aa.C38.4	0.97825796	0.02638483	0.98121166	-1.8733451	1.92611477	836
PC.aa.C38.6	0.98121166	-0.02307452	0.98121166	-1.94570419	1.89955516	836
PC.aa.C40.6	0.68207894	-0.37071541	0.95077671	-2.14631793	1.40488712	901
PC.ae.C40.0	0.73397944	-0.30964042	0.96161725	-2.09726527	1.47798443	925
PC.ae.C40.6	0.76884902	-0.28173014	0.96161725	-2.16278943	1.59932916	836
SM.a.C36.0	0.51703026	0.74080752	0.91474584	-1.50312734	2.98474239	643
SM.a.C42.4	0.48125046	-0.66985009	0.91474584	-2.53578373	1.19608355	865
SM.a.C42.6	0.50445751	-0.64315743	0.91474584	-2.53353697	1.24722212	865
SM.a.C44.6	0.80983209	-0.23945082	0.98032306	-2.19200844	1.7131068	810
NEFA_24_5	0.6250767	-0.58108488	0.9461093	-2.91525187	1.75308212	602
Carn.a.C3.0	0.08588135	1.87961857	0.91474584	-0.26579107	4.02502821	994
PC.aa.C32.3	0.44279823	0.73126351	0.91474584	-1.13798649	2.6005135	868
PC.aa.C34.1	0.65150906	0.41100661	0.9461093	-1.37426654	2.19627976	935
PC.aa.C36.1	0.56645112	0.55739043	0.93059827	-1.35005706	2.46483791	924
PC.aa.C36.2	0.50187234	0.6225462	0.91474584	-1.19608575	2.44117815	925
PC.aa.C36.3	0.43368998	0.71268845	0.91474584	-1.07307149	2.49844838	936
PC.aa.C38.0	0.43612944	-0.75047747	0.91474584	-2.64107374	1.14011879	867
PC.aa.C38.5	0.21638903	1.17885916	0.91474584	-0.6915176	3.04923593	836
PC.aa.C40.4	0.24634337	1.01204457	0.91474584	-0.70016233	2.72425146	925
PC.aa.C40.5	0.19699683	1.21229933	0.91474584	-0.63059938	3.05519805	836

PC.ae.C36.1	0.36481077	-0.89828854	0.91474584	-2.84266338	1.04608631	925
PC.ae.C38.0	0.61421895	0.45517733	0.9461093	-1.31644358	2.22679823	925
SM.a.C38.1	0.46722179	0.6598672	0.91474584	-1.12058882	2.44032323	993
SM.a.C40.3	0.90223131	0.13048724	0.98121166	-1.95426808	2.21524256	712
SM.a.C40.5	0.33779179	0.87942361	0.91474584	-0.92028496	2.67913218	877
NEFA_26_1	0.95476849	0.07188841	0.98121166	-2.41561245	2.55938927	714

Supplemental Table 6.3: Results for the testing of males versus *nh*females

Waist Circumference

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.00059186	4.10094985	0.01361287	1.76629501	6.4356047	925
lyso.PC.a.C18.3	0.00013425	5.11737847	0.00617528	2.49972979	7.73502715	793
SM.a.C41.0	0.00173942	-3.73901041	0.0266711	-6.07469747	-1.40332334	776
PC.aa.C34.2	0.57644483	0.66826293	0.77989595	-1.67879499	3.01532086	925
PC.aa.C34.3	0.79514382	0.31290237	0.83280015	-2.05158577	2.67739051	925
PC.aa.C36.4	0.61398872	0.67136479	0.79580699	-1.94017223	3.28290182	865
SM.a.C38.2	0.88167659	-0.16747811	0.9012694	-2.37494341	2.03998718	996
SM.a.C40.4	0.12265533	1.79168136	0.40301037	-0.48393876	4.06730147	995
lyso.PC.a.C16.0	0.01570163	2.79848239	0.12037919	0.52925797	5.06770682	925
lyso.PC.a.C16.1	0.52942574	-0.65093366	0.77989595	-2.68138995	1.37952264	996
lyso.PC.a.C18.0	0.18845591	1.61095497	0.52973918	-0.79110984	4.01301977	996
lyso.PC.a.C20.3	0.02182454	2.91100056	0.1434184	0.42428088	5.39772024	853
lyso.PC.a.C20.4	0.00645561	3.25753349	0.0593916	0.91554224	5.59952475	996
lyso.PC.a.C20.5	0.032845	2.44007936	0.16787447	0.19940711	4.68075162	920
lyso.PC.a.C22.5	0.28474987	1.31969156	0.59540733	-1.10018142	3.73956455	874
lyso.PC.a.C22.6	0.00332299	3.13801926	0.03821438	1.04599957	5.23003895	939
lyso.PC.e.C18.0	0.10665261	1.87395808	0.37738617	-0.40323511	4.15115127	967
lyso.PC.e.C18.1	0.03826703	2.98823771	0.17602833	0.16201171	5.8144637	707
PC.aa.C36.0	0.22021814	1.19171	0.5331597	-0.7147323	3.09815231	924
PC.aa.C38.3	0.20014618	-1.43781462	0.52973918	-3.63893846	0.76330922	836
PC.aa.C38.4	0.49362091	-0.76779035	0.77989595	-2.96828676	1.43270606	836
PC.aa.C38.6	0.26615513	1.53104892	0.59540733	-1.16973172	4.23182955	836
PC.aa.C40.6	0.54265877	-0.73523654	0.77989595	-3.10455971	1.63408664	901
PC.ae.C40.0	0.73176224	0.41611327	0.83280015	-1.96555931	2.79778586	925
PC.ae.C40.6	0.3288635	1.14697525	0.59540733	-1.15738561	3.45133611	836
SM.a.C36.0	0.1353062	-1.90193128	0.41493901	-4.39947395	0.59561139	643
SM.a.C42.4	0.5319012	-0.67671011	0.77989595	-2.80060898	1.44718876	865
SM.a.C42.6	0.29218029	1.44376663	0.59540733	-1.24478351	4.13231677	865
SM.a.C44.6	0.6597729	0.50675069	0.79867245	-1.7519552	2.76545657	810
NEFA_24_5	0.04307788	-3.78640886	0.18014384	-7.45453024	-0.11828749	602
Carn.a.C3.0	0.09519208	-1.89587367	0.36490298	-4.12336292	0.33161558	994
PC.aa.C32.3	0.64029923	0.49218356	0.79604769	-1.57440891	2.55877603	868
PC.aa.C34.1	0.32738743	1.11764394	0.59540733	-1.12073446	3.35602234	935
PC.aa.C36.1	0.76224842	0.3050118	0.83280015	-1.67305662	2.28308023	924
PC.aa.C36.2	0.78083573	0.29135779	0.83280015	-1.76318954	2.34590512	925
PC.aa.C36.3	0.62280547	0.61250605	0.79580699	-1.83048543	3.05549754	936
PC.aa.C38.0	0.20728924	1.3558909	0.52973918	-0.75285139	3.46463318	867
PC.aa.C38.5	0.74655053	0.36109706	0.83280015	-1.83121586	2.55340998	836

PC.aa.C40.4	0.36007749	-0.99362795	0.61346535	-3.12325319	1.13599728	925
PC.aa.C40.5	0.33653458	-1.07653537	0.59540733	-3.27398901	1.12091827	836
PC.ae.C36.1	0.32054009	0.99178395	0.59540733	-0.96661609	2.950184	925
PC.ae.C38.0	0.47393685	0.75520871	0.77861054	-1.31370581	2.82412323	925
SM.a.C38.1	0.5685123	0.63592299	0.77989595	-1.55173527	2.82358125	993
SM.a.C40.3	0.79659145	-0.40005556	0.83280015	-3.44607983	2.64596872	712
SM.a.C40.5	0.03118773	2.35996121	0.16787447	0.21375105	4.50617136	877
NEFA_26_1	0.97077491	0.04830982	0.97077491	-2.53966981	2.63628944	714

HDL

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.00188545	-0.0867251	0.04244896	-0.14133404	-0.03211616	925
lyso.PC.a.C18.3	0.00423584	-0.08893126	0.04244896	-0.14979094	-0.02807158	793
SM.a.C41.0	0.23499906	0.03390509	0.3179399	-0.02209566	0.08990583	776
PC.aa.C34.2	0.03322815	-0.05515674	0.07278546	-0.1059171	-0.00439639	925
PC.aa.C34.3	0.02262385	-0.06064474	0.05863456	-0.11276393	-0.00852554	925
PC.aa.C36.4	0.19814806	-0.03790938	0.28483783	-0.09568506	0.0198663	865
SM.a.C38.2	0.10412774	-0.04054764	0.18387445	-0.08946336	0.00836809	996
SM.a.C40.4	0.02424412	-0.05825751	0.05863456	-0.10891655	-0.00759848	995
lyso.PC.a.C16.0	0.16788992	-0.03750629	0.24912697	-0.09084134	0.01582875	925
lyso.PC.a.C16.1	0.10792631	-0.03889281	0.18387445	-0.08632594	0.00854033	996
lyso.PC.a.C18.0	0.42869425	-0.02266926	0.47881011	-0.07885516	0.03351663	996
lyso.PC.a.C20.3	0.02437324	-0.0662185	0.05863456	-0.1238496	-0.00858741	853
lyso.PC.a.C20.4	0.00461402	-0.0787238	0.04244896	-0.13313348	-0.02431413	996
lyso.PC.a.C20.5	0.02549329	-0.0585652	0.05863456	-0.10993382	-0.00719657	920
lyso.PC.a.C22.5	0.15142468	-0.04185394	0.23218451	-0.09906793	0.01536005	874
lyso.PC.a.C22.6	8.15E-05	-0.10055643	0.0037509	-0.1504239	-0.05068896	939
lyso.PC.e.C18.0	0.05882544	-0.05141913	0.11765088	-0.1047597	0.00192144	967
lyso.PC.e.C18.1	0.00783876	-0.09153214	0.04686588	-0.15892469	-0.02413958	707
PC.aa.C36.0	0.00941039	-0.05627628	0.04686588	-0.09871822	-0.01383433	924
PC.aa.C38.3	0.94549041	0.00184324	0.94549041	-0.0510574	0.05474387	836
PC.aa.C38.4	0.31809328	-0.02569531	0.40645252	-0.07618204	0.02479143	836
PC.aa.C38.6	0.02100537	-0.07162357	0.05863456	-0.13242232	-0.01082483	836
PC.aa.C40.6	0.43717445	-0.02174118	0.47881011	-0.07663438	0.03315202	901
PC.ae.C40.0	0.00848188	-0.0722637	0.04686588	-0.12602549	-0.01850191	925
PC.ae.C40.6	0.01788838	-0.06278901	0.05863456	-0.11473274	-0.01084529	836
SM.a.C36.0	0.43613719	0.02512649	0.47881011	-0.03819402	0.08844699	643
SM.a.C42.4	0.43210987	-0.01953243	0.47881011	-0.06830983	0.02924498	865
SM.a.C42.6	0.0067854	-0.08495953	0.04686588	-0.1464062	-0.02351286	865
SM.a.C44.6	0.26234891	-0.03019421	0.34480143	-0.08303527	0.02264686	810

NEFA_24_5	0.60124187	0.02362259	0.64318898	-0.06510225	0.11234742	602
Carn.a.C3.0	0.79149475	0.00712881	0.80908352	-0.04577268	0.0600303	994
PC.aa.C32.3	0.34331538	-0.02347731	0.42682452	-0.07207626	0.02512164	868
PC.aa.C34.1	0.01018823	-0.065512	0.04686588	-0.11544851	-0.01557549	935
PC.aa.C36.1	0.20557567	-0.02935705	0.28656003	-0.07484038	0.01612627	924
PC.aa.C36.2	0.14056478	-0.03418045	0.22296483	-0.07966009	0.0112992	925
PC.aa.C36.3	0.13163521	-0.04100754	0.21625785	-0.09433915	0.01232407	936
PC.aa.C38.0	0.02353235	-0.05632118	0.05863456	-0.10504602	-0.00759635	867
PC.aa.C38.5	0.04551673	-0.04976004	0.09517134	-0.09852537	-0.00099471	836
PC.aa.C40.4	0.42473249	-0.02008291	0.47881011	-0.06943685	0.02927102	925
PC.aa.C40.5	0.73651314	-0.00890155	0.76999101	-0.0608115	0.04300839	836
PC.ae.C36.1	0.02075564	-0.05269837	0.05863456	-0.09734657	-0.00805017	925
PC.ae.C38.0	0.01163551	-0.05885532	0.04865757	-0.10454477	-0.01316587	925
SM.a.C38.1	0.01313568	-0.0612674	0.05035343	-0.10965778	-0.01287701	993
SM.a.C40.3	0.08831241	-0.05825458	0.16249483	-0.12526761	0.00875846	712
SM.a.C40.5	0.00434003	-0.07342387	0.04244896	-0.12381442	-0.02303332	877
NEFA_26_1	0.08513043	-0.05438939	0.16249483	-0.1163262	0.00754742	714

Triacylglycerol

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.1138274	0.08499625	0.1586685	-0.02039728	0.19038977	925
lyso.PC.a.C18.3	0.00431873	0.1689871	0.00866116	0.05309104	0.28488317	793
SM.a.C41.0	0.17722199	0.07324598	0.22033004	-0.03321496	0.17970692	776
PC.aa.C34.2	0.00369663	0.14358522	0.00809739	0.04676306	0.24040739	925
PC.aa.C34.3	0.00030486	0.17523792	0.00180113	0.08036503	0.2701108	925
PC.aa.C36.4	0.00111676	0.18002399	0.00366934	0.07198256	0.28806542	865
SM.a.C38.2	0.04955082	0.09266532	0.08140491	0.00018237	0.18514828	996
SM.a.C40.4	0.0018443	0.14999429	0.00472189	0.05573408	0.2442545	995
lyso.PC.a.C16.0	0.01328543	0.12341607	0.02546375	0.02578373	0.2210484	925
lyso.PC.a.C16.1	0.031938	0.09373688	0.0544129	0.00811	0.17936376	996
lyso.PC.a.C18.0	0.02148791	0.11960055	0.03953776	0.01768821	0.2215129	996
lyso.PC.a.C20.3	0.0748888	0.09846296	0.11112532	-0.0099067	0.20683261	853
lyso.PC.a.C20.4	0.14296577	0.07615229	0.18789787	-0.02578392	0.1780885	996
lyso.PC.a.C20.5	0.19268733	0.06430838	0.22727223	-0.03250523	0.16112199	920
lyso.PC.a.C22.5	0.36043705	0.05065964	0.38978751	-0.05800486	0.15932415	874
lyso.PC.a.C22.6	0.39235672	0.04057925	0.41019112	-0.05248229	0.13364079	939
lyso.PC.e.C18.0	0.78259255	0.01386012	0.78259255	-0.08468232	0.11240256	967
lyso.PC.e.C18.1	0.06042699	0.12203354	0.09265472	-0.00536317	0.24943025	707
PC.aa.C36.0	0.34414901	0.03992629	0.3861184	-0.04286135	0.12271393	924
PC.aa.C38.3	0.00027569	0.16671947	0.00180113	0.07713294	0.256306	836

PC.aa.C38.4	0.00072133	0.15843523	0.00335533	0.06681013	0.25006033	836
PC.aa.C38.6	0.13672474	0.08723885	0.18498053	-0.02771922	0.20219693	836
PC.aa.C40.6	0.14894392	0.0728372	0.19031723	-0.02612446	0.17179886	901
PC.ae.C40.0	0.27811957	0.0560332	0.31983751	-0.04530149	0.15736788	925
PC.ae.C40.6	0.58258333	0.028398	0.59552962	-0.07297938	0.12977538	836
SM.a.C36.0	0.00162804	0.18598155	0.00468062	0.07056963	0.30139347	643
SM.a.C42.4	0.0010475	0.15084971	0.00366934	0.06082083	0.24087859	865
SM.a.C42.6	0.1873986	0.07763277	0.22685093	-0.03785628	0.19312182	865
SM.a.C44.6	0.05864775	0.09539568	0.09265472	-0.00349641	0.19428777	810
NEFA_24_5	0.11240971	-0.13232397	0.1586685	-0.29578974	0.03114179	602
Carn.a.C3.0	0.03193572	0.10386546	0.0544129	0.00898762	0.1987433	994
PC.aa.C32.3	0.00024243	0.16747417	0.00180113	0.07828786	0.25666047	868
PC.aa.C34.1	8.70E-05	0.17650568	0.00180113	0.08862596	0.2643854	935
PC.aa.C36.1	1.77E-05	0.17643478	0.00081391	0.09618849	0.25668107	924
PC.aa.C36.2	0.00013368	0.16443371	0.00180113	0.08030414	0.24856327	925
PC.aa.C36.3	0.00031324	0.17868024	0.00180113	0.08175053	0.27560995	936
PC.aa.C38.0	0.36436659	0.04366715	0.38978751	-0.05076953	0.13810382	867
PC.aa.C38.5	0.00072942	0.15635028	0.00335533	0.06584831	0.24685226	836
PC.aa.C40.4	0.00329655	0.13249363	0.00758207	0.04424079	0.22074648	925
PC.aa.C40.5	0.00136673	0.14826344	0.0041913	0.05767435	0.23885252	836
PC.ae.C36.1	0.00262442	0.1279796	0.00635386	0.0447256	0.2112336	925
PC.ae.C38.0	0.0018477	0.13864253	0.00472189	0.05151065	0.22577441	925
SM.a.C38.1	0.00086804	0.15333515	0.00363	0.06325509	0.24341521	993
SM.a.C40.3	0.00109205	0.20637413	0.00366934	0.08281419	0.32993406	712
SM.a.C40.5	0.00020823	0.17605855	0.00180113	0.08328367	0.26883343	877
NEFA_26_1	0.00433058	0.1646378	0.00866116	0.05170729	0.27756831	714

Glucose

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.46548217	0.03054538	0.62205378	-0.05155629	0.11264706	925
lyso.PC.a.C18.3	0.42512938	0.03672946	0.60113072	-0.05362421	0.12708314	793
SM.a.C41.0	0.18319508	0.05535571	0.34252665	-0.0262144	0.13692581	776
PC.aa.C34.2	0.00121917	0.13088367	0.01869393	0.05171355	0.21005378	925
PC.aa.C34.3	0.00730879	0.10889977	0.05603406	0.02940322	0.18839631	925
PC.aa.C36.4	0.00656591	0.12321911	0.05603406	0.03446017	0.21197805	865
SM.a.C38.2	0.00070697	0.13017382	0.01626025	0.05498814	0.2053595	996
SM.a.C40.4	0.00063829	0.13527266	0.01626025	0.05778506	0.21276027	995
lyso.PC.a.C16.0	0.08025216	0.06893584	0.30763326	-0.00832156	0.14619324	925
lyso.PC.a.C16.1	0.85503307	-0.00649576	0.8740338	-0.07624782	0.06325629	996
lyso.PC.a.C18.0	0.12526925	0.06422868	0.34252665	-0.01791823	0.14637559	996

lyso.PC.a.C20.3	0.43124595	0.03403675	0.60113072	-0.0508034	0.1188769	853
lyso.PC.a.C20.4	0.54875457	0.02489558	0.67281469	-0.05655073	0.10634189	996
lyso.PC.a.C20.5	0.35573689	0.03519201	0.53726122	-0.03955643	0.10994046	920
lyso.PC.a.C22.5	0.57720082	-0.02357982	0.68080097	-0.10656555	0.0594059	874
lyso.PC.a.C22.6	0.82617829	0.00823247	0.86373185	-0.06531655	0.08178148	939
lyso.PC.e.C18.0	0.36206735	0.0364627	0.53726122	-0.04200899	0.1149344	967
lyso.PC.e.C18.1	0.92846294	0.00452825	0.92846294	-0.09446368	0.10352019	707
PC.aa.C36.0	0.11311768	0.05214272	0.34252665	-0.01238596	0.11667141	924
PC.aa.C38.3	0.7746683	0.01137141	0.82871492	-0.06657094	0.08931376	836
PC.aa.C38.4	0.17077128	0.0530021	0.34252665	-0.0228843	0.12888851	836
PC.aa.C38.6	0.07414145	0.08360729	0.30763326	-0.00817517	0.17538975	836
PC.aa.C40.6	0.54192395	0.02570166	0.67281469	-0.05697214	0.10837545	901
PC.ae.C40.0	0.18615579	0.05444027	0.34252665	-0.02631531	0.13519585	925
PC.ae.C40.6	0.22746627	0.04842842	0.38758351	-0.03027356	0.1271304	836
SM.a.C36.0	0.16213033	0.06369863	0.34252665	-0.02567543	0.15307269	643
SM.a.C42.4	0.13068517	0.05608357	0.34252665	-0.01667765	0.12884479	865
SM.a.C42.6	0.17581899	0.06331098	0.34252665	-0.0284052	0.15502716	865
SM.a.C44.6	0.66469833	-0.01710953	0.74985556	-0.09456571	0.06034664	810
NEFA_24_5	0.71128159	0.02248229	0.7790227	-0.096753	0.14171758	602
Carn.a.C3.0	0.66834952	-0.01687137	0.74985556	-0.09412826	0.06038552	994
PC.aa.C32.3	0.13330242	0.05468669	0.34252665	-0.01674485	0.12611822	868
PC.aa.C34.1	0.06619861	0.07202816	0.30451361	-0.00482785	0.14888418	935
PC.aa.C36.1	0.16301335	0.04761617	0.34252665	-0.01931839	0.11455074	924
PC.aa.C36.2	0.01760555	0.0840374	0.10123189	0.0146849	0.1533899	925
PC.aa.C36.3	0.02304951	0.09710197	0.11780858	0.01338842	0.18081553	936
PC.aa.C38.0	0.26806221	0.04112896	0.44038792	-0.03171078	0.11396869	867
PC.aa.C38.5	0.16301541	0.05321174	0.34252665	-0.02159305	0.12801652	836
PC.aa.C40.4	0.22749467	0.04466213	0.38758351	-0.02791855	0.11724281	925
PC.aa.C40.5	0.55580344	0.02295544	0.67281469	-0.0535008	0.09941168	836
PC.ae.C36.1	0.16438584	0.04704814	0.34252665	-0.01930392	0.1134002	925
PC.ae.C38.0	0.01398479	0.08763475	0.09190004	0.01778846	0.15748103	925
SM.a.C38.1	0.00374245	0.11048289	0.04303822	0.03587617	0.18508961	993
SM.a.C40.3	0.47330179	0.03595853	0.62205378	-0.06243644	0.13435351	712
SM.a.C40.5	0.14389093	0.0565296	0.34252665	-0.01931977	0.13237896	877
NEFA_26_1	0.3560959	0.04039323	0.53726122	-0.0454873	0.12627376	714

Systolic blood pressure

Analytes	P-Values	BETA	FDR P-Value	CI lower	CI upper	Number of observations
lyso.PC.a.C18.1	0.29329593	1.30517176	0.97122968	-1.13079101	3.74113452	925
lyso.PC.a.C18.3	0.02039483	3.12920467	0.62513218	0.4857732	5.77263614	793

SM.a.C41.0	0.13854627	-1.82382746	0.97122968	-4.23841686	0.59076195	776
PC.aa.C34.2	0.59822813	0.63429629	0.97122968	-1.72722837	2.99582094	925
PC.aa.C34.3	0.11981211	1.86435491	0.97122968	-0.48558884	4.21429866	925
PC.aa.C36.4	0.39450156	1.13287962	0.97122968	-1.47718357	3.7429428	865
SM.a.C38.2	0.95011599	-0.06969687	0.97122968	-2.2553358	2.11594206	996
SM.a.C40.4	0.02717966	2.52474893	0.62513218	0.28514836	4.76434949	995
lyso.PC.a.C16.0	0.15400032	1.66633968	0.97122968	-0.62582349	3.95850285	925
lyso.PC.a.C16.1	0.85921491	0.18184569	0.97122968	-1.82947169	2.19316307	996
lyso.PC.a.C18.0	0.73246689	0.41658764	0.97122968	-1.97415782	2.80733311	996
lyso.PC.a.C20.3	0.08771052	2.16746925	0.97122968	-0.32100821	4.65594672	853
lyso.PC.a.C20.4	0.17278812	1.64396042	0.97122968	-0.72068501	4.00860586	996
lyso.PC.a.C20.5	0.57117481	0.64312381	0.97122968	-1.58478893	2.87103655	920
lyso.PC.a.C22.5	0.92615472	-0.11777006	0.97122968	-2.61098256	2.37544244	874
lyso.PC.a.C22.6	0.38112012	0.95573633	0.97122968	-1.18480045	3.0962731	939
lyso.PC.e.C18.0	0.98557829	-0.02087754	0.98557829	-2.28688653	2.24513146	967
lyso.PC.e.C18.1	0.59979184	0.77127801	0.97122968	-2.11342963	3.65598565	707
PC.aa.C36.0	0.37399665	0.86807684	0.97122968	-1.04732643	2.78348011	924
PC.aa.C38.3	0.68392771	-0.46221287	0.97122968	-2.68993457	1.76550884	836
PC.aa.C38.4	0.62212847	0.55147242	0.97122968	-1.64406677	2.7470116	836
PC.aa.C38.6	0.58600691	0.74787205	0.97122968	-1.94637394	3.44211805	836
PC.aa.C40.6	0.92230325	0.11703695	0.97122968	-2.23739409	2.47146799	901
PC.ae.C40.0	0.91926231	0.1239062	0.97122968	-2.27445828	2.52227068	925
PC.ae.C40.6	0.65959169	-0.51812718	0.97122968	-2.8261463	1.78989194	836
SM.a.C36.0	0.23663156	1.61550479	0.97122968	-1.06258011	4.29358969	643
SM.a.C42.4	0.81475675	-0.254393	0.97122968	-2.38484456	1.87605856	865
SM.a.C42.6	0.65672393	-0.61278958	0.97122968	-3.31803751	2.09245834	865
SM.a.C44.6	0.75389071	-0.36464343	0.97122968	-2.64691377	1.91762691	810
NEFA_24_5	0.28600807	-2.04450443	0.97122968	-5.80459525	1.71558639	602
Carn.a.C3.0	0.75674185	-0.35215863	0.97122968	-2.58249531	1.87817804	994
PC.aa.C32.3	0.1380804	1.60896718	0.97122968	-0.51852531	3.73645967	868
PC.aa.C34.1	0.90347373	0.1356842	0.97122968	-2.05942674	2.33079515	935
PC.aa.C36.1	0.82371685	-0.22453545	0.97122968	-2.2021036	1.7530327	924
PC.aa.C36.2	0.88957608	0.14567464	0.97122968	-1.91290593	2.20425521	925
PC.aa.C36.3	0.75124138	-0.38792461	0.97122968	-2.78880049	2.01295128	936
PC.aa.C38.0	0.75226384	-0.34993121	0.97122968	-2.52508467	1.82522226	867
PC.aa.C38.5	0.89454539	0.14593887	0.97122968	-2.01441301	2.30629076	836
PC.aa.C40.4	0.76101131	-0.32959146	0.97122968	-2.45565213	1.79646921	925
PC.aa.C40.5	0.91264499	-0.12309462	0.97122968	-2.32485959	2.07867035	836
PC.ae.C36.1	0.63829601	-0.47154102	0.97122968	-2.43952681	1.49644477	925
PC.ae.C38.0	0.56116454	0.6112458	0.97122968	-1.45232037	2.67481196	925
SM.a.C38.1	0.56128813	0.64125766	0.97122968	-1.52416934	2.80668466	993
SM.a.C40.3	0.34046469	1.45030051	0.97122968	-1.53475635	4.43535736	712
SM.a.C40.5	0.61200137	0.56071994	0.97122968	-1.60821495	2.72965483	877
NEFA_26_1	0.92918623	-0.11750057	0.97122968	-2.71244687	2.47744574	714

Supplemental Table 7: Median, 25% and 75 % quartile for every metabolite (215) of the Raine Study metabolomics data set stratified by males, non-hormonal and hormonal contraceptive taking females.

Supplemental Table 7.1: Non-hormonal taking females.

Metabolites	Median	25% Quartile	75% Quartile
Carn	39.034	33.576	43.977
Carn.a.C10.0	0.273	0.185	0.372
Carn.a.C10.1	0.307	0.235	0.49
Carn.a.C12.0	0.092	0.058	0.126
Carn.a.C12.1	0.357	0.251	0.519
Carn.a.C14.0	0.034	0.025	0.052
Carn.a.C14.1	0.111	0.09	0.149
Carn.a.C14.2	0.02	0.014	0.03
Carn.a.C16.0	0.081	0.064	0.095
Carn.a.C16.1	0.037	0.026	0.049
Carn.a.C18.0	0.034	0.028	0.042
Carn.a.C18.1	0.099	0.08	0.119
Carn.a.C2.0	4.778	3.879	5.941
Carn.a.C3.0	0.348	0.28	0.429
Carn.a.C4.0	0.207	0.165	0.259
Carn.a.C4.0.DC	0.001	0.001	0.002
Carn.a.C5.0	0.145	0.107	0.203
Carn.a.C6.0	0.054	0.039	0.07
Carn.a.C8.1	0.122	0.083	0.162
lyso.PC.a.C14.0	1.921	1.477	2.508
lyso.PC.a.C16.0	74.599	65.999	92.594
lyso.PC.a.C16.1	3.073	2.532	3.832
lyso.PC.a.C18.0	21.564	17.859	24.943
lyso.PC.a.C18.1	21.751	17.529	25.747
lyso.PC.a.C18.2	39.504	30.028	47.332
lyso.PC.a.C18.3	0.789	0.586	1.013
lyso.PC.a.C18.6	0.291	0.253	0.36
lyso.PC.a.C20.2	0.215	0.17	0.278
lyso.PC.a.C20.3	2.174	1.714	2.695
lyso.PC.a.C20.4	6.523	5.331	8.002
lyso.PC.a.C20.5	0.75	0.54	1.001
lyso.PC.a.C22.5	0.56	0.478	0.694
lyso.PC.a.C22.6	1.554	1.279	2.017
lyso.PC.e.C16.0	0.938	0.747	1.106
lyso.PC.e.C18.0	1.581	1.299	1.916
lyso.PC.e.C18.1	0.361	0.302	0.455
PC.aa.C30.0	3.391	2.499	4.426
PC.aa.C30.1	2.195	1.73	2.894

PC.aa.C30.2	0.541	0.424	0.633
PC.aa.C32.0	12.81	10.873	14.735
PC.aa.C32.1	15.143	12.006	20.189
PC.aa.C32.2	3.586	2.637	4.398
PC.aa.C32.3	0.485	0.388	0.607
PC.aa.C34.0	2.786	2.255	3.499
PC.aa.C34.1	213.892	178.873	251.871
PC.aa.C34.2	390.29	346.152	448.067
PC.aa.C34.3	13.759	11.888	16.375
PC.aa.C34.4	1.765	1.321	2.14
PC.aa.C34.5	0.251	0.176	0.337
PC.aa.C36.0	1.477	1.196	1.887
PC.aa.C36.1	47.764	40.296	57.972
PC.aa.C36.2	254.507	226.537	306.406
PC.aa.C36.3	140.328	119.083	167.77
PC.aa.C36.4	164.72	141.652	192.815
PC.aa.C36.5	21.095	16.296	25.778
PC.aa.C36.6	0.778	0.598	1.015
PC.aa.C38.0	1.956	1.548	2.347
PC.aa.C38.1	0.633	0.507	0.77
PC.aa.C38.2	4.369	3.425	5.256
PC.aa.C38.3	41.905	34.038	52.764
PC.aa.C38.4	106.402	89.831	126.018
PC.aa.C38.5	57.518	49.288	67.362
PC.aa.C38.6	75.84	61.699	88.202
PC.aa.C40.0	0.418	0.332	0.497
PC.aa.C40.1	0.202	0.155	0.244
PC.aa.C40.3	0.238	0.182	0.302
PC.aa.C40.4	3.09	2.545	3.607
PC.aa.C40.5	11.84	10.015	14.339
PC.aa.C40.6	27.719	23.004	33.168
PC.aa.C42.0	0.417	0.35	0.488
PC.aa.C42.1	0.145	0.112	0.179
PC.aa.C42.2	0.077	0.064	0.102
PC.aa.C42.4	0.105	0.09	0.132
PC.aa.C42.5	0.241	0.188	0.279
PC.aa.C42.6	0.572	0.446	0.691
PC.aa.C43.4	0.188	0.154	0.231
PC.aa.C43.6	1.01	0.864	1.208
PC.aa.C44.12	1.129	0.896	1.381
PC.ae.C30.0	0.272	0.187	0.354
PC.ae.C30.1	0.682	0.516	0.837
PC.ae.C32.0	2.959	2.54	3.46
PC.ae.C32.1	2.953	2.484	3.497
PC.ae.C32.2	0.925	0.748	1.141

PC.ae.C34.0	1.551	1.257	1.875
PC.ae.C34.1	10.303	9.055	11.885
PC.ae.C34.2	11.819	10.255	13.833
PC.ae.C34.3	9.111	7.846	11.427
PC.ae.C34.4	0.226	0.172	0.308
PC.ae.C36.0	0.356	0.289	0.429
PC.ae.C36.1	3.654	2.987	4.38
PC.ae.C36.2	11.428	9.924	13.819
PC.ae.C36.3	8.295	7.122	10.035
PC.ae.C36.4	16.582	14.09	19.687
PC.ae.C36.5	11.427	9.679	13.821
PC.ae.C36.6	0.678	0.478	0.959
PC.ae.C38.0	1.807	1.435	2.182
PC.ae.C38.2	1.079	0.893	1.305
PC.ae.C38.3	3.366	2.895	4.084
PC.ae.C38.4	13.323	11.636	15.493
PC.ae.C38.5	17.863	15.092	19.977
PC.ae.C38.6	7.644	6.487	9.436
PC.ae.C40.0	11.237	8.88	13.177
PC.ae.C40.1	1.226	0.986	1.463
PC.ae.C40.2	0.97	0.811	1.186
PC.ae.C40.3	0.625	0.493	0.769
PC.ae.C40.4	1.743	1.518	2.105
PC.ae.C40.5	3.713	3.224	4.4
PC.ae.C40.6	4.818	4.196	5.715
PC.ae.C42.0	0.304	0.242	0.392
PC.ae.C42.1	0.202	0.166	0.25
PC.ae.C42.2	0.413	0.334	0.504
PC.ae.C42.3	0.71	0.548	0.874
PC.ae.C42.4	0.858	0.731	1.068
PC.ae.C42.5	2.294	1.918	2.692
PC.ae.C42.6	1.119	0.928	1.379
SM.a.C30.1	0.407	0.312	0.506
SM.a.C32.0	0.363	0.269	0.493
SM.a.C32.1	8.426	6.983	9.742
SM.a.C32.2	0.753	0.587	0.968
SM.a.C33.1	6.024	5.145	6.826
SM.a.C33.2	0.204	0.161	0.25
SM.a.C34.0	1.836	1.254	2.588
SM.a.C34.1	100.21	87.118	112.885
SM.a.C34.2	14.972	13.007	16.844
SM.a.C34.3	0.103	0.083	0.126
SM.a.C35.0	0.584	0.489	0.694
SM.a.C35.1	2.891	2.482	3.418
SM.a.C36.0	1.369	1.094	1.718

SM.a.C36.1	18.989	16.078	21.781
SM.a.C36.2	10.415	8.991	12.502
SM.a.C36.3	0.798	0.649	0.934
SM.a.C37.1	2.064	1.728	2.494
SM.a.C38.1	31.022	26.045	37.64
SM.a.C38.2	18.306	15.637	21.173
SM.a.C39.1	4.703	3.98	5.697
SM.a.C39.2	1.412	1.177	1.741
SM.a.C40.1	15.88	11.954	19.882
SM.a.C40.2	30.736	27.074	35.557
SM.a.C40.3	9.529	8.076	12.019
SM.a.C40.4	2.345	1.963	2.783
SM.a.C40.5	0.947	0.738	1.202
SM.a.C41.1	10.32	8.784	12.303
SM.a.C41.2	8.635	7.412	10.224
SM.a.C42.1	16.653	14.133	19.755
SM.a.C42.2	41.458	35.349	47.694
SM.a.C42.3	24.171	21.083	27.828
SM.a.C42.4	7.212	6.377	8.467
SM.a.C42.5	2.549	2.141	3.291
SM.a.C42.6	3.032	2.394	3.423
SM.a.C43.1	1.063	0.886	1.3
SM.a.C43.2	2.419	1.841	2.902
SM.a.C44.2	0.256	0.184	0.332
SM.a.C44.6	1.222	0.931	1.495
SM.a.C31.1	0.255	0.188	0.319
SM.a.C33.3	0.113	0.096	0.137
SM.a.C35.2	0.435	0.356	0.509
SM.a.C37.3	0.339	0.255	0.414
SM.a.C39.5	0.397	0.298	0.493
SM.a.C41.0	0.471	0.343	0.637
SM.a.C41.3	1.383	1.077	1.664
SM.a.C43.0	0.636	0.517	0.787
SM.a.C43.3	0.578	0.478	0.71
Ala	313	258	391
Arg	68.2	53.75	80.7
Asn	40.4	34.5	46.8
Asp	7.64	6.35	8.945
Cit	23.7	19.1	29.35
Gln	541	459	637
Glu	53.9	43.65	66.65
Gly	214	177	271
His	80.55	66.8	105
Ile	51.8	43.825	60.625
Leu	104	93.5	119

Lys	162	130	219
Met	23.6	19.9	26.8
Orn	46.6	38.1	59.8
Phe	51.1	45.4	57.2
Pro	150	116	194
Trp	97.6	61.05	118.5
Ser	108	82.45	131
Thr	133	101	193
Tyr	54	46.5	63.7
Val	188	162	222
NEFA_12_0	1.45	0.878	2.345
NEFA_14_0	4.965	2.542	9.323
NEFA_14_1	0.942	0.607	1.575
NEFA_15_0	0.736	0.424	1.17
NEFA_15_1	0.07	0.031	0.111
NEFA_16_0	43.45	28.375	69.625
NEFA_16_1	7.905	4.51	13.9
NEFA_17_0	1.275	0.81	1.865
NEFA_17_1	0.682	0.402	1.073
NEFA_18_0	14.85	9.547	20.925
NEFA_18_1	73.4	46.3	107
NEFA_18_2	22.2	13.4	31
NEFA_18_3	2.505	1.593	3.98
NEFA_20_1	0.626	0.377	0.894
NEFA_20_2	0.362	0.215	0.521
NEFA_20_3	0.439	0.304	0.588
NEFA_20_4	1.37	1.06	1.69
NEFA_22_6	0.876	0.627	1.21
NEFA_24_1	0.135	0.086	0.196
NEFA_12_1	0.19	0.102	0.348
NEFA_13_1	0.028	0.005	0.045
NEFA_14_2	0.02	-0.003	0.064
NEFA_16_2	0.111	0.063	0.174
NEFA_18_4	0.04	0.023	0.068
NEFA_19_0	0.133	0.092	0.192
NEFA_19_1	0.236	0.15	0.368
NEFA_20_5	0.24	0.152	0.317
NEFA_22_4	0.208	0.139	0.281
NEFA_22_5	0.364	0.248	0.522
NEFA_24_4	0.013	0.008	0.018
NEFA_24_5	0.015	0.009	0.022
NEFA_26_1	0.09	0.059	0.136

Supplemental Table 7.2: Hormonal taking females.

Metabolites	Median	25% Quartile	75% Quartile
Carn	32.328	26.801	38.32
Carn.a.C10.0	0.258	0.179	0.411
Carn.a.C10.1	0.296	0.22	0.392
Carn.a.C12.0	0.085	0.054	0.125
Carn.a.C12.1	0.331	0.207	0.536
Carn.a.C14.0	0.033	0.024	0.047
Carn.a.C14.1	0.114	0.086	0.135
Carn.a.C14.2	0.017	0.011	0.027
Carn.a.C16.0	0.072	0.057	0.087
Carn.a.C16.1	0.031	0.022	0.043
Carn.a.C18.0	0.028	0.02	0.036
Carn.a.C18.1	0.082	0.064	0.101
Carn.a.C2.0	4.224	3.44	5.176
Carn.a.C3.0	0.316	0.24	0.375
Carn.a.C4.0	0.224	0.168	0.287
Carn.a.C4.0.DC	0.001	0.001	0.002
Carn.a.C5.0	0.127	0.095	0.171
Carn.a.C6.0	0.046	0.032	0.067
Carn.a.C8.1	0.101	0.075	0.139
lyso.PC.a.C14.0	2.104	1.705	2.67
lyso.PC.a.C16.0	70.591	60.417	87.32
lyso.PC.a.C16.1	2.865	2.344	3.554
lyso.PC.a.C18.0	16.113	11.973	20.091
lyso.PC.a.C18.1	16.038	12.697	20.741
lyso.PC.a.C18.2	27.228	19.218	35.905
lyso.PC.a.C18.3	0.574	0.404	0.845
lyso.PC.a.C18.6	0.251	0.187	0.306
lyso.PC.a.C20.2	0.199	0.149	0.252
lyso.PC.a.C20.3	1.891	1.49	2.46
lyso.PC.a.C20.4	5.391	4.034	6.732
lyso.PC.a.C20.5	0.503	0.306	0.742
lyso.PC.a.C22.5	0.412	0.274	0.538
lyso.PC.a.C22.6	1.345	1.036	1.614
lyso.PC.e.C16.0	0.814	0.668	0.998
lyso.PC.e.C18.0	1.315	1.045	1.636
lyso.PC.e.C18.1	0.293	0.218	0.378
PC.aa.C30.0	4.352	3.259	6.117
PC.aa.C30.1	2.391	1.965	2.883
PC.aa.C30.2	0.533	0.438	0.653
PC.aa.C32.0	14.493	12.827	17.164
PC.aa.C32.1	20.586	15.726	29.224
PC.aa.C32.2	4.683	3.526	6.073

PC.aa.C32.3	0.52	0.415	0.65
PC.aa.C34.0	2.931	2.266	3.691
PC.aa.C34.1	254.683	215.828	300.232
PC.aa.C34.2	449.935	396.944	513.619
PC.aa.C34.3	16.061	13.242	19.586
PC.aa.C34.4	2.264	1.75	2.978
PC.aa.C34.5	0.243	0.177	0.314
PC.aa.C36.0	1.48	1.234	1.789
PC.aa.C36.1	46.121	38.677	54.367
PC.aa.C36.2	244.564	207.457	271.574
PC.aa.C36.3	167.813	143.826	202.318
PC.aa.C36.4	204.04	178.551	249.944
PC.aa.C36.5	22.275	17.085	27.09
PC.aa.C36.6	0.948	0.64	1.248
PC.aa.C38.0	1.977	1.583	2.375
PC.aa.C38.1	0.649	0.489	0.79
PC.aa.C38.2	5.064	3.984	6.109
PC.aa.C38.3	46.422	37.022	57.778
PC.aa.C38.4	111.528	94.41	127.453
PC.aa.C38.5	57.957	48.738	66.312
PC.aa.C38.6	90.391	72.298	113.238
PC.aa.C40.0	0.397	0.322	0.509
PC.aa.C40.1	0.198	0.157	0.247
PC.aa.C40.3	0.257	0.2	0.317
PC.aa.C40.4	3.166	2.624	3.739
PC.aa.C40.5	11.214	9.1	12.872
PC.aa.C40.6	28.409	22.266	35.958
PC.aa.C42.0	0.427	0.315	0.536
PC.aa.C42.1	0.152	0.121	0.198
PC.aa.C42.2	0.079	0.06	0.101
PC.aa.C42.4	0.119	0.095	0.145
PC.aa.C42.5	0.292	0.222	0.36
PC.aa.C42.6	0.608	0.467	0.79
PC.aa.C43.4	0.181	0.147	0.231
PC.aa.C43.6	0.995	0.806	1.231
PC.aa.C44.12	1.126	0.938	1.375
PC.ae.C30.0	0.303	0.233	0.394
PC.ae.C30.1	0.683	0.502	0.853
PC.ae.C32.0	3.053	2.641	3.626
PC.ae.C32.1	2.978	2.579	3.45
PC.ae.C32.2	0.945	0.751	1.14
PC.ae.C34.0	1.627	1.344	1.994
PC.ae.C34.1	10.917	9.672	12.497
PC.ae.C34.2	11.68	10.061	13.573
PC.ae.C34.3	9.01	7.589	10.398

PC.ae.C34.4	0.234	0.18	0.286
PC.ae.C36.0	0.362	0.284	0.433
PC.ae.C36.1	3.776	3.218	4.516
PC.ae.C36.2	11.355	9.875	13.649
PC.ae.C36.3	8.361	7.22	9.751
PC.ae.C36.4	16.85	14.603	19.189
PC.ae.C36.5	11.268	9.62	13.038
PC.ae.C36.6	0.559	0.388	0.778
PC.ae.C38.0	1.919	1.517	2.38
PC.ae.C38.2	1.09	0.882	1.253
PC.ae.C38.3	3.803	3.16	4.419
PC.ae.C38.4	14.22	12.042	15.752
PC.ae.C38.5	16.791	14.45	18.911
PC.ae.C38.6	7.517	6.256	9.186
PC.ae.C40.0	12.157	10.126	15.135
PC.ae.C40.1	1.217	0.98	1.445
PC.ae.C40.2	1.129	0.891	1.338
PC.ae.C40.3	0.64	0.539	0.759
PC.ae.C40.4	1.81	1.556	2.085
PC.ae.C40.5	3.605	3.074	4.116
PC.ae.C40.6	4.884	4.031	5.661
PC.ae.C42.0	0.422	0.306	0.534
PC.ae.C42.1	0.213	0.16	0.261
PC.ae.C42.2	0.395	0.326	0.468
PC.ae.C42.3	0.703	0.569	0.851
PC.ae.C42.4	0.884	0.706	1.019
PC.ae.C42.5	2.309	1.955	2.803
PC.ae.C42.6	1.11	0.867	1.327
SM.a.C30.1	0.442	0.333	0.533
SM.a.C32.0	0.39	0.292	0.536
SM.a.C32.1	8.664	7.467	10.048
SM.a.C32.2	0.735	0.629	0.859
SM.a.C33.1	5.755	4.958	6.541
SM.a.C33.2	0.183	0.155	0.221
SM.a.C34.0	2.001	1.573	2.588
SM.a.C34.1	97.688	86.858	107.891
SM.a.C34.2	14.279	12.709	15.836
SM.a.C34.3	0.097	0.081	0.119
SM.a.C35.0	0.555	0.454	0.647
SM.a.C35.1	2.726	2.348	3.126
SM.a.C36.0	1.688	1.306	2.015
SM.a.C36.1	19.116	16.406	21.758
SM.a.C36.2	9.737	8.485	11.269
SM.a.C36.3	0.751	0.643	0.868
SM.a.C37.1	2.031	1.694	2.492

SM.a.C38.1	35.666	30.281	43.117
SM.a.C38.2	19.953	17.281	22.729
SM.a.C39.1	4.951	4.16	5.673
SM.a.C39.2	1.382	1.109	1.731
SM.a.C40.1	18.037	13.793	21.835
SM.a.C40.2	32.113	27.967	36.507
SM.a.C40.3	12.407	9.837	14.673
SM.a.C40.4	2.854	2.465	3.519
SM.a.C40.5	1.055	0.813	1.281
SM.a.C41.1	11.22	9.116	12.915
SM.a.C41.2	8.842	7.547	9.989
SM.a.C42.1	18.824	15.972	21.711
SM.a.C42.2	46.702	38.496	52.929
SM.a.C42.3	25.776	22.031	29.425
SM.a.C42.4	7.547	6.377	8.885
SM.a.C42.5	3.133	2.432	3.913
SM.a.C42.6	3.723	2.952	4.689
SM.a.C43.1	1.072	0.9	1.264
SM.a.C43.2	2.551	2.079	3.109
SM.a.C44.2	0.258	0.206	0.316
SM.a.C44.6	1.275	0.987	1.677
SM.a.C31.1	0.252	0.208	0.306
SM.a.C33.3	0.115	0.092	0.138
SM.a.C35.2	0.384	0.329	0.453
SM.a.C37.3	0.32	0.251	0.395
SM.a.C39.5	0.396	0.286	0.503
SM.a.C41.0	0.533	0.402	0.707
SM.a.C41.3	1.346	1.132	1.682
SM.a.C43.0	0.674	0.53	0.865
SM.a.C43.3	0.608	0.497	0.718
Ala	307	242	387
Arg	57.9	47.4	70.35
Asn	41.9	36.45	49.15
Asp	7.98	6.78	9.52
Cit	19.3	14.7	24.4
Gln	470	393.5	560
Glu	51.2	38.8	64.1
Gly	160	133	206
His	86	70.675	112
Ile	48.55	40.1	55.45
Leu	98.6	86.4	115.5
Lys	156	124	196.5
Met	21.8	18.8	25.75
Orn	36.8	27.65	44.95
Phe	48.8	42.75	55.1

Pro	124	101	161
Trp	95	56.9	122
Ser	91.3	72.2	118
Thr	141	95.175	203.5
Tyr	45.3	36.4	53.9
Val	180	155.5	207.5
NEFA_12_0	1.65	0.975	2.8
NEFA_14_0	5.145	2.777	9.575
NEFA_14_1	1.115	0.608	1.688
NEFA_15_0	0.824	0.511	1.19
NEFA_15_1	0.069	0.04	0.119
NEFA_16_0	50.85	33.55	69.5
NEFA_16_1	9.18	5.35	14.9
NEFA_17_0	1.27	0.881	1.71
NEFA_17_1	0.711	0.455	1.04
NEFA_18_0	14.55	9.498	20.5
NEFA_18_1	79.4	49.475	115.5
NEFA_18_2	23.3	15.6	35.35
NEFA_18_3	2.745	1.835	4.15
NEFA_20_1	0.676	0.457	1.07
NEFA_20_2	0.43	0.265	0.618
NEFA_20_3	0.529	0.358	0.696
NEFA_20_4	1.47	1.11	1.97
NEFA_22_6	1.05	0.692	1.455
NEFA_24_1	0.142	0.088	0.196
NEFA_12_1	0.191	0.09	0.361
NEFA_13_1	0.02	0.003	0.041
NEFA_14_2	0.027	-0.001	0.071
NEFA_16_2	0.114	0.069	0.18
NEFA_18_4	0.038	0.02	0.063
NEFA_19_0	0.14	0.098	0.185
NEFA_19_1	0.254	0.165	0.376
NEFA_20_5	0.217	0.149	0.318
NEFA_22_4	0.221	0.156	0.301
NEFA_22_5	0.361	0.231	0.493
NEFA_24_4	0.015	0.011	0.025
NEFA_24_5	0.028	0.014	0.042
NEFA_26_1	0.082	0.05	0.138

Supplemental Table 7.3: Male subset.

Metabolites	Median	25% Quartile	75% Quartile
Carn	43.332	37.223	50.219
Carn.a.C10.0	0.269	0.204	0.38
Carn.a.C10.1	0.338	0.262	0.456
Carn.a.C12.0	0.104	0.081	0.145
Carn.a.C12.1	0.433	0.272	0.694
Carn.a.C14.0	0.04	0.031	0.052
Carn.a.C14.1	0.113	0.087	0.146
Carn.a.C14.2	0.022	0.015	0.033
Carn.a.C16.0	0.088	0.074	0.105
Carn.a.C16.1	0.034	0.025	0.046
Carn.a.C18.0	0.039	0.031	0.048
Carn.a.C18.1	0.102	0.082	0.127
Carn.a.C2.0	4.787	3.931	5.812
Carn.a.C3.0	0.42	0.344	0.528
Carn.a.C4.0	0.254	0.189	0.337
Carn.a.C4.0.DC	0.001	0.001	0.002
Carn.a.C5.0	0.189	0.138	0.26
Carn.a.C6.0	0.054	0.04	0.073
Carn.a.C8.1	0.106	0.074	0.154
lyso.PC.a.C14.0	2.111	1.594	2.754
lyso.PC.a.C16.0	82.756	71.75	99.261
lyso.PC.a.C16.1	3.229	2.686	3.929
lyso.PC.a.C18.0	21.782	18.213	25.75
lyso.PC.a.C18.1	23.796	19.589	28.722
lyso.PC.a.C18.2	43.987	35.956	53.638
lyso.PC.a.C18.3	0.91	0.707	1.184
lyso.PC.a.C18.6	0.298	0.249	0.35
lyso.PC.a.C20.2	0.24	0.184	0.296
lyso.PC.a.C20.3	2.802	2.334	3.454
lyso.PC.a.C20.4	8.364	6.769	9.91
lyso.PC.a.C20.5	0.9	0.708	1.233
lyso.PC.a.C22.5	0.717	0.587	0.865
lyso.PC.a.C22.6	1.744	1.381	2.201
lyso.PC.e.C16.0	0.98	0.803	1.191
lyso.PC.e.C18.0	1.705	1.447	2.107
lyso.PC.e.C18.1	0.422	0.345	0.515
PC.aa.C30.0	3.378	2.477	4.4
PC.aa.C30.1	2.014	1.555	2.522
PC.aa.C30.2	0.483	0.391	0.572
PC.aa.C32.0	12.461	10.865	14.091
PC.aa.C32.1	15.505	11.721	20.186
PC.aa.C32.2	3.165	2.388	4.173

PC.aa.C32.3	0.446	0.352	0.562
PC.aa.C34.0	2.726	2.034	3.416
PC.aa.C34.1	218.642	188.479	255.634
PC.aa.C34.2	363.064	319.581	420.708
PC.aa.C34.3	12.82	10.432	15.494
PC.aa.C34.4	1.815	1.36	2.215
PC.aa.C34.5	0.255	0.189	0.349
PC.aa.C36.0	1.467	1.157	1.785
PC.aa.C36.1	45.241	37.498	54.409
PC.aa.C36.2	235.602	201.663	265.509
PC.aa.C36.3	139.382	117.45	158.438
PC.aa.C36.4	170.961	147.072	200.908
PC.aa.C36.5	22.054	16.925	26.548
PC.aa.C36.6	0.774	0.559	0.957
PC.aa.C38.0	1.821	1.429	2.138
PC.aa.C38.1	0.59	0.47	0.727
PC.aa.C38.2	3.925	3.206	4.722
PC.aa.C38.3	41.645	33.132	50.582
PC.aa.C38.4	103.458	87.464	121.751
PC.aa.C38.5	56.335	48.648	65.04
PC.aa.C38.6	68.124	54.913	82.699
PC.aa.C40.0	0.374	0.29	0.449
PC.aa.C40.1	0.186	0.151	0.226
PC.aa.C40.3	0.231	0.18	0.283
PC.aa.C40.4	3.106	2.549	3.661
PC.aa.C40.5	11.544	9.489	13.765
PC.aa.C40.6	24.075	18.82	29.075
PC.aa.C42.0	0.351	0.278	0.444
PC.aa.C42.1	0.133	0.106	0.164
PC.aa.C42.2	0.075	0.059	0.093
PC.aa.C42.4	0.101	0.08	0.122
PC.aa.C42.5	0.207	0.168	0.255
PC.aa.C42.6	0.509	0.409	0.637
PC.aa.C43.4	0.163	0.132	0.202
PC.aa.C43.6	0.927	0.746	1.115
PC.aa.C44.12	1.044	0.852	1.257
PC.ae.C30.0	0.258	0.188	0.346
PC.ae.C30.1	0.576	0.45	0.77
PC.ae.C32.0	2.829	2.42	3.261
PC.ae.C32.1	2.76	2.321	3.172
PC.ae.C32.2	0.805	0.654	0.97
PC.ae.C34.0	1.569	1.262	1.852
PC.ae.C34.1	9.823	8.526	11.117
PC.ae.C34.2	10.747	9.083	12.499
PC.ae.C34.3	8.979	7.183	10.683

PC.ae.C34.4	0.229	0.175	0.303
PC.ae.C36.0	0.353	0.285	0.421
PC.ae.C36.1	3.769	3.068	4.509
PC.ae.C36.2	10.767	9.16	12.914
PC.ae.C36.3	7.943	6.704	9.33
PC.ae.C36.4	17.522	15.01	19.959
PC.ae.C36.5	12.594	10.58	14.58
PC.ae.C36.6	0.744	0.546	1.036
PC.ae.C38.0	1.689	1.366	2.032
PC.ae.C38.2	0.972	0.81	1.177
PC.ae.C38.3	3.319	2.801	3.897
PC.ae.C38.4	13.74	11.643	15.633
PC.ae.C38.5	17.729	15.481	20.221
PC.ae.C38.6	7.542	6.305	8.913
PC.ae.C40.0	9.901	7.971	11.624
PC.ae.C40.1	1.185	0.972	1.418
PC.ae.C40.2	0.876	0.709	1.052
PC.ae.C40.3	0.554	0.469	0.652
PC.ae.C40.4	1.711	1.44	1.955
PC.ae.C40.5	3.626	3.091	4.14
PC.ae.C40.6	4.535	3.821	5.248
PC.ae.C42.0	0.274	0.208	0.351
PC.ae.C42.1	0.2	0.158	0.247
PC.ae.C42.2	0.396	0.326	0.471
PC.ae.C42.3	0.612	0.504	0.735
PC.ae.C42.4	0.785	0.623	0.931
PC.ae.C42.5	2.09	1.721	2.473
PC.ae.C42.6	1.028	0.839	1.245
SM.a.C30.1	0.325	0.237	0.419
SM.a.C32.0	0.301	0.215	0.411
SM.a.C32.1	7.564	6.178	9.069
SM.a.C32.2	0.531	0.413	0.641
SM.a.C33.1	5.42	4.639	6.451
SM.a.C33.2	0.158	0.128	0.191
SM.a.C34.0	1.518	1.187	2.033
SM.a.C34.1	89.313	79.086	99.798
SM.a.C34.2	12.046	10.623	13.591
SM.a.C34.3	0.081	0.064	0.102
SM.a.C35.0	0.525	0.442	0.607
SM.a.C35.1	2.684	2.25	3.103
SM.a.C36.0	1.241	0.935	1.595
SM.a.C36.1	16.034	13.607	18.671
SM.a.C36.2	8.344	7.061	9.681
SM.a.C36.3	0.639	0.52	0.758
SM.a.C37.1	1.803	1.483	2.112

SM.a.C38.1	29.262	24.673	34.792
SM.a.C38.2	15.737	14.092	18.256
SM.a.C39.1	4.249	3.458	5.162
SM.a.C39.2	1.149	0.937	1.41
SM.a.C40.1	14.427	10.786	19.628
SM.a.C40.2	27.179	23.58	31.002
SM.a.C40.3	9.469	7.878	11.552
SM.a.C40.4	2.395	2.008	2.802
SM.a.C40.5	0.978	0.758	1.242
SM.a.C41.1	9.879	8.184	11.699
SM.a.C41.2	7.379	6.221	8.663
SM.a.C42.1	16.65	14.343	20.042
SM.a.C42.2	37.61	32.486	43.575
SM.a.C42.3	20.457	17.334	23.285
SM.a.C42.4	6.884	5.731	7.914
SM.a.C42.5	2.477	1.93	3.085
SM.a.C42.6	2.669	2.142	3.265
SM.a.C43.1	1.05	0.822	1.269
SM.a.C43.2	2.226	1.81	2.779
SM.a.C44.2	0.235	0.188	0.287
SM.a.C44.6	1.041	0.818	1.336
SM.a.C31.1	0.209	0.156	0.266
SM.a.C33.3	0.105	0.085	0.127
SM.a.C35.2	0.372	0.3	0.44
SM.a.C37.3	0.301	0.247	0.371
SM.a.C39.5	0.421	0.325	0.539
SM.a.C41.0	0.411	0.315	0.544
SM.a.C41.3	1.114	0.897	1.39
SM.a.C43.0	0.53	0.436	0.685
SM.a.C43.3	0.497	0.401	0.601
Ala	320.5	249	396.75
Arg	68.7	55.9	83.8
Asn	42.4	36.675	48.7
Asp	7.745	6.433	9.218
Cit	25.2	20.025	29.9
Gln	565.5	489	657
Glu	59.85	46.95	75.275
Gly	205	170	240
His	85.1	67.8	111
Ile	60.65	49.925	73.1
Leu	132	113	148
Lys	183	145.75	228
Met	25.9	22.2	30.3
Orn	51.7	42.075	61.8
Phe	55.65	49.55	62

Pro	170	129.25	224
Trp	115	72.15	150.75
Ser	93.95	71.625	117
Thr	135	89.45	192
Tyr	56.4	48.9	64.95
Val	223	191	256
NEFA_12_0	1.24	0.683	2.2
NEFA_14_0	5.05	2.43	9.055
NEFA_14_1	0.681	0.387	1.15
NEFA_15_0	0.719	0.428	1.14
NEFA_15_1	0.058	0.029	0.094
NEFA_16_0	44.05	31.525	67.725
NEFA_16_1	5.775	3.353	10.5
NEFA_17_0	1.3	0.935	1.902
NEFA_17_1	0.598	0.391	0.959
NEFA_18_0	14.8	9.898	23.125
NEFA_18_1	66.55	43.875	97.6
NEFA_18_2	19.8	13.725	28.5
NEFA_18_3	2.27	1.47	3.53
NEFA_20_1	0.579	0.378	0.833
NEFA_20_2	0.34	0.22	0.494
NEFA_20_3	0.458	0.34	0.634
NEFA_20_4	1.495	1.18	1.89
NEFA_22_6	0.829	0.612	1.21
NEFA_24_1	0.157	0.111	0.223
NEFA_12_1	0.121	0.053	0.261
NEFA_13_1	0.023	0.002	0.047
NEFA_14_2	0.017	-0.004	0.057
NEFA_16_2	0.089	0.051	0.133
NEFA_18_4	0.032	0.018	0.055
NEFA_19_0	0.152	0.101	0.2
NEFA_19_1	0.23	0.153	0.341
NEFA_20_5	0.243	0.164	0.342
NEFA_22_4	0.206	0.155	0.274
NEFA_22_5	0.362	0.261	0.497
NEFA_24_4	0.013	0.008	0.019
NEFA_24_5	0.012	0.007	0.022
NEFA_26_1	0.106	0.07	0.187