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Lipidomics-based investigation of its impact on the pathogenesis of coronary atherosclerosis: a Mendelian randomization study

Qun Wang^{1†}, Yuan Cao^{1†} and Lianqun Jia^{1*}

Abstract

Background Considerable attention has been devoted to investigating the association between lipid metabolites and cardiovascular diseases, particularly coronary atherosclerosis.

Methods A two-sample MR framework was used to investigate the relationship between lipid metabolites and the risk of coronary atherosclerosis. Two GWAS datasets were examined to take intersections of SNPs from 51,589 cases and 343,079 controls, and 14,334 cases and 346,860 controls to determine genetic susceptibility to coronary atherosclerosis. Random-effects inverse variance weighted (IVW) MR analyses were performed by a series of sensitivity assessments to measure the robustness of our findings and to detect any violations of MR assumptions.

Results Through IVW, MR-Egger and weighted median regression methods, we inferred that these six lipid metabolites: cholesterol levels, sterol ester (27:1/18:2) levels, triacylglycerol (52:4) levels, triacylglycerol (52:5) levels, diacylglycerol (18:1_18.2) levels, triacylglycerol (53:4), could directly impact the development of atherosclerosis.

Conclusion In conclusion, our study comprehensively illustrates a causal relationship between lipid metabolites and the risk of coronary atherosclerosis. Furthermore, cholesterol levels, sterol ester (27:1/18:2) levels, triacylglycerol (52:4) levels, triacylglycerol (52:5) levels, diacylglycerol (18:1_18.2) levels, and triacylglycerol (53:4) levels are positively correlated with the risk of coronary atherosclerosis. These six lipid metabolites have the potential as new predictors of the risk of atherosclerosis, providing new insights into the treatment and prevention of cardiovascular diseases.

Keywords Mendelian randomization, Lipid metabolism, Atherosclerosis, Intermediate analysis, Incidence of a disease

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Background

Cardiovascular disease (CVD) ranks as the foremost factor behind global mortality, with an annual toll of around 18 million deaths (31% of all deaths). Atherosclerotic coronary heart disease is the primary contributor to CVD deaths, responsible for nearly 45% of all cases [1]. Coronary atherosclerosis is a long-term refractory disease with a wide range of clinical manifestations, from an asymptomatic state to stable angina, acute coronary syndrome (ACS), heart failure (HF), and sudden cardiac death (SCD) [2]. The principal issues in atherosclerosis are the local deposition of fat within arteries and the



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development of smooth muscle cells and fibrous matrix, which promote the formation of atherosclerotic plaques over time [3]. Studies have shown that atherosclerosis is characterized by inflammatory responses and arterial lipid accumulation [4]. Inflammation is an important driver of atherosclerosis [5] and atherosclerosis is a chronic inflammatory response that increases the risk of cardiovascular disease [6]. Lipid metabolites, including cholesterol and triglycerides, play significant roles in the development of inflammatory responses and exacerbate diseases associated with chronic metabolic inflammation, such as atherosclerosis and obesity [7]. Therefore, we speculate that inflammatory responses and lipid accumulation directly affect the risk of atherosclerosis.

Recent studies have shown that lipid abnormalities such as cholesterol and triglycerides are implicated in the pathogenesis of atherosclerosis [8]. Lipid metabolites include many types, like cholesterol, triglycerides, and phosphatidylcholine. Phosphatidylcholine is the most abundant phospholipid in all types of mammalian cells and subcellular organelles [9]. One study examined the plasma levels of TMAO biomarkers in Ldlr-/- male mice after dietary phosphatidylcholine supplementation and concluded that dietary phosphatidylcholine supplementation could improve atherosclerosis in mice [10]. Cholesterol is the major sterol in mammals and significantly affects membrane fluidity, permeability, and signaling [11]. All cell membranes require cholesterol, so cholesterol metabolism and its circulating levels are crucial for atherosclerosis [12]. Recent epidemiological data suggest that triglycerides are a causal pathway in the pathogenesis of atherosclerosis.

The important role of lipid metabolism disorders in the pathogenesis of atherosclerosis has been unveiled [13]. However, which lipid metabolites matter most has not been concluded. Therefore, in this study, MR analyses were performed with lipid metabolites as the exposure factor and coronary atherosclerosis as the outcome to explore the potential causal relationship. We aim to provide a theoretical basis for further research on the complex mechanisms and clinical efficacy of lipid metabolites in the risk of atherosclerosis.

Methods

Experimental design

To elucidate the presumed causal relationship between lipid metabolites and atherosclerosis, a two-sample Mendelian randomization (MR) approach was used. Single nucleotide polymorphisms (SNPs) were used as instrumental variables (IVs). This SNP-centered approach reflects the principle of a randomized controlled trial and helps identify the causal relationship between exposure factors (lipid metabolites) and

Study design drawing

atherosclerotic outcomes.



Ethics and data use statement



Data were incorporated from previous studies that had been approved by the relevant institutional review board. Participants in the original study provided informed consent, so no further ethical review was required for this analysis. Nonetheless, we obtained an ethical statement from the institutional review board and ensured informed consent from all participants involved in the study.

Genetic instrument variants for exposure

Our analyses used 179 SNPs associated with lipid metabolite levels from the PMID37907536. SNPs were selected if $p < 5 \times 10^{-8}$, and SNPs were excluded if Maf<0.01 and F>10.

GWAS Summary Data for Atherosclerosis

We retrieved data from the FinnGen dataset (https:// gwas.mrcieu.ac.uk/datasets/finn-R10-I9/) and the UKb dataset (https://gwas.mrcieu.ac.uk/datasets/ukb-d-I9/)

using the keyword "Atherosclerosis". The FinnGen dataset included 161 exposures with $SNPs \ge 1$, and the combined GWAS summary data for AS could be found at finngen_ R10 I9 CORATHER, including 51,589 cases and 343,079 controls. The UKb dataset included 162 exposures with SNPs \geq 1, and the combined GWAS summary data for atherosclerosis could be found at ukb-d-I9 CORATHER, including 14,334 cases and 346,860 controls. Diagnostic criteria for atherosclerosis were based on a comprehensive assessment of glucose and lipids, calcium deposition on x-ray, and atherosclerotic plaques confirmed by arteriography, or Doppler ultrasound. Through IVW analysis (SNPs > 1) and Wald Ratio (SNP = 1) methods, we explored the potential causal relationship between the levels of each lipid metabolite and atherosclerosis. Also, each genetic marker surpassed the threshold for genomewide significance (P < 0.001), indicating robust instrument strength (F-statistic > 10).

Screening of IVs

The process of screening SNPs was meticulous attention to detail. Initially, SNPs closely associated with atherosclerosis were selected, with a genome-wide significance threshold of $P < 5 \times 10^{-8}$. To ensure SNP independence and minimize the influence of linkage disequilibrium (LD), a stringent r² of 0.01 was implemented within a 10,000 kb range. This step was essential to reduce the potential bias from LD. Additionally, the relationship between (IVs and the exposure was quantified using the F-statistic for each SNP, with IVs exhibiting an F-statistic > 10 indicating unbiased estimates.

Statistical analysis

The primary method was the inverse variance-weighting (IVW) approach, which was predicated on the assumption that all SNPs were valid IVs, thus providing the most accurate estimates. If any SNP did not conform to the IV assumption, a modified version known as the randomeffects IVW method was utilized. This method adjusted each estimate based on its standard error, thereby accounting for potential heterogeneity. The weighted median approach required that at least 50% of SNPs are valid to maintain the integrity of the IV assumption. The SNPs were ranked according to their weights and the experimental outcomes were examined to determine the median of the corresponding distribution. Furthermore, the MR-Egger regression, independent of the absence of pleiotropic effects, was used to derive an effect estimate. The intercept from the MR-Egger regression was used to evaluate the pleiotropic effect, with a non-significant deviation from zero indicating no directional pleiotropic bias.

Sensitivity analysis

The random-effects IVW method was the cornerstone of our analysis of the causal links between atherosclerosis and lipid metabolites. This method synthesized the Wald ratio estimates for each SNP to obtain a causal estimate for each risk factor, yielding reliable estimates in the absence of pleiotropy. Sensitivity analyses were conducted to confirm the associations. The weighted median method was employed, which required only half of SNPs to be valid instruments, and the MR-Egger approach was utilized to accommodate a non-zero intercept, indicating pleiotropy. The MR-PRESSO test was employed to identify potential outliers, with adjustments made by excluding such SNPs. If, The IVW-MR estimates were considered robust if the adjusted effect was consistent with the uncorrected effect. However, in case of significant discrepancies, the adjusted effects should be prioritized, as they may be less biased and better reflect the true relationship.

A two-stage MR analysis was performed to evaluate the mediating effects. The first stage used a genetic instrument of the lipid metabolites to estimate the causal effect of the exposure on the mediator. The second stage employed genetic instruments of the mediator to ascertain the causal effect on the risk of atherosclerosis.

The causal effects of lipid metabolites on the risk of atherosclerosis were described using odds ratios (ORs), beta coefficients (β), and 95% confidence intervals (CIs). MR and sensitivity analyses were performed using R software (version 4.2.1) and the "TwoSampleMR" package (version 0.5.6). In the univariate MR analyses, a *P*-value of < 3.11 × 10[^]-4 (FinnGen dataset) or a *P*-value of < 3.09 × 10[^]-4 (UKb dataset) (adjusted for multiple comparisons as 0.05 divided by the number of exposures and outcomes) implied a statistically significant causal relationship.

Results

MR Analysis: the role of lipid metabolites in atherosclerosis (FinnGen dataset)

Fourteen out of 161 exposures with a P < 0.001 were found. By applying IVW analyses and weighted median methods, we explored potential causal associations between lipid metabolite levels and atherosclerosis. In the Finn database, the IVW methods unveiled significant associations, implying that elevated levels of lipid metabolites may increase the risk of atherosclerosis. The influence of each lipid metabolite on the risk of atherosclerosis is represented in the volcano plot (Fig. 1) and detailed data can be found in Table 1. The *P*-value for exposure to 14 lipid metabolites on the risk of atherosclerosis was less than 0.001, as shown by a forest plot (Fig. 2).

MR Analysis: the role of lipid metabolites in atherosclerosis (UKb dataset)

Thirteen out of 162 Exposures were found to have a P < 0.001. By applying (IVW analyses and weighted median methods, we explored potential causal associations between lipid metabolite levels and atherosclerosis. In the UKb database, the IVW methods revealed notable associations, implying that elevated levels of lipid metabolites may increase the risk of atherosclerosis. The influence of each lipid metabolite on atherosclerosis risk is graphically represented in the volcano plot (Fig. 3) and detailed data can be found in Table 2. The *P* value for exposure to 13 lipid metabolites for atherosclerosis risk was ≤ 0.001 , as represented by a forest plot (Fig. 4).

Identifying key potential lipid metabolites in atherosclerosis

After the crossover of the ADJUSTED < 0.05 fraction of differential lipid metabolites in the above two datasets, we identified six crossover levels of lipid metabolites that affect the risk of atherosclerosis. Finn database:

Cholesterol levels (WR, OR=2. 310; P=2.063*10-5; [95% CI: 1.970–2.700]), Sterol ester (27:1/18:2) levels (IVW, OR=1. 410; P=8.977*10-5; [95% CI: 1.210–1.630]), Triacylglycerol (52:4) levels (IVW, OR=1. 270; P=9.434*10-5; [95% CI: 1.140–1.410]), Triacylglycerol (52:5) levels (IVW, OR=1. 340; P=4.603*10-5; [95% CI: 1.160–1.540]), Diacylglycerol (18:1_18:2) levels (IVW, OR=1. 220; P=5.797*10-5; [95% CI: 1.110–1.350]),

UKb database: Cholesterol levels (WR, OR=1.030; P=8.444*10-5; [95% CI: 1.020-1.040]), Sterol ester (27:1/18:2) levels (IVW, OR=1.010; P=7.102*10-5; [95% CI: 1.010-1.020]), Triacylglycerol (52:4) levels (IVW, OR=1.010; P=0.006*10-5; [95% CI: 1.00-1.010]), Triacylglycerol (52:5) levels (IVW, OR=1.010; P=2.088*10-5; [95% CI: 1.00-1.010]), Diacylglycerol (18:1_18:2) levels (IVW, OR=1.010; P=1.678*10-5; [95% CI: 1.010-1.010]), Triacylglycerol (53:4) levels (IVW, OR=1.010; P=1.776*10-5; [95% CI: 1.000-1.010]). Detailed information is in Fig. 5, Table 3.

Verification of MR Presumptions

In our study, SNPs were selected based on the genomewide significance threshold (p < 0.001) in these analyses and no directional pleiotropy was noticed, suggesting that the second MR assumption was not violated (p > 0.05, Table 3). Additionally, the MR heterogeneity test showed no heterogeneity in most of our positive outcomes (p > 0.05, Table 3). In summary, the rigorous assessment of the three fundamental assumptions in MR analysis suggested that the selected SNPs were appropriate as genetic instruments, and the relationships between genetically predicted lipid metabolites and atherosclerosis were not influenced by potential confounders or mediators.



Fig. 1 Volcano Plot of Lipid on Coronary Atherosclerosis (Finngen dataset). Note: The horizontal coordinate represents the relative risk of atherosclerosis and the vertical coordinate represents the *p*-value

No Method nSNP OR(95%CI) P value Exposure 1 Cholesterol levels WR 1 2.31(1.97-2.70) 2.06E-25 2 IVW 2 Triacylglycerol (58:8) levels 1.53(1.39-1.67) 9.10E-19 Diacylglycerol (16:0_18:1) levels 3 WR 1 1.59(1.42-1.78) 2.07E-15 4 Diacylglycerol (16:0_18:2) levels WR 1 1.46(1.33-1.61) 2.07E-15 5 WR Diacylglycerol (18:1_18:3) levels 1 1.65(1.46-1.87) 2.07E-15 2 6 Sterol ester (27:1/14:0) levels IVW 1.50(1.35-1.66) 7.40E-15 7 Phosphatidylcholine (O-17:0_17:1) levels WR 1 0.69(0.60-0.79) 1.69E-07 8 Sterol ester (27:1/18:2) levels IVW 9 1.41(1.21-1.63) 8.98E-06 9 7 Triacylglycerol (52:4) levels IVW 1.27(1.14-1.41) 9.43E-06 10 Sterol ester (27:1/17:1) levels W/R 1 1.43(1.21-1.69) 2.03E-05 IVW 4 11 Triacylglycerol (52:5) levels 1.34(1.16 - 1.54)4.60E-05 12 Diacylglycerol (18:1_18:2) levels IVW 6 5.80E-05 1.22(1.11-1.35) 13 Triacylglycerol (53:4) levels IVW 4 1.32(1.15 - 1.51)7.48E-05 7 14 Sterol ester (27:1/18:0) levels IVW 1.34(1.15-1.56) 0.000136624 15 IVW 6 Triacylglycerol (52:3) levels 1.24(1.10-1.39) 0.000367859 16 Phosphatidylcholine (16:0_20:3) levels IVW 2 0.89(0.84-0.95) 0.00041228 17 Triacylglycerol (54:4) levels IVW 6 1.25(1.10-1.41) 0.000512616 18 Phosphatidylcholine (O-18:0_16:1) levels WR 1 0.80(0.70-0.91) 0.000555411 6 19 Triacylglycerol (51:3) levels IVW 1.30(1.12-1.51) 0.000580395 20 Triacylglycerol (50:1) levels IVW 3 1.45(1.17 - 1.79)0.00058479 21 Sterol ester (27:1/18:1) levels IVW 6 1.59(1.19-2.11) 0.00150153 IVW 3 22 Phosphatidylcholine (18:0_20:3) levels 0.91(0.86-0.97) 0.00231212 23 Triacylglycerol (53:2) levels IVW 2 1.35(1.11-1.64) 0.002801806 9 24 IVW Sterol ester (27:1/16:0) levels 1.30(1.09-1.56) 0.003863431 25 Sterol ester (27:1/20:2) levels IVW 3 1.24(1.07 - 1.44)0.003953403 26 Triacylglycerol (50:3) levels IVW 3 1.31(1.09-1.58) 0.004007562 27 Triacylglycerol (52:2) levels IVW 4 1.34(1.10-1.64) 0.004200314 28 Triacylglycerol (54:5) levels IVW 4 1.30(1.09-1.56) 0.004384377 IVW 7 29 Sphingomyelin (d34:1) levels 1.30(1.08-1.57) 0.006416098 30 Triacylglycerol (51:4) levels IVW 2 1.32(1.07-1.63) 0.009523203 3 31 Triacylglycerol (50:4) levels IVW 1.30(1.06-1.58) 0.009925336 32 Triacylglycerol (53:3) levels IVW 6 0.009998098 1.23(1.05-1.45) 33 Phosphatidylcholine (O-16:2_18:0) levels IVW 2 1.09(1.02-1.16) 0.0100131 5 34 Triacylglycerol (56:7) levels IVW 1.29(1.06-1.56) 0.010074157 35 Triacylglycerol (50:5) levels IVW 3 1.31(1.07 - 1.62)0.010359191 5 36 Diacylglycerol (18:1_18:1) levels IVW 1.20(1.04-1.39) 0.011355585 IVW 37 Triacylglycerol (54:3) levels 4 1.25(1.04-1.51) 0.017438794 38 Sphingomyelin (d42:2) levels IVW 9 0.018204147 1.30(1.05 - 1.61)39 IVW 2 Triacylglycerol (51:2) levels 1.35(1.05 - 1.74)0.018830444 40 Phosphatidylethanolamine (16:0_20:4) levels IVW 5 1.03(1.01 - 1.06)0.020840435 41 Triacylglycerol (52:6) levels IVW 4 1.25(1.03-1.50) 0.022170992 Phosphatidylcholine (16:0_16:1) levels 42 WR 0.024598158 1 1.18(1.02-1.37) 43 Phosphatidylcholine (16:1_18:0) levels WR 1 1.18(1.02-1.37) 0.024598158 44 Triacylglycerol (46:2) levels WR 1 1.17(1.02-1.35) 0.024598158 45 Triacylglycerol (54:6) levels IVW 3 1.28(1.02-1.61) 0.032887895 IVW 4 46 Triacylglycerol (54:7) levels 1.28(1.02-1.61) 0.035398945 47 Diacylglycerol (16:1_18:1) levels IVW 2 1.43(1.01-2.04) 0.045686665 2 48 Phosphatidylcholine (16:0_18:1) levels IVW 1.12(1.00-1.25) 0.047744613 49 Phosphatidylethanolamine (O-18:2_18:2) levels WR 1 1.10(1.00-1.21) 0.05910026

Table 1 Finngen dataset of lipid metabolites on atherosclerosis risk

Table 1 (continued)

Description Tracylglyceol (568) levels WW S 125099-132 0.0001009-122 0.0001009-123 0.0001009-123 51 Storol estar (227/17.0) levels WW 2 1.10099-123 0.0001009-123 53 Storol estar (227/17.0) levels WW 2 1.26008-129 0.000945021 54 Storol estar (227/17.0) levels WW 2 1.35007-1.81 0.000945021 55 Thocydgiveen (602) levels WW 2 1.35007-1.81 0.000955021 57 Thocydgiveen (622) levels WW 2 1.35007-1.81 0.000955021 58 Phocyhatidylebtanolamine (16.1.82) levels WW 2 1.350091-1.98 0.01203521 61 Thocydgiveen (48.3) levels WW 2 1.360091-1.98 0.1120092-1.10 0.11202371 61 Thocydgiveen (48.3) levels WW 2 1.360091-1.98 0.100093-1.10 0.12120014 63 Thocydgiveen (16.3) levels WW 3 1.40091-1.91 0.12120114 64 Phocphatadiyhonistin (16.1, 0.12114	No	Exposure	Method	nSNP	OR(95%CI)	P value
Splingenrygeling (d3:61) levels WW 9 1.15(209-12) 0.00103029 52 Phosphatidy(choline (16.0_00) levels MW 2 1.10(0.99-122) 0.09525621 53 Sterol ester (72:1/103) levels MW 2 1.26(0.98-1.87) 0.00737175 54 Sterol ester (72:1/103) levels MW 2 1.26(0.97-1.87) 0.00737175 55 Triacy(g)recel (49.2) levels MW 2 1.26(0.97-1.17) 0.00887169 57 Triacy(g)recel (49.2) levels MW 2 1.26(0.97-1.11) 0.007875732 58 Phospharddy(chandamine (16.0_1.18.2) levels MW 2 1.37(0.91-1.98) 0.01703971 59 Priospharddy(chandamine (16.0_1.8.2) levels MW 3 0.07(0.93-1.01) 0.14720 (67) 61 Tricy(g)recel (66.0) levels MW 3 1.04(0.09-1.02) 0.14720 (67) 62 Triospharddy(chanic (16.0_1.8.1) levels NW 3 1.02(0.92-1.02) 0.1260244 64 Phospharddy(chanic (16.0_1.8.1) levels NW 3 1.02(0.92-1.02)	50	Triacylglycerol (56:8) levels	IVW	5	1.25(0.99–1.58)	0.060719079
52 Prosphate/phone (6.0, 200 (ovels) IVW 2 1.10(099-1.24) 0.069346504 53 Sterol exter (27.1/7.0) levels IVW 2 1.36(0.9=1.68) 0.069346504 55 Tritoc/glycerol (50.2) levels IVW 2 1.35(0.9=1.14) 0.027572305 56 Prosphate/sthanolamine (18.1, 18.1) levels IVW 2 1.41(0.9=1.14) 0.039752305 57 Tritoc/glycerol (6.2) levels IVW 2 1.41(0.9=1.16) 0.016235712 58 Phosphate/sthanolamine (18.1, 18.2) levels IVW 2 1.35(0.9=1.10) 0.016225712 61 Tritoc/glycerol (6.2) levels IVW 2 1.43(0.08=2.3) 0.12263021 62 Tritoc/glycerol (6.2) levels IVW 2 1.43(0.08=1.0) 0.12624054 63 Tritoc/glycerol (6.2) levels IVW 3 1.04(0.9=-1.0) 0.1264285 64 Phosphate/shinostru (1.60, 1.8.1) levels IVW 3 1.04(0.9=-1.0) 0.1264286 65 Phosphate/shinostru (1.60, 1.8.1) levels IVW 3 1.0	51	Sphingomyelin (d36:1) levels	IVW	9	1.15(0.99-1.32)	0.061033083
51 Sterol ester (27.1/7.6) levels IVW 2 136(039-12.0) 0.007317159 54 Tracylghycard (50.2) levels IVW 7 1.060.09-1.24) 0.071317159 55 Phosphatidylethanolamine (18.1_18.1) levels IVW 7 1.060.09-1.14) 0.00857195 57 Tracylghycard (40.1_16.2) levels IVW 2 1.470.09-1.16) 0.106255712 58 Phosphatidylechanolamine (16.0, 1821 levels IVW 2 1.363.001-1.38) 0.106255712 61 Tracylghycard (44.3) levels IVW 2 1.363.001-1.38) 0.113224524 61 Sphingomycalin (32.1) levels IVW 3 0.970.033.101 0.147271677 63 Tracylghycard (44.2) levels IVW 3 1.040.09-1.09 0.16716428 64 Phosphatidylinostid (16.0, 18.1) levels IVW 3 1.040.09-1.09 0.16726428 65 Tracylghycard (44.2) levels IVW 3 1.040.09-1.09 0.16605064 66 Sphingomyelin (44.20 levels IVW 3 1.040.09-1.13	52	Phosphatidylcholine (16:0_0:0) levels	IVW	2	1.10(0.99-1.22)	0.069255821
54 Sterol ester (2)://18.3) levels VW 5 1110.997-18.40 007137159 55 Phisphatidylethanolamine (18.1_18.1) levels VW 2 1.35(0.97-1.87) 0.077572305 50 Phisphatidylethanolamine (18.1_18.2) levels VW 2 1.41(0.97-1.87) 0.028387/18 51 Phisphatidylethanolamine (16.1_16.2) levels VW 2 1.35(0.97-1.18) 0.03122462 61 Shipogravelin (43.2) levels VW 3 0.971038-1.01) 0.147271677 62 Triacyldylecrol (50.4) levels VW 3 1.19(0.97-1.19) 0.16126324 63 Phisphatidylinastol (16.0_18.1) levels VW 3 1.04009-1.019 0.1662046 64 Phisphatidylinastol (16.0_18.2) levels VW 3 1.04009-1.019 0.16602464 65 Phisphatidylinastol (16.0_18.2) levels VW 3 0.04009-1.019 0.22337920 66 Phisphatidylinastol (16.0_18.1) levels VW 3 0.04009-1.10 0.22337920 70 Phisphatidylethanolamine (18.0_18.2) levels VW	53	Sterol ester (27:1/17:0) levels	IVW	2	1.36(0.98-1.89)	0.069346504
55 Triacylghycord (502) [evels IVW 2 135007-1187 0.07722305 56 Phosphatidylethanolamine (18.1_18.1) [evels IVW 7 1.66(0.99-1.14) 0.080867196 57 Triacylghycerol (42.2) [evels IVW 6 1.05(0.09-1.16) 0.080867196 59 Phosphatidylcholine (16.1_18.2) [evels IVW 6 1.05(0.09-1.16) 0.1016255712 60 Triacylghycerol (48.3) [evels IVW 2 1.35(0.91-1.98) 0.131224652 61 Sphingomyelin (32.21) [evels IVW 2 1.0700.97-1.19) 0.15725021 62 Triacylghycerol (54.4) [evels IVW 2 1.070.97-1.19) 0.16764422 63 Sphingomyelin (34.20) [evels IVW 3 1.04(0.99-1.08) 0.12790298 64 Prosphatidylinositol (16.0_18.2) [evels IVW 3 1.04(0.99-1.08) 0.12790298 65 Sphingomyelin (34.20) [evels IVW 3 0.70825.116) 0.228370302 70 Prosphatidylinositol (16.0_18.2) [evels IVW 3 0.80805-1.	54	Sterol ester (27:1/18:3) levels	IVW	5	1.11(0.99-1.24)	0.071317159
56 Phosphatidylenhanolamine (18.1.16.1) levels NW 7 1.06(0.95.2.10) 0.08075195 57 Triacylglycstol (49.2) levels NW 2 1.41(0.95.2.10) 0.0807558732 58 Phosphatidylethanolamine (10.0.18.2) levels NW 2 1.35(0.91-1.01) 0.0915/0398 50 Triacylglycstol (48.3) levels NW 2 1.35(0.91-1.03) 0.147871677 61 Sphingornyelin (32.1) levels NW 3 0.97(0.93.101) 0.147871677 62 Triacylglycstol (16.0.181) levels NW 3 1.49(0.93-1.52) 0.161660264 65 Phosphatidylinostol (16.0.181) levels NW 3 1.36(0.97-1.19) 0.16716428 66 Sphingornyelin (34.01) levels NW 3 1.36(0.97-1.19) 0.16706326 67 Triacylglycetol (6.0.10) levels NW 3 1.36(0.97-1.18) 0.2407213 68 Phosphatidylinostol (16.0.182) levels NW 10 1.660056-1.16) 0.2407203 70 Phosphatidylinostol (18.0.182) levels NW 1 <	55	Triacylglycerol (50:2) levels	IVW	2	1.35(0.97-1.87)	0.077572305
57 Triacylglycerol (49.2) levels IVW 2 1.10(0.95-2.10) 0.0887588732 58 Phosphatidy/chanamie (16.0_18.2) levels IVW 6 1.05(0.95-1.10) 0.013(22452) 59 Phosphatidy/chanie (0-16.1_16.0) levels WW 2 1.35(0.91-1.98) 0.13(22452) 60 Triacylg yccrol (48.3) levels WW 2 1.35(0.91-1.98) 0.13(22452) 61 Sphingomyelin (43.2) levels WW 2 1.36(0.93-1.52) 0.162150321 62 Triacylg yccrol (48.1) levels WW 3 1.19(0.93-1.52) 0.162150321 64 Phosphatidy/inostol (16.0_18.1) levels WW 3 1.03(0.93-1.02) 0.167060346 65 Sphingomyelin (43.40) levels WW 3 1.03(0.93-1.02) 0.17209996 66 Sphingomyelin (43.10) levels WW 3 0.7(0.97-1.13) 0.23431811 71 Phosphatidy/Inostol (18.0_18.1) levels WW 6 1.06(0.95-1.16) 0.23609656 72 Phosphatidy/Inostol (18.1_18.1) levels WW 6 1.08	56	Phosphatidylethanolamine (18:1_18:1) levels	IVW	7	1.06(0.99-1.14)	0.080867196
58 Phosphatidylectanalamine (160_182) levels NW 6 1.05(0.9-1.1) 0.09157089 59 Phosphatidylectal (483) levels WR 1 1.07099-1.16) 0.010235712 61 Sphingomyelin (432.1) levels WW 2 1.35(0.91-1.9) 0.11322452 61 Sphingomyelin (432.1) levels WW 2 1.43(0.88-2.3) 0.115(0.510321 62 Triac/glycerci (46.0) levels WW 3 1.01(0.97-1.19) 0.1167(0.428) 64 Phosphatidylinostol (160_1.18.2) levels WW 3 1.03(0.99-1.09) 0.11703098 65 Phosphatidylinostol (160_1.18.2) levels WW 3 1.03(0.99-1.10) 0.11703098 66 Phosphatidylinostol (160_1.18.2) levels WW 3 0.26(0.95-1.16) 0.22379302 70 Phosphatidylinostol (160_1.18.2) levels WW 3 0.06(0.95-1.10) 0.22609866 72 Phosphatidylinostol (180_1.18.2) levels WW 3 0.04(0.97-1.13) 0.224379312 74 Phosphatidylinostol (181_18.2) levels WW 3 <td>57</td> <td>Triacylglycerol (49:2) levels</td> <td>IVW</td> <td>2</td> <td>1.41(0.95-2.10)</td> <td>0.087558732</td>	57	Triacylglycerol (49:2) levels	IVW	2	1.41(0.95-2.10)	0.087558732
59 Phosphatidycholine (D-16.1_60) levels WR 1 1.70(0.9-1.16) 0.10623712 60 Triacy(g)ycer(148.3) levels IVW 2 1.33(0.91-1.38) 0.11722462 61 Sphingomyelin (132.1) levels IVW 3 0.97(0.93-1.01) 0.11722462 62 Triacy(g)ycerol (16.0) levels IVW 3 1.19(0.93-1.52) 0.162150321 63 Triacy(g)ycerol (16.0) levels IVW 3 1.04(0.09-1.00) 0.16260344 64 Phosphatidy(inositol (16.0_1.18.1) levels IVW 3 1.04(0.09-1.00) 0.16260344 65 Phosphatidy(inositol (16.0_1.18.2) levels IVW 3 1.04(0.09-1.00) 0.16260344 66 Sphingomyelin (18.0_1.18.2) levels IVW 3 0.76053-1.10 0.224879302 70 Phosphatidy(inositol (18.0_1.18.1) levels IVW 3 0.2605-1.20 0.24655044 71 Phosphatidy(inositol (18.0_1.18.1) levels IVW 3 1.04(0.97-1.11) 0.224098565 74 Phosphatidy(inositol (18.0_1.18.1) levels IVW 3	58	Phosphatidylethanolamine (16:0_18:2) levels	IVW	6	1.05(0.99-1.11)	0.091570989
60 Triacylghcerol (48.3) levels NW 2 1.35(0.91 - 1.98) 0.131224652 61 Sphingomyelin (43.21) levels NW 3 0.97(0.93 - 1.01) 0.147271677 63 Triacylghycerl (48.1) levels NW 2 1.43(0.88 - 2.33) 0.15253021 64 Phosphatdylinositol (16.0, 18.2) levels NW 3 1.04(0.97-1.19) 0.167164245 65 Phosphatdylinositol (16.0, 18.2) levels NW 3 1.03(0.99-1.08) 0.1729998 67 Triacylghycerol (48.2) levels NW 3 0.30(0.92-1.16) 0.228379302 68 Phosphatdylchone (0-160.2.03) levels NW 1 0.50(0.95-1.16) 0.228379302 70 Phosphatdylchone (0-161.2.18.2) levels NW 1 0.80(0.55-1.16) 0.228379302 71 Phosphatdylchone (18.0, 18.2) levels NW 3 0.400(0.95-1.16) 0.228570485 72 Phosphatdylchonitol (18.1, 18.2) levels NW 5 1.11(0.91-14) 0.229608469 74 Phosphatdylchonitol (18.1, 18.2) levels NW 6 <td>59</td> <td>Phosphatidylcholine (O-16:1_16:0) levels</td> <td>WR</td> <td>1</td> <td>1.07(0.99–1.16)</td> <td>0.106235712</td>	59	Phosphatidylcholine (O-16:1_16:0) levels	WR	1	1.07(0.99–1.16)	0.106235712
61 Sphingomyelin (d32:1) levels IVW 3 0.97(0.93-1.01) 0.147871677 62 Triacylgycerol (64:1) levels IVW 2 1.13(0.33-1.22) 0.61210321 64 Phosphatidylinostol (16.0_18:1) levels IVW 3 1.07(0.97-1.13) 0.167164428 65 Phosphatidylinostol (16.0_18:2) levels IVW 3 1.03(0.97-1.08) 0.17020998 66 Sphingomyelin (d340) levels IVW 3 1.03(0.97-1.08) 0.17520998 67 Triacylgycerol (48.2) levels IVW 3 0.78(0.52-1.16) 0.21472013 68 Phosphatidylcholine (0-16.002.03) levels IVW 3 0.80(0.55-1.16) 0.228379302 70 Phosphatidylcholine (0-16.1_81.1) levels IVW 3 0.80(0.55-1.16) 0.23609666 72 Phosphatidylcholine (0-16.1_81.1) levels IVW 7 1.06(0.95-1.13) 0.246550485 74 Phosphatidylcholine (16.1_8.1) levels IVW 1 1.06(0.95-1.19) 0.286706301 75 Phosphatidylcholine (18.2_1.20.2) levels IVW	60	Triacylglycerol (48:3) levels	IVW	2	1.35(0.91-1.98)	0.131224652
62 Triacy(glycerol (564) levels IVW 2 143(0.88-2.33) 0.152630194 63 Triacy(glycerol (56.4) levels IVW 3 1.19(0.93-1.52) 0.162180321 64 Phosphatid(inositol (160_18.2) levels IVW 3 1.04(0.99-1.09) 0.168603646 65 Sphingomyelin (34.0) levels IVW 3 1.04(0.99-1.09) 0.168603646 66 Sphingomyelin (34.0) levels IVW 3 0.78(0.52-1.16) 0.21472013 68 Phosphatid(vinositol (160_18.2) levels IVW 6 1.06(0.96-1.16) 0.228973902 70 Phosphatid(vinositol (180_1.82) levels IVW 10 1.05(0.97-1.13) 0.23696566 72 Phosphatid(vinositol (181_18.2) levels IVW 6 1.08(0.95-1.16) 0.23699656 73 Sphingomyelin (440.1) levels IVW 7 1.99(0.94-1.28) 0.236520485 74 Phosphatid(vinositol (181_1.82) levels IVW 3 1.04(0.97-1.11) 0.27706447 75 Sphingomyelin (348.1) levels IVW 8 1.0	61	Sphingomyelin (d32:1) levels	IVW	3	0.97(0.93-1.01)	0.147871677
63 Triacy(q)ycerol (56:4) levels IVW 3 1.19(0.93-1.52) 0.162150321 64 Phosphatidylinositol (16.0_18:1) levels IVW 2 1.07(0.97-1.19) 0.167164428 65 Phosphatidylinositol (16.0_18:2) levels IVW 3 1.03(0.99-1.08) 0.17209998 66 Sphingomyelin (d34.0) levels IVW 2 1.36(0.87-2.12) 0.173396599 67 Triacy(g)ycerol (48.2) levels IVW 3 0.78(0.52-1.16) 0.21472013 69 Phosphatidylinositol (18.0_18.2) levels IVW 6 0.166(0.92-1.13) 0.23431811 71 Phosphatidylinositol (18.0_18.1) levels IVW 6 0.26059-1.16) 0.23496566 72 Phosphatidylinositol (18.1_18.2) levels IVW 6 0.26059-1.16) 0.224526048 74 Phosphatidylinositol (18.1_18.2) levels IVW 7 1.09(0.94-1.28) 0.224526048 75 Sphingomyelin (d38.1) levels IVW 10 1.06(0.97-1.11) 0.227623535 76 Phosphatidylinositol (18.1_18.1) levels IVW	62	Triacylglycerol (48:1) levels	IVW	2	1.43(0.88-2.33)	0.152630194
64 Phosphatidylinositol (16.0_18.1) levels IVW 2 1.07(0.97-1.19) 0.167164428 65 Phosphatidylinositol (16.0_18.2) levels IVW 3 1.04(0.99-1.09) 0.169603646 66 Sphingomyelin (d34.0) levels IVW 3 1.03(0.99-1.08) 0.17209998 67 Triacyldycerol (42.2) levels IVW 3 0.78(0.52-1.16) 0.21472013 69 Phosphatidylinositol (18.0_18.2) levels IVW 6 1.06(0.96-1.16) 0.223379302 70 Phosphatidylinositol (18.0_18.2) levels IVW 6 1.06(0.95-1.13) 0.23431811 71 Phosphatidylinositol (18.1_18.1) levels IVW 6 1.08(0.95-1.23) 0.24656994 72 Phosphatidylinositol (18.1_18.1) levels IVW 7 1.09(0.94-1.28) 0.243520485 74 Phosphatidylinositol (18.1_18.1) levels IVW 3 1.04(0.97-1.11) 0.27780447 75 Sphingomyelin (d38.1) levels IVW 8 1.03(0.97-1.09) 0.28712853 76 Phosphatidylinositol (18.1_18.1) levels IVW </td <td>63</td> <td>Triacylglycerol (56:4) levels</td> <td>IVW</td> <td>3</td> <td>1.19(0.93-1.52)</td> <td>0.162150321</td>	63	Triacylglycerol (56:4) levels	IVW	3	1.19(0.93-1.52)	0.162150321
65 Phosphatidylinositol (160_18:2) levels IVW 3 1.040.99-1.09 0.169603646 66 Sphingomyelin (34:0) levels IVW 3 1.03(0.99-1.08) 0.1720998 67 Triacylglycerol (48:2) levels IVW 3 0.78(0.52-1.16) 0.21472013 69 Phosphatidylcholine (0-16:0_2.03) levels IVW 6 1.06(0.96-1.16) 0.22837302 70 Phosphatidylcholine (0-16:1_18:1) levels IVW 3 0.80(0.55-1.16) 0.22837392 71 Phosphatidylcholine (0-16:1_18:1) levels IVW 3 0.80(0.55-1.16) 0.226320485 72 Phosphatidylcholine (0-16:1_18:1) levels IVW 7 1.09(0.94-1.28) 0.26320485 74 Phosphatidylchositol (18:1_18:2) levels IVW 3 0.40(0.97-1.11) 0.2787086447 75 Sphingomyelin (38:1) levels IVW 4 1.16(0.86-1.58) 0.320966903 76 Phosphatidylchositol (18:1_18:1) levels IVW 4 1.16(0.97-1.11) 0.278728502 76 Phosphatidylcholine (16:0_2.04) levels IVW 4 1.16(0.86-1.58) 0.320966903 77	64	Phosphatidylinositol (16:0_18:1) levels	IVW	2	1.07(0.97-1.19)	0.167164428
66 Sphingomyelin (d34.0) levels IVW 3 1.03(0.99–1.08) 0.17209998 67 Triacylglycerol (48.2) levels IVW 2 1.36(0.87–2.12) 0.175396599 68 Phosphatidylcholine (0-16.0_20.3) levels IVW 6 1.06(0.95–1.16) 0.22837302 69 Phosphatidylcholine (0-16.1_18.1) levels IVW 6 1.06(0.95–1.16) 0.22837302 70 Phosphatidylcholine (0-16.1_18.1) levels IVW 3 0.80(0.55–1.16) 0.22809566 72 Phosphatidylcholine (0-16.1_18.1) levels IVW 7 1.09(0.94–1.28) 0.263520485 74 Phosphatidylinositol (18.1_18.2) levels IVW 7 1.09(0.94–1.28) 0.26370485 75 Sphingomyelin (d3.1) levels IVW 3 1.04(0.97–1.11) 0.277806447 75 Sphingonsyelin (d3.8.1) levels IVW 4 1.06(0.95–1.19) 0.28770303 76 Phosphatidylcholine (0-16.1_2.03) levels IVW 4 1.04(0.97–1.11) 0.32705305 78 Triacylglycerol (65.5) levels IVW <td< td=""><td>65</td><td>Phosphatidylinositol (16:0_18:2) levels</td><td>IVW</td><td>3</td><td>1.04(0.99-1.09)</td><td>0.169603646</td></td<>	65	Phosphatidylinositol (16:0_18:2) levels	IVW	3	1.04(0.99-1.09)	0.169603646
67 Triacylglycerol (482) levels IVW 2 1.36(0.87-2.12) 0.175396599 68 Phosphatidylcholine (0-16.0_20.3) levels IVW 3 0.78(0.52-1.16) 0.21472013 69 Phosphatidylcholine (0-16.1_18.1) levels IVW 6 1.06(0.96-1.16) 0.228379302 70 Phosphatidylcholine (0-16.1_18.1) levels IVW 3 0.80(0.57-1.13) 0.23409804 71 Phosphatidylcholine (0-16.1_18.1) levels IVW 6 1.08(0.95-1.16) 0.236096566 72 Phosphatidylinositol (18.1_18.1) levels IVW 7 1.09(0.97-1.13) 0.224058944 73 Sphingomyelin (34.3) levels IVW 3 1.04(0.97-1.11) 0.277806447 75 Sphingomyelin (38.3) levels IVW 3 1.04(0.97-1.11) 0.237035639 76 Phosphatidylchonine (18.2_0.4) levels IVW 4 1.16(0.86-1.58) 0.320966903 77 Phosphatidylcholine (0-16.1_2.0.3) levels IVW 3 0.93(0.80-1.08) 0.35708690 78 Sphingomyelin (38.2) levels IVW	66	Sphingomyelin (d34:0) levels	IVW	3	1.03(0.99-1.08)	0.17209998
Best Phosphatidylicholine (0-160_20.3) levels IVW 3 0.78(0.52-1.16) 0.21472013 69 Phosphatidylionsitol (180_18.2) levels IVW 6 1.06(0.96-1.16) 0.228379302 70 Phosphatidylicholine (0-16.1].81) levels IVW 10 1.05(0.97-1.13) 0.23431811 71 Phosphatidylicholine (0-16.1].81) levels IVW 3 0.80(0.55-1.16) 0.23609656 72 Phosphatidylinositol (180_18.1) levels IVW 6 1.08(0.95-1.23) 0.240569804 73 Sphingomyelin (d40.1) levels IVW 7 1.09(0.94-1.28) 0.263520485 74 Phosphatidylinositol (181_18.1) levels IVW 10 1.06(0.95-1.19) 0.287128535 76 Phosphatidylichaolamine (180_20.4) levels IVW 8 1.03(0.97-1.09) 0.38670301 78 Sphingomyelin (38.2) levels IVW 6 1.14(0.97-1.11) 0.327035359 80 Phosphatidylcholine (0-16.1_20.3) levels IVW 5 1.14(0.86-1.49) 0.357238502 81 Sphingomyelin (34.2) levels <t< td=""><td>67</td><td>Triacylglycerol (48:2) levels</td><td>IVW</td><td>2</td><td>1.36(0.87-2.12)</td><td>0.175396599</td></t<>	67	Triacylglycerol (48:2) levels	IVW	2	1.36(0.87-2.12)	0.175396599
69 Phosphatidylinositol (18.0_18.2) levels IVW 6 1.06(0.96-1.16) 0.228379302 70 Phosphatidylethanolamine (18.0_18.2) levels IVW 10 1.05(0.97-1.13) 0.23431811 71 Phosphatidylicholine (0-16.1_18.1) levels IVW 3 0.80(0.55-1.16) 0.23609566 72 Phosphatidylinositol (18.0_18.1) levels IVW 6 1.08(0.95-1.23) 0.2463520485 74 Phosphatidylinositol (18.1_18.2) levels IVW 7 1.09(0.94-1.28) 0.2263520485 74 Phosphatidylinositol (18.1_18.2) levels IVW 3 1.04(0.97-1.11) 0.277805447 75 Sphingomyelin (34.81) levels IVW 5 1.11(0.91-1.34) 0.298008439 76 Phosphatidylethanolamine (18.0_2.04) levels IVW 8 1.03(0.97-1.09) 0.387703010 78 Triacylglycerol (56.5) levels IVW 4 1.16(0.86-1.58) 0.3220966903 79 Sphingomyelin (34.2) levels IVW 5 1.14(0.86-1.49) 0.357238502 80 Phosphatidylcholine (0-16.1_2.03) levels <td>68</td> <td>Phosphatidylcholine (O-16:0 20:3) levels</td> <td>IVW</td> <td>3</td> <td>0.78(0.52-1.16)</td> <td>0.21472013</td>	68	Phosphatidylcholine (O-16:0 20:3) levels	IVW	3	0.78(0.52-1.16)	0.21472013
70 Phosphatidylethanolamine (18.0_18.2) levels IVW 10 1.05(0.97-1.13) 0.23431811 71 Phosphatidylcholine (0-16.1_18.1) levels IVW 3 0.80(0.55-1.16) 0.23609656 72 Phosphatidylinositol (18.0_18.1) levels IVW 6 1.08(0.95-1.23) 0.246552045 73 Sphingomyelin (d40:1) levels IVW 7 1.09(0.94-1.28) 0.263520455 74 Phosphatidylinositol (18:1_18.2) levels IVW 3 1.04(0.97-1.11) 0.277806447 75 Sphingomyelin (d38.1) levels IVW 5 1.11(0.91-1.34) 0.28002439 76 Phosphatidylinositol (18:1_18.1) levels IVW 5 1.11(0.91-1.34) 0.28006301 78 Triacyldylcerol (56.5) levels IVW 4 1.04(0.97-1.11) 0.337063031 78 Sphingomyelin (d38.2) levels IVW 3 0.93(0.80-1.08) 0.33709809 81 Sphingomyelin (d38.2) levels IVW 4 0.99(0.96-1.02) 0.38870850 82 Phosphatidylcholine (18.2_12.04) levels IVW <td< td=""><td>69</td><td>Phosphatidylinositol (18:0 18:2) levels</td><td>IVW</td><td>6</td><td>1.06(0.96-1.16)</td><td>0.228379302</td></td<>	69	Phosphatidylinositol (18:0 18:2) levels	IVW	6	1.06(0.96-1.16)	0.228379302
71 Phosphatidylcholine (O-16.1_18.1) levels IVW 3 0.80(055-1.16) 0.236096566 72 Phosphatidylinositol (18.0_18.1) levels IVW 6 1.08(0.95-1.23) 0.240569804 73 Sphingomyelin (148.1) levels IVW 7 1.09(0.94-1.28) 0.240569804 74 Phosphatidylinositol (18.1_18.1) levels IVW 3 1.04(0.97-1.11) 0.277806447 75 Sphingomyelin (13.1] 18.1) levels IVW 10 1.06(0.95-1.19) 0.287128535 76 Phosphatidylinositol (18.1_18.1) levels IVW 5 1.11(0.91-1.34) 0.298008439 77 Phosphatidylcholine (16.0_2.024) levels IVW 8 1.03(0.97-1.09) 0.30876331 78 Sphingomyelin (13.2) levels IVW 4 1.06(0.86-1.58) 0.320966903 79 Sphingomyelin (13.2) levels IVW 3 0.93(0.80-1.08) 0.333708090 80 Phosphatidylcholine (0-16.1_2.03) levels IVW 4 0.80(0.91-1.29) 0.3657876 81 Sphingomyelin (13.2) levels IVW 2 0.95(0.85-1.26) 0.41286532 82 Phosph	70	Phosphatidylethanolamine (18:0–18:2) levels	IVW	10	1.05(0.97-1.13)	0.23431811
Phosphatidylinositol (18.0_18.1) levels IVW 6 1.08(0.95-1.23) 0.240569804 73 Sphingomyelin (d40:1) levels IVW 7 1.09(0.94-1.28) 0.263520485 74 Phosphatidylinositol (18:1_18:2) levels IVW 3 1.04(0.97-1.11) 0.277806447 75 Sphingomyelin (d38:1) levels IVW 10 1.06(0.95-1.19) 0.287126355 76 Phosphatidylinositol (18:1_18:1) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38:2) levels IVW 6 1.04(0.97-1.11) 0.327053290 80 Phosphatidylcholine (18.2_20:4) levels IVW 3 0.93(0.80-1.08) 0.335703809 81 Sphingomyelin (d34:2) levels IVW 4 1.08(0.91-1.29) 0.35723850 82 Phosphatidylcholine (18.2_20:4) levels IVW 4 0.99(0.96-1.02) 0.388590869 83 Phosphatidylcholine (0-16:1_18:2) levels IVW 3 1	71	Phosphatidylcholine (O-16:1_18:1) levels	IVW	3	0.80(0.55-1.16)	0.236096566
73 Sphingomyelin (d40:1) levels IVW 7 1.09(0.94-1.28) 0.263520485 74 Phosphatidylinositol (18:1_18:2) levels IVW 3 1.04(0.97-1.11) 0.277806447 75 Sphingomyelin (d38:1) levels IVW 10 1.06(0.95-1.19) 0.287128535 76 Phosphatidylethanolamine (18:0_20:4) levels IVW 5 1.11(0.91-1.34) 0.29808439 77 Phosphatidylethanolamine (18:0_20:4) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38:2) levels IVW 4 1.04(0.97-1.11) 0.327053359 80 Phosphatidylcholine (0-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353708809 81 Sphingomyelin (d34:2) levels IVW 4 0.80(0.91-1.29) 0.3657876 82 Phosphatidylcholine (18:0_218:1) levels IVW 2 0.95(0.85-1.06) 0.38126322 84 Phosphatidylcholine (10:0_18:1_18:2) levels IVW 3 1.07(0.91-1.25) 0.41236352 85	72	Phosphatidylinositol (18:0–18:1) levels	IVW	6	1.08(0.95-1.23)	0.240569804
74 Phosphatidylinositol (18:1_18:2) levels IVW 3 1.04(0.97-1.1) 0.277806447 75 Sphingomyelin (d38:1) levels IVW 10 1.06(0.95-1.19) 0.287128535 76 Phosphatidylinositol (18:1_18:1) levels IVW 5 1.11(0.91-1.34) 0.298008439 77 Phosphatidylethanolamine (18:0_20:4) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320066903 79 Sphingomyelin (d38:2) levels IVW 4 1.04(0.97-1.11) 0.327035359 80 Phosphatidylcholine (0-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.333708809 81 Sphingomyelin (d34:2) levels IVW 4 1.08(0.91-1.29) 0.3657876 82 Phosphatidylcholine (18:0_18:1) levels IVW 4 0.99(0.96-1.02) 0.388590869 84 Phosphatidylcholine (0-16:1_18:2) levels IVW 3 1.07(0.91-1.25) 0.411984515 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 3 1.01(0.85-1.46) 0.43131784 86	73	Sphingomyelin (d40:1) levels	IVW	7	1.09(0.94-1.28)	0.263520485
75 Sphingomyelin (d38.1) levels IVW 10 1.06(0.95-1.19) 0.287128535 76 Phosphatidylinositol (18.1_18.1) levels IVW 5 1.11(0.91-1.34) 0.298008439 77 Phosphatidylethanolamine (18.0_20.4) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56.5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38.2) levels IVW 6 1.04(0.97-1.11) 0.327053359 80 Phosphatidylcholine (0-16.1_20.3) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18.2_20.4) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18.2_20.4) levels IVW 4 0.99(0.96-1.02) 0.388290869 83 Phosphatidylcholine (0.42.0) levels IVW 4 0.99(0.96-1.02) 0.388290869 84 Phosphatidylcholine (0.7.18.2) levels IVW 3 1.01(0.85-1.45) 0.41236352 86 Ceramide (42:2) levels IVW <	74	Phosphatidylinositol (18:1–18:2) levels	IVW	3	1.04(0.97-1.11)	0.277806447
76 Phosphatidylinositol (18:1_18:1) levels IVW 5 1.11(0.91-1.34) 0.298008439 77 Phosphatidylethanolamine (18:0_20:4) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38:2) levels IVW 6 1.04(0.97-1.11) 0.327053359 80 Phosphatidylcholine (O-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353709809 81 Sphingomyelin (d34:2) levels IVW 4 1.08(0.91-1.29) 0.3657876 82 Phosphatidylcholine (18:0_18:1) levels IVW 2 0.95(0.85-1.06) 0.381266322 84 Phosphatidylcholine (0:4:0.0) levels IVW 4 0.99(0.96-1.02) 0.385870869 85 Phosphatidylcholine (0:-16:1_18:2) levels IVW 3 1.07(0.91-1.25) 0.4126352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (1:0_2.0:4) levels IVW 3 1.01(0.86-1.43) 0.43698918 89 Ph	75	Sphingomyelin (d38:1) levels	IVW	10	1.06(0.95-1.19)	0.287128535
77 Phosphatidylethanolamine (18.0_20:4) levels IVW 8 1.03(0.97-1.09) 0.308760301 78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38:2) levels IVW 6 1.04(0.97-1.11) 0.327053359 80 Phosphatidylcholine (O-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353709809 81 Sphingomyelin (d34:2) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18.0_18:1) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatidylcholine (18.0_18:1) levels IVW 4 0.99(0.68-1.06) 0.381266322 84 Phosphatidylcholine (0.41_0.18:2) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (17.0_18:2) levels IVW 3 1.07(0.91-1.25) 0.4126352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17.0_18:2) levels IVW 3 1.04(0.94-1.16) 0.431698915 89 P	76	Phosphatidylinositol (18:1–18:1) levels	IVW	5	1.11(0.91–1.34)	0.298008439
78 Triacylglycerol (56:5) levels IVW 4 1.16(0.86-1.58) 0.320966903 79 Sphingomyelin (d38:2) levels IVW 6 1.04(0.97-1.11) 0.327053359 80 Phosphatidylcholine (O-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353709809 81 Sphingomyelin (d34:2) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18:2_20:4) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatidylcholine (18:0_18:1) levels IVW 4 0.99(0.96-1.02) 0.38850869 84 Phosphatidylcholine (0-16:1_18:2) levels IVW 4 0.99(0.96-1.02) 0.38850869 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 3 1.07(0.91-1.25) 0.4126352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.4126352 87 Phosphatidylcholine (0-16:1_18:2) levels IVW 3 1.01(0.94-1.16) 0.431698515 87 Phosphatidylcholine (0-18:2_20:4) levels IVW 3 1.01(0.94-1.16) 0.4316989488 91 Phosphatidyl	77	Phosphatidylethanolamine (18:0 20:4) levels	IVW	8	1.03(0.97-1.09)	0.308760301
79 Sphingomyelin (d38:2) levels IVW 6 1.04(0.97-1.11) 0.327033359 80 Phosphatidylcholine (O-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353709809 81 Sphingomyelin (d34:2) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18:2_20:4) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatidylcholine (18:0_18:1) levels IVW 4 0.99(0.96-1.02) 0.388590869 84 Phosphatidylcholine (20:4_0.0) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (O-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.01(0.94-1.16) 0.431331784 88 Ceramide (d42:2) levels IVW 3 1.01(0.94-1.16) 0.431698515 89 Phosphatidylcholine (16:0_20:4) levels IVW 3	78	Triacylalycerol (56:5) levels	IVW	4	1.16(0.86- 1.58)	0.320966903
80 Phosphatidylcholine (0-16:1_20:3) levels IVW 3 0.93(0.80-1.08) 0.353709809 81 Sphingomyelin (d34:2) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18:2_20:4) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatidylcholine (18:0_18:1) levels IVW 4 0.99(0.96-1.02) 0.388590869 84 Phosphatidylcholine (0-16:1_18:2) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 4 0.99(0.96-1.02) 0.388590869 86 Ceramide (d42:1) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.01(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.436989488 91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452391397 92 Ceramide (d40:	79	Sphingomvelin (d38:2) levels	IVW	6	1.04(0.97-1.11)	0.327053359
81 Sphingomyelin (d34:2) levels IVW 5 1.14(0.86-1.49) 0.357238502 82 Phosphatidylcholine (18:2_20:4) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatidylcholine (18:0_18:1) levels IVW 2 0.95(0.85-1.06) 0.381266322 84 Phosphatidylcholine (20:4_0:0) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.01(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 3 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (0-18:2_20:4) levels IVW 3 1.01(0.86-1.43) 0.43698488 91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452391397 92 Ceramide (d40:1) levels IVW 6 1.03(0.95-1.12) 0.452391397 93 Phosphatidylcholin	80	Phosphatidylcholine (O-16:1 20:3) levels	IVW	3	0.93(0.80-1.08)	0.353709809
22 Phosphatight(choline (18:2_20:4) levels IVW 4 1.08(0.91-1.29) 0.3657876 83 Phosphatight(choline (18:0_18:1) levels IVW 2 0.95(0.85-1.06) 0.381266322 84 Phosphatight(choline (20:4_0.0) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatight(choline (0-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatightcholine (17:0_18:2) levels IVW 3 1.01(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatightcholine (0-18:2_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 90 Phosphatightcholine (0-16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452391397 91 Phosphatightcholine (18:0_20:4) levels IVW 3 1.04(0.93-1.17) 0.452391397 92 Ceramide (d40:1) levels IVW 3 1.04(0.93-1.17) 0.452391397 93 P	81	Sphingomvelin (d34:2) levels	IVW	5	1.14(0.86–1.49)	0.357238502
83 Phosphatidylcholine (18:0_18:1) levels IVW 2 0.95(0.85-1.06) 0.381266322 84 Phosphatidylcholine (20:4_0:0) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.11(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (0-18:2_20:4) levels IVW 8 1.04(0.94-1.16) 0.436989488 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452391397 92 Ceramide (d40:1) levels IVW 3 1.04(0.93-1.17) 0.452391397 93 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 94 Phosp	82	Phosphatidylcholine (18:2–20:4) levels	IVW	4	1.08(0.91-1.29)	0.3657876
84 Phosphatidylcholine (20:4_0:0) levels IVW 4 0.99(0.96-1.02) 0.388590869 85 Phosphatidylcholine (0-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.11(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (0-18:2_20:4) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (16:0_20:4) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452091397 92 Ceramide (d40:1) levels IVW 3 1.04(0.93-1.17) 0.452391397 93 Phosphatidylcholine (16:0_20:2) levels IVW 3 1.04(0.93-1.17) 0.452320865 95 Phosp	83	Phosphatidylcholine (18:0–18:1) levels	IVW	2	0.95(0.85-1.06)	0.381266322
85 Phosphatidylcholine (O-16:1_18:2) levels IVW 2 0.85(0.58-1.25) 0.41236352 86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.11(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (0-18:2_20:4) levels IVW 8 1.03(0.96-1.11) 0.435446807 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylinositol (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.452391397 92 Ceramide (d40:1) levels IVW 6 1.03(0.95-1.12) 0.452391397 93 Phosphatidylcholine (16:0_20:2) levels IVW 3 1.04(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylinositol (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Ph	84	Phosphatidylcholine (20.4 0.0) levels	IVW	4	0.99(0.96-1.02)	0 388590869
86 Ceramide (d42:1) levels IVW 3 1.07(0.91-1.25) 0.419941618 87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.11(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (0-18:2_20:4) levels IVW 2 1.03(0.96-1.11) 0.43646807 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylinositol (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 6 1.05(0.93-1.19) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.04(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylcholine (016:0_16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 <td< td=""><td>85</td><td>Phosphatidylcholine (0-16:1-18:2) levels</td><td>IVW</td><td>2</td><td>0.85(0.58-1.25)</td><td>0.41236352</td></td<>	85	Phosphatidylcholine (0-16:1-18:2) levels	IVW	2	0.85(0.58-1.25)	0.41236352
87 Phosphatidylcholine (17:0_18:2) levels IVW 3 1.11(0.85-1.46) 0.431331784 88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (O-18:2_20:4) levels IVW 2 1.03(0.96-1.11) 0.435446807 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylinositol (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 3 1.03(0.95-1.11) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.05(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (16:0_20:2) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylcholine (0-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122 98<	86	Ceramide (d42·1) levels	IVW	3	1 07(0 91-1 25)	0.419941618
88 Ceramide (d42:2) levels IVW 8 1.04(0.94-1.16) 0.431698515 89 Phosphatidylcholine (O-18:2_20:4) levels IVW 2 1.03(0.96-1.11) 0.435446807 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 3 1.03(0.95-1.11) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.05(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylcholine (0-16:0_16:1) levels IVW 2 1.04(0.94-1.14) 0.462048634 97 Phosphatidylcholine (0-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.4652312122	87	Phosphatidylcholine ($17:0, 18:2$) levels	IVW	3	1 11(0 85–1 46)	0.431331784
89 Phosphatidylcholine (0-18:2_20:4) levels IVW 2 1.03(0.96-1.11) 0.435446807 90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86-1.43) 0.436989488 91 Phosphatidylinositol (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 3 1.03(0.95-1.11) 0.452094084 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.05(0.93-1.19) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.03(0.95-1.12) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.04(0.94-1.14) 0.462048634 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122 <	88	Ceramide (d42·2) levels		8	1.04(0.94-1.16)	0.431698515
90 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.11(0.86–1.43) 0.436989488 91 Phosphatidylinositol (16:0_20:4) levels IVW 3 1.03(0.95–1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 6 1.05(0.93–1.19) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.04(0.93–1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95–1.12) 0.453230865 95 Phosphatidylcholine (16:0_20:2) levels IVW 2 1.26(0.68–2.32) 0.461168643 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.04(0.94–1.14) 0.462048634 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57–1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98–1.05) 0.465212122	89	Phosphatidylcholine (Ω -18·2, 20·4) levels		2	1.03(0.96-1.11)	0.435446807
91 Phosphatidylcholine (16:0_20:4) levels IVW 3 1.03(0.95-1.11) 0.450094084 92 Ceramide (d40:1) levels IVW 6 1.05(0.93-1.19) 0.452391397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.04(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.26(0.68-2.32) 0.461168643 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122	90	Phosphatidylcholine (16:0, 20:4) levels		2	1.11(0.86–1.43)	0.436989488
92 Ceramide (d40:1) levels IVW 6 1.05(0.93-1.17) 0.452091397 93 Phosphatidylcholine (18:2_18:2) levels IVW 6 1.04(0.93-1.17) 0.452391397 94 Phosphatidylcholine (16:0_20:2) levels IVW 3 1.04(0.93-1.17) 0.453618054 94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylcholine (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylcholine (0-16:0_0) levels IVW 2 1.04(0.94-1.14) 0.462048634 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122	Q1	Phosphatidylenosital (16:0_20:1) levels		3	1.03(0.95_1.11)	0.450094084
93 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.04(0.93-1.17) 0.45251557 94 Phosphatidylcholine (16:0_20:2) levels IVW 3 1.04(0.93-1.17) 0.453618054 95 Phosphatidylinositol (18:1_20:4) levels IVW 6 1.03(0.95-1.12) 0.458230865 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.26(0.68-2.32) 0.461168643 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122	07	Ceramide (d40:1) levels		6	1.05(0.93-1.10)	0.450301307
94 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.453010054 95 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.03(0.95-1.12) 0.458230865 95 Phosphatidylethanolamine (18:1_20:4) levels IVW 2 1.26(0.68-2.32) 0.461168643 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.04(0.94-1.14) 0.462048634 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122	03	Phosphatidy/choline (18:2 18:2) levels		3	1.03(0.93 1.17)	0.453618054
95 Phosphatidyletionine (10.2_20.2) levels IVW 0 1.50(0.55 1.12) 0.45025005 95 Phosphatidyletionine (18.1_20:4) levels IVW 2 1.26(0.68–2.32) 0.461168643 96 Phosphatidyletionine (18:0_0:0) levels IVW 2 1.04(0.94–1.14) 0.462048634 97 Phosphatidyletionine (0-16:0_16:1) levels IVW 2 0.86(0.57–1.30) 0.463523251 98 Phosphatidyletionine (0-16:1_20:4) levels IVW 3 1.01(0.98–1.05) 0.465212122	95 QA	Phosphatidylcholine (16:0_20:2) levels		6	1.03(0.95-1.17)	0.458230865
96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.20(0.06-2.32) 0.401100045 96 Phosphatidylethanolamine (18:0_0:0) levels IVW 2 1.04(0.94-1.14) 0.462048634 97 Phosphatidylcholine (O-16:0_16:1) levels IVW 2 0.86(0.57-1.30) 0.463523251 98 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.01(0.98-1.05) 0.465212122	95	Phosphatidylinosital (18:1 20:4) lovals	1\/\/	2	1.05(0.99 1.12)	0.461168642
97 Phosphatidylcholine (O-16:1) levels IVW 2 1.04(0.9+1.14) 0.402040034 98 Phosphatidylcholine (O-16:1 20:4) levels IVW 2 0.86(0.57-1.30) 0.463523251	96	Phosphatidylethanolamine (18:0, 0:0) levels		2	1.20(0.00-2.32)	0.4670/1862/
98 Phosphatidylcholine (0-16:1-20:4) levels IVW 2 0.00(0.57-1.50) 0.465212122	97	Phosphatidylcholine (Ω -16:0, 16:1) levels		2	0.86(0.57_1.14)	0.463533351
	98	Phosphatidylcholine ($O = 10.0 - 10.1$) levels	1.///	2	1 01/0 98_1 05)	0.465010100

Table 1 (continued)

99 Charmide (#102) levels N/V 2 0.98(0):51-104) 0.49(1500) 100 Steol estre (72) (20.5) levels N/W 3 0.99(0):51-109 0.5390027 101 Steol estre (72) (20.5) levels N/W 7 1.04(0):51-119 0.5390027 102 Phosphatidy(cholme (140_124) levels N/W 7 1.04(0):51-119 0.5390027 104 Phosphatidy(cholme (0-142_142) levels N/W 2 0.89(0):61-129 0.532800725 105 Phosphatidy(cholme (0-142_142) levels N/W 2 0.28(0):61-129 0.532800725 106 Phosphatidy(cholme (0-142_142) levels N/W 2 1.02(0):61-08 0.544326134 107 Springenrygin (440.2) levels M/W 2 1.02(0):61-08 0.56376951 108 Sterol estre (72) (72.2) levels M/W 2 0.29(0):61-129 0.55646244 110 Phosphatidy(cholme (161_181) levels M/W 2 0.56(0):74 0.65005079 111 Phosphatidy(cholme (161_120) levels M/W 1 0.140(0):114<	No	Exposure	Method	nSNP	OR(95%CI)	P value
100 Sterol ester (27) (203) levels NW 3 0.99(095-10.1) 0.496(18902) 101 Sterol ester (27) (20.4) levels NW 7 1.04(032-1.15) 0.536802915 103 Trikeydykerel (56.6) levels NW 7 1.07(026-1.34) 0.523117997 104 Phosphatidykholine (10.18.2.16.2) levels NW 2 0.89(0.61-1.29) 0.53260727 105 Phosphatidykholine (10.18.2.16.2) levels NW 3 1.0200.61.08) 0.54348134 106 Phosphatidykholine (10.18.2) levels NW 2 1.21(0.632-2.34) 0.553769727 107 Sterol ester (27.1/2.2.6) levels NW 2 0.07(06.8-1.2.7) 0.55984928 108 Sterol ester (27.1/2.2.6) levels NW 4 0.99(0.8-1.1.4) 0.55966794 119 Phosphatidykholine (16.1.2.2.1) levels NW 4 0.99(0.8-1.1.2) 0.5666744 111 Phosphatidykholine (16.1.2.2.2.4) levels NW 4 0.96(0.8-1.1.4) 0.6242944 113 Phosphatidykholine (16.0.2.2.4) levels NW 4	99	Ceramide (d40:2) levels	IVW	2	0.98(0.92-1.04)	0.495150006
101 Steriol estar (2/1204) lowels IVW 8 144002-115 0.50309155 102 Phosphatidylinositel (18.0.204) levels IVW 7 1.04003-115 0.50309155 103 Tracylybycene (16.0.204) levels IVW 2 0.09005-1.29 0.53200725 104 Phosphatidylcholme (14.0_1.202) levels IVW 2 0.09005-1.29 0.53200725 106 Phosphatidylcholme (14.0_1.202) levels IVW 2 1.20008-1.09 0.54436813 107 Sptingerwyelin (44.02) levels IVW 2 1.20008-1.20 0.54436813 108 Sterol estar (27.122.61 levels IVW 2 0.120065-1.27 0.5575987737 110 Phosphatidylcholme (16.1.21 levels IVW 4 0.95007113 0.55805799 111 Phosphatidylcholme (16.0.225) levels IVW 4 0.95008-1.10 0.6542784 112 Phosphatidylcholme (16.0.225) levels IVW 2 0.96008-1.10 0.6542784 113 Phosphatidylcholme (16.0.1.201/190114 IVW 3 0.96008-1.10	100	Sterol ester (27:1/20:5) levels	IVW	3	0.99(0.95-1.02)	0.496189805
International (International Content of International Contecote Internation Content of International Content of Internation	101	Sterol ester (27:1/20:4) levels	IVW	8	1.04(0.92-1.19)	0.50390227
103 Tracylghyenel (sch) levels NW 7 1.07(306-1-128) 0.57800506 104 Phosphatidylcholine (O-182_16) levels NW 2 0.89(0.61-12.9) 0.57800506 105 Phosphatidylcholine (1-0.18.2_16.2) levels NW 3 1.02(0.36-1.08) 0.54380170 106 Sterol ester (27.1/2.6) levels NW 7 1.09(0.8-1.27) 0.563765551 109 Tracylghycord (5k7) levels NW 6 1.09(0.81-1.48) 0.5697649 110 Phosphatidylcholine (18.1, 81) levels NW 4 0.95(0.81-1.24) 0.58662494 111 Phosphatidylcholine (18.1, 82) levels NW 4 0.95(0.81-1.24) 0.85662494 112 Phosphatidylcholine (18.1, 82) levels NW 4 0.95(0.81-1.24) 0.8462494 113 Phosphatidylcholine (18.1, 82) levels NW 2 1.08(0.85-1.24) 0.950507391 114 Phosphatidylcholine (16.1, 81.10) levels NR 1 1.040308-1.14) 0.8248624 115 Phosphatidylcholine (16.1, 81.10) levels NR <t< td=""><td>102</td><td>Phosphatidylinositol (18:0_20:4) levels</td><td>IVW</td><td>7</td><td>1.04(0.93-1.15)</td><td>0.508039155</td></t<>	102	Phosphatidylinositol (18:0_20:4) levels	IVW	7	1.04(0.93-1.15)	0.508039155
101 Phosphatidylcholine (0-182-182) levels NW 2 0.88(0.6-1-128) 0.53280725 105 Phosphatidylcholine (0-182-160) levels NW 2 0.89(0.6-1-128) 0.53280725 106 Phosphatidylcholine (0-182-160) levels NW 3 1.000.65-1.08 0.544436114 107 Sphingomyelin (4402) levels NW 2 0.1210.63-2.34 0.55990741 108 Steroleter (27) / 2020 levels NW 2 0.910.65-1.27 0.5598074 110 Phosphatidylcholine (10-182) levels NW 4 0.990.81-1.13 0.590.879979 112 Phosphatidylcholine (160_2.25) levels NW 4 0.990.86-1.02 0.544244 113 Phosphatidylcholine (160_2.182) levels NW 2 1.050.87-1.07 0.614292473 114 Phosphatidylcholine (160_1.281_104) levels NW 2 0.990.99-1.19 0.63038745 115 Phosphatidylcholine (160_1.281_104) levels NW 2 0.990.99-1.19 0.63038745 116 Phosphatidylcholine (160_1.281_104) levels NW	103	Triacylglycerol (56:6) levels	IVW	7	1.07(0.86-1.34)	0.523177997
105 Phosphatidylcholine (0-182_16.0) levels NW 2 0.890.01-10.90 0.5240725 106 Phosphatidylcholine (140_18.2) levels NW 3 1.020.05-10.80 0.54438470 107 Springoryelin (440_18.2) levels NW 2 1.210.63-12.40 0.56394202 108 Sterol ester (22/12.25) levels NW 6 1.090.81.14.60 0.569942023 101 Phosphatidylcholine (0-16.0_18.2) levels NW 4 0.990.05-12.27 0.57580737 111 Phosphatidylcholine (160_22.51) levels NW 4 0.990.05-12.27 0.614292443 113 Phosphatidylcholine (180_18.2) levels NW 4 0.990.05-12.27 0.614292443 115 Phosphatidylcholine (181_0.01 levels NW 2 1.960.08-11.40 0.63305726 116 Phosphatidylcholine (160_22.51) levels NW 2 0.990.09-1.00 0.630245557 117 Phosphatidylcholine (160_12.04) levels NW 3 0.990.09-1.10 0.630245557 116 Phosphatidylcholine (160_12.04) levels NW	104	Phosphatidylcholine (O-18:2_18:2) levels	IVW	2	0.89(0.62-1.28)	0.528096266
106 Phosphatidylcholine (140_182) levels NW 3 1.02(080-108) 0.54438134 107 Sphingernyelin (442.2) levels NW 7 1.06(0.88-1.27) 0.55379921 108 Sterol estre (271.220 levels NW 2 0.91(0.65-1.27) 0.55799023 110 Phosphatidylcholine (16.1.62,182) levels NW 4 0.90(0.65-1.27) 0.557980273 111 Phosphatidylcholine (16.1.22) levels NW 4 0.90(0.85-1.24) 0.558463744 113 Phosphatidylcholine (16.0.1.22) levels NW 4 0.90(0.85-1.34) 0.55950579 114 Phosphatidylcholine (16.0.1.24) levels NW 2 0.950(0.87-1.2) 0.61422473 115 Phosphatidylcholine (16.1.2.4) levels NW 2 0.990(0.8-1.1.4) 0.623057271 116 Phosphatidylcholine (16.1.2.1.81) levels NW 2 0.990(0.8-1.1.4) 0.633073271 118 Phosphatidylcholine (16.1.1.8.1) levels NW 2 0.990(0.8-1.1.4) 0.6363057267 119 Phosphatidylcholine (16.1.1.8.1) levels <	105	Phosphatidylcholine (O-18:2_16:0) levels	IVW	2	0.89(0.61-1.29)	0.532607275
107 Sphingomyelin (4402) levels IVW 7 1.060.88–127 0.54934207 108 Sterol estar (27:122.6) levels IVW 2 1.020.83–3.40 0.55094028 110 Phosphatidylcholine (0-16.0_18.2) levels IVW 4 0.95081-1.13 0.55694028 111 Phosphatidylcholine (16.0_2.25) levels IVW 4 0.95036-1.27 0.55662249 112 Phosphatidylcholine (16.0_2.25) levels IVW 4 0.95036-1.27 0.55662249 113 Phosphatidylcholine (16.0_2.25) levels IVW 2 1.060.85-1.34 0.5565249 114 Phosphatidylcholine (16.1_2.24) levels IVW 2 0.960.80-1.14 0.6247584 115 Phosphatidylcholine (17.2_1.81) levels IVW 2 0.960.80-1.14 0.6247584 116 Phosphatidylcholine (16.1_2.24) levels IVW 2 0.960.83-1.40 0.630.82475 117 Phosphatidylcholine (16.1_2.84) levels IVW 2 0.960.81-1.00 0.660.83647 118 Phosphatidylcholine (16.1_2.84) levels IVW <	106	Phosphatidylcholine (14:0_18:2) levels	IVW	3	1.02(0.96-1.08)	0.544368134
108 Sterol ester (27.1/22.6) levels NW 2 1.210.63-23.4) 0.563769551 109 Triacylgycraf (58.7) levels NW 6 1.090.61-1.42) 0.563769551 110 Phosphatidy(choline (18.1_18.1) levels NW 4 0.950.06-1.02) 0.56867344 112 Phosphatidy(choline (18.1_18.1) levels NW 4 0.950.06-1.02) 0.5846744 113 Phosphatidy(choline (16.0_2.25.) levels NW 2 1.060.08-1.33 0.59505079 114 Phosphatidy(choline (14.0_1.18.1) levels NW 2 1.060.08-1.10 0.61429247 115 Phosphatidy(choline (16.1_18.1) levels NW 4 0.960.08-1.10 0.61624794 116 Phosphatidy(choline (16.1_18.1) levels NW 2 0.990.08-1.09 0.63364458 117 Phosphatidy(choline (16.1_18.1) levels NW 7 1.030.09-1.19 0.63364458 118 Phosphatidy(choline (16.1_18.1) levels NW 7 1.030.09-1.19 0.6336475 112 Phosphatidy(choline (16.1_18.1) levels NW <	107	Sphingomyelin (d40:2) levels	IVW	7	1.06(0.88-1.27)	0.549347207
109 Triacylglycerol (58.7) levels NW 6 1.09(0.81-1.46) 0.569940028 110 Phosphatidy/choline (16.1_12.1) levels NW 2 0.91(0.55-1.27) 0.575980737 111 Phosphatidy/choline (16.1_12.1) levels NW 4 0.99(0.96-1.02) 0.58462494 112 Phosphatidy/choline (16.0_2.25) levels NW 5 1.06(0.85-1.34) 0.55050799 114 Phosphatidy/choline (14.0_1.81) levels NW 2 1.05(0.87-1.20) 0.58462494 115 Phosphatidy/choline (14.0_1.81) levels NW 4 0.99(0.94-1.02) 0.66247984 116 Phosphatidy/choline (14.0_1.81) levels NW 2 0.99(0.94-1.04) 0.0307327 118 Phosphatidy/choline (16.0_1.24) levels NW 5 0.99(0.94-1.01) 0.6363143 110 Phosphatidy/choline (16.0_1.24) levels NW 7 1.03(0.90-1.19) 0.63123 1121 Phosphatidy/choline (16.1_1.20.4) levels NW 3 0.99(0.87-1.03) 0.6560936 1124 Phosphatidy/choline (16.1_2.04) levels	108	Sterol ester (27:1/22:6) levels	IVW	2	1.21(0.63-2.34)	0.563765951
110 Phosphatidylcholine (0-160_182) levels NW 2 0.91(0.65-1.27) 0.575980737 111 Phosphatidylcholine (160_225) levels NW 4 0.990(0.96-1.02) 0.846244 113 Phosphatidylcholine (160_225) levels NW 2 1.06(0.85-1.34) 0.595850799 114 Phosphatidylcholine (181_00) levels NW 2 1.06(0.85-1.34) 0.614292473 115 Phosphatidylcholine (181_00) levels WW 2 0.99(0.94-1.04) 0.62435879 116 Phosphatidylcholine (161_2.24) levels NW 2 0.99(0.94-1.04) 0.630373271 118 Phosphatidylcholine (161_1.81) levels NW 2 0.99(0.94-1.04) 0.630374458 110 Phosphatidylcholine (161_1.81) levels NW 5 0.03(0.83,11) 0.65238475 112 Phosphatidylcholine (161_1.81) levels NW 2 0.99(0.95-1.03) 0.65238475 112 Phosphatidylcholine (161_1.23) levels NW 3 0.94(0.68-1.29) 0.65728647 112 Phosphatidylcholine (161_1.23) levels	109	Triacylglycerol (58:7) levels	IVW	6	1.09(0.81-1.46)	0.569949028
111 Phosphatidylcholine (16.1_18.1) levels NW 4 0.95(0.81-1.13) 0.580667249 112 Phosphatidylcholine (18.1_12.1) levels NW 4 0.99(0.95-1.02) 0.580667249 113 Phosphatidylcholine (18.1_12.1) levels NW 5 1.00(0.85-1.27) 0.614292473 115 Phosphatidylcholine (18.1_0.0) levels NR 1 0.90(0.80-1.19) 0.61624794 116 Phosphatidylcholine (16.2_0.24) levels NW 2 0.99(0.94-1.04) 0.630073271 118 Phosphatidylcholine (16.1_2.11) levels NW 2 0.99(0.94-1.04) 0.630073271 118 Phosphatidylcholine (16.1_2.11) levels NW 5 0.97(0.86-1.10) 0.63507364 120 Phosphatidylcholine (16.1_2.0.4) levels NW 2 0.99(0.95-1.03) 0.6580867 121 Phosphatidylcholine (16.1_2.0.4) levels NW 2 0.99(0.95-1.03) 0.6580867 122 Phosphatidylcholine (16.1_2.0.4) levels NW 3 0.94(0.66-1.29) 0.668036 124 Phosphatidylcholine (16.2_0.2.04) level	110	Phosphatidylcholine (O-16:0_18:2) levels	IVW	2	0.91(0.65-1.27)	0.575980737
112 Phosphatidylcholine (160_225) levels IVW 4 0.99(0.96-1.02) 0.58462494 113 Phosphatidylcholine (160_182) levels IVW 5 1.06(0.85-1.37) 0.0516247984 116 Phosphatidylcholine (16.181_0.00) levels WR 1 1.04(0.97-1.19) 0.616247984 116 Phosphatidylcholine (16.0_22.4) levels WW 2 0.99(0.94-1.04) 0.630073271 117 Phosphatidylcholine (16.0_12.4) levels WW 2 0.99(0.94-1.04) 0.630073271 118 Phosphatidylcholine (16.1_181) levels WW 5 0.97(0.86-1.10) 0.63679846 120 Phosphatidylcholine (16.1_18.1) levels IVW 7 1.03(0.90-1.19) 0.6360367 121 Phosphatidylcholine (16.1_2.04) levels IVW 2 0.99(0.93-1.05) 0.65288475 122 Phosphatidylcholine (0-1.82, 0) levels IVW 2 0.99(0.93-1.10) 0.6608036 123 Phosphatidylcholine (0-1.81_0.03) levels IVW 3 0.94(0.66.1.29) 0.6608321371 126 Sterol ester (27.120.3) levels IVW 6 1.01(0.97-1.05) 0.72755475 <tr< td=""><td>111</td><td>Phosphatidylcholine (18:1_18:1) levels</td><td>IVW</td><td>4</td><td>0.95(0.81-1.13)</td><td>0.580667249</td></tr<>	111	Phosphatidylcholine (18:1_18:1) levels	IVW	4	0.95(0.81-1.13)	0.580667249
113 Phosphatidylcholine (180_182) levels IVW S 1.06(0.85-1.34) 0.599050799 114 Phosphatidylcholine (181_0.0) levels IVW 2 1.05(0.87-1.27) 0.614292473 115 Phosphatidylcholine (161_0.0) levels WR 1 1.04(0.90-1.19) 0.616247984 116 Phosphatidylcholine (16-2.82) levels IVW 4 0.96(0.80-1.14) 0.63037271 117 Phosphatidylcholine (160_1.21) levels WR 1 1.03(0.90-1.19) 0.633874458 120 Phosphatidylcholine (160_1.82) levels WW 5 0.97(0.86-1.10) 0.636123 121 Phosphatidylcholine (0.161_0.20.4) levels IVW 7 1.03(0.90-1.19) 0.636123 122 Phosphatidylcholine (0.161_0.20.4) levels IVW 2 0.99(0.95-1.03) 0.6660306 123 Phosphatidylcholine (0.181_0.20.4) levels IVW 3 0.94(0.68-1.29) 0.667695676 124 Phosphatidylcholine (160_183_104) IVW 6 1.04(0.97-1.33) 0.72756475 125 Phosphatidylcholine (161_0.18.1) levels IVW 3 0.94(0.67-1.34) 0.74535587 <tr< td=""><td>112</td><td>Phosphatidylcholine (16:0_22:5) levels</td><td>IVW</td><td>4</td><td>0.99(0.96-1.02)</td><td>0.58462494</td></tr<>	112	Phosphatidylcholine (16:0_22:5) levels	IVW	4	0.99(0.96-1.02)	0.58462494
114 Phosphatidylcholine (140_181) levels IVW 2 105(0.87-1.27) 0.614292473 115 Phosphatidylcholine (161_0.00) levels WR 1 1.04(0.90-1.19) 0.616247984 116 Phosphatidylcholine (16.1_0.01) levels WW 2 0.99(0.94-1.04) 0.63034458 117 Phosphatidylcholine (16.0_2.181) levels WW 2 0.99(0.94-1.04) 0.63034458 119 Phosphatidylcholine (16.1_18.1) levels WW 7 1.03(0.90-1.19) 0.636123 120 Phosphatidylcholine (16.1_18.1) levels VW 7 1.03(0.90-1.19) 0.6362836475 121 Phosphatidylcholine (16.1_8.2) levels VW 2 0.99(0.95-1.03) 0.6668036 123 Phosphatidylcholine (16.1_2.0.3) levels VW 3 0.99(0.95-1.03) 0.668823371 124 Phosphatidylcholine (16.1_2.0.3) levels VW 6 1.01(0.97-1.05) 0.72755475 125 Phosphatidylcholine (16.1_1.2.0.4) levels VW 6 1.04(0.83-1.30) 0.72755475 126 Sterol ester (27.1/2.0.3) levels	113	Phosphatidylcholine (18:0_18:2) levels	IVW	5	1.06(0.85-1.34)	0.595050799
115 Phosphatidylcholine (18.1_00) levels WR 1 1.040.90-1.19 0.616247984 116 Phosphatidylcholine (16.18.1_20.4) levels IVW 4 0.96(0.80-1.14) 0.62305879 117 Phosphatidylcholine (16.0_22.4) levels IVW 2 0.97(0.84-1.10) 0.633073271 118 Phosphatidylcholine (16.0_18.2) levels IVW 5 0.97(0.86-1.10) 0.636123 120 Phosphatidylcholine (16.0_18.2) levels IVW 7 1.03(0.90-1.19) 0.653123 121 Phosphatidylcholine (0-16.2_0.20.4) levels IVW 3 0.99(0.87-1.09) 0.676095676 122 Phosphatidylcholine (0-16.1_2.0.3) levels IVW 3 0.94(0.68-1.29) 0.6676095676 124 Phosphatidylcholine (16.1_2.0.4) levels IVW 6 1.04(0.83-1.20) 0.72158475 125 Phosphatidylcholine (18.1_2.0.4) levels IVW 6 1.04(0.87-1.33) 0.72158475 128 Phosphatidylcholine (18.1_2.0.4) levels IVW 3 0.94(0.67-1.33) 0.72755475 129 Phosphatidylcholine (18.1_2.0.3) levels IVW 3 0.94(0.67-1.34) 0.72755475	114	Phosphatidylcholine (14:0_18:1) levels	IVW	2	1.05(0.87-1.27)	0.614292473
116 Phosphatidylcholine (0-18:1_20:4) levels IVW 4 0.96(0.80-1.14) 0.624365879 117 Phosphatidylcholine (16:0_22:4) levels IVW 2 0.99(0.94-1.04) 0.630073271 118 Phosphatidylcholine (16:0_18:1) levels WR 1 1.03(0.90-1.19) 0.636123 119 Phosphatidylcholine (16:0_18:2) levels IVW 7 1.03(0.90-1.19) 0.636123 121 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 0.99(0.93-1.05) 0.652836475 122 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 0.99(0.87-1.09) 0.667095676 124 Phosphatidylcholine (10:18:1_20:4) levels IVW 3 0.94(0.68-1.29) 0.687458624 125 Phosphatidylcholine (18:1_20:4) levels IVW 6 1.01(0.97-1.05) 0.727556475 126 Sterol ester (27:1/20:3) levels IVW 6 1.04(0.87-1.33) 0.730309613 129 Phosphatidylcholine (18:1_20:4) levels IVW 3 0.94(0.67-1.34) 0.75755475 128 Phosphatidylcholine (18:0_20	115	Phosphatidylcholine (18:1 0:0) levels	WR	1	1.04(0.90-1.19)	0.616247984
117 Phosphatidylcholine (16.2-24) levels IVW 2 0.99(0.94-1.04) 0.630073271 118 Phosphatidylcholine (16.1_8.1) levels WR 1 1.03(0.00-1.19) 0.633034458 119 Phosphatidylcholine (16.1_18.1) levels WW 5 0.97(0.86-1.10) 0.635(723 120 Phosphatidylcholine (0-16.1_20.4) levels IVW 7 1.03(0.90-1.19) 0.636(723 121 Phosphatidylcholine (0-16.1_20.4) levels IVW 3 0.99(0.95-1.03) 0.66608036 123 Phosphatidylcholine (0-16.1_20.4) levels IVW 3 0.94(0.68-1.29) 0.667458624 125 Phosphatidylcholine (16.18.1_20.4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27.1/20.3) levels IVW 6 1.04(0.83-1.30) 0.72169317 127 Phosphatidylcholine (16.18.2.0.4) levels IVW 3 0.94(0.67-1.33) 0.723030613 128 Phosphatidylcholine (16.1_8.2.0.3) levels IVW 3 0.94(0.67-1.34) 0.752732493 131 Phosphatidylcholine (16.2_	116	Phosphatidylcholine (O-18:1 20:4) levels	IVW	4	0.96(0.80-1.14)	0.624365879
118 Phosphatidylcholine (17.2_18.1) levels WR 1 1.03(0.90-1.19) 0.630384458 119 Phosphatidylcholine (16.1_18.1) levels IVW 5 0.97(0.86-1.10) 0.63567846 120 Phosphatidylcholine (16.0_18.2) levels IVW 7 1.03(0.90-1.19) 0.656123 121 Phosphatidylcholine (0.61.2.02.04) levels IVW 2 0.99(0.95-1.03) 0.65608036 123 Phosphatidylcholine (16.0_18.3) levels IVW 3 0.94(0.88-1.29) 0.6676095676 124 Phosphatidylcholine (16.0_18.3) levels IVW 3 0.94(0.68-1.29) 0.6676095676 124 Phosphatidylcholine (16.0_18.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 126 Sterol ester (27.1/20.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18.1_20.3) levels IVW 3 0.94(0.67-1.33) 0.730309613 128 Phosphatidylcholine (0-18.1_0.0) levels IVW 3 0.94(0.67-1.34) 0.74535943 131 Phosphatidylcholine (0-18.1_0.	117	Phosphatidylcholine (16:0 22:4) levels	IVW	2	0.99(0.94-1.04)	0.630073271
Insplaticly/choline (16.1_18:) levels IVW 5 0.97(0.86-1.10) 0.633679846 120 Phosphatidylcholine (16.0_18.2) levels IVW 7 1.03(0.90-1.19) 0.636123 121 Phosphatidylcholine (0-16.1_20.4) levels IVW 2 0.99(0.95-1.03) 0.6660836 122 Phosphatidylcholine (0-16.1_20.4) levels IVW 2 0.99(0.95-1.03) 0.6660836 123 Phosphatidylcholine (16.0_18.3) levels IVW 2 0.99(0.87-1.09) 0.667695676 124 Phosphatidylcholine (16.0_18.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 126 Sterol ester (27.1/20.3) levels IVW 6 1.01(0.97-1.05) 0.72756475 128 Phosphatidylcholine (16.1_20.2) levels IVW 3 0.94(0.67-1.33) 0.73030613 129 Phosphatidylcholine (0-18.1_16.0) levels IVW 3 0.94(0.67-1.34) 0.74535437 130 Phosphatidylcholine (16.1_8.2_0.0) levels IVW 2 0.99(0.94-1.05) 0.75232493 132 Phosphatidylcholine (16.0_2.0.1) levels	118	Phosphatidylcholine (17:0 18:1) levels	WR	1	1.03(0.90-1.19)	0.630384458
120 Phosphatidylcholine (16.0_18.2) levels IVW 7 1.03(0.90-1.19) 0.636123 121 Phosphatidylcholine (0-16.1_20.4) levels IVW 2 0.99(0.93-1.05) 0.652836475 122 Phosphatidylcholine (0-16.1_20.4) levels IVW 3 0.99(0.95-1.03) 0.6608036 123 Phosphatidylcholine (0-18.1_20.3) levels IVW 2 0.98(0.87-1.09) 0.667095676 124 Phosphatidylcholine (18.1_20.4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27.1/20.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18.1_20.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 128 Phosphatidylcholine (18.1_20.3) levels IVW 3 0.94(0.67-1.33) 0.730309613 129 Phosphatidylcholine (18.1_20.3) levels IVW 3 0.94(0.67-1.34) 0.74555457 130 Phosphatidylcholine (18.2_0.20.5) levels IVW 2 0.99(0.94-1.05) 0.752732493 131 Phosphatidylcholine (18.0_2	119	Phosphatidylcholine (16:1 18:1) levels	IVW	5	0.97(0.86-1.10)	0.635679846
121 Phosphatidylethanolamine (0-16:1_20:4) levels IVW 2 0.99(0.93-1.05) 0.652836475 122 Phosphatidylcholine (0-16:1_20:3) levels IVW 3 0.99(0.95-1.03) 0.6608036 123 Phosphatidylcholine (0-18:1_20:3) levels IVW 2 0.98(0.87-1.09) 0.676095676 124 Phosphatidylcholine (16:1_8:3) levels IVW 3 0.94(0.68-1.29) 0.687458624 125 Phosphatidylcholine (16:1_8:1_20:4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27:1/20:3) levels IVW 6 1.01(0.97-1.05) 0.727556475 128 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.94(0.67-1.33) 0.73030613 129 Phosphatidylcholine (0-18:1_20:4) levels IVW 3 0.94(0.67-1.34) 0.745359543 130 Phosphatidylcholine (0-18:1_20:4) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 1.01(0.93-1.13) 0.77554587 133 Sphingomyelin (120	Phosphatidylcholine (16:0 18:2) levels	IVW	7	1.03(0.90-1.19)	0.636123
122 Phosphatidylcholine (O-16.0_20.4) levels IVW 3 0.99(0.95-1.03) 0.6608036 123 Phosphatidylcholine (Io.18.1_20.3) levels IVW 2 0.98(0.87-1.09) 0.676095676 124 Phosphatidylcholine (16.0_18.3) levels IVW 3 0.94(0.68-1.29) 0.687458624 125 Phosphatidylcholine (18.1_20.4) levels IVW 6 1.02(0.93-1.11) 0.688281371 126 Sterol ester (27.1/20.3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18.1_20.4) levels IVW 6 1.04(0.97-1.05) 0.72755475 128 Phosphatidylcholine (0-18.1_16.0) levels IVW 3 0.94(0.67-1.33) 0.730309613 129 Phosphatidylcholine (18.1_20.3) levels IVW 3 0.94(0.67-1.34) 0.745359543 131 Phosphatidylcholine (18.0_20.5) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18.0_20.5) levels IVW 2 0.91(0.91-1.13) 0.774221869 134 Phosphatidylcholine (16.0	121	Phosphatidylethanolamine (O-16:1 20:4) levels	IVW	2	0.99(0.93-1.05)	0.652836475
123 Phosphatidylcholine (0-18:1_20:3) levels IVW 2 0.98(0.87-1.09) 0.676095676 124 Phosphatidylcholine (16:0_18:3) levels IVW 3 0.94(0.68-1.29) 0.687458624 125 Phosphatidylcholine (18:1_20:4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27:1/20:3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18:0_20:4) levels IVW 6 1.01(0.97-1.05) 0.727556475 128 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.94(0.67-1.33) 0.73030613 129 Phosphatidylcholine (0-16:1_8:1) levels IVW 3 0.94(0.67-1.34) 0.745359543 131 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.76754587 132 Phosphatidylcholine (18:0_20:5) levels IVW 4 1.02(0.91-1.13) 0.74221869 134 Phosphatidylcholine (18:0_20:0) levels IVW 2 0.99(0.92-1.07) 0.88163188 137 Phosphatidylcholine (16:0_22:1	122	Phosphatidylcholine (O-16:0 20:4) levels	IVW	3	0.99(0.95-1.03)	0.6608036
124 Phosphatidylcholine (16:0_18:3) levels IVW 3 0.94(0.68-1.29) 0.687458624 125 Phosphatidylcholine (18:1_20:4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27:1/20:3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18:0_20:4) levels IVW 6 1.01(0.97-1.05) 0.727556475 128 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.94(0.67-1.33) 0.730309613 129 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.94(0.67-1.34) 0.745359543 130 Phosphatidylcholine (18:1_20:4) levels IVW 3 0.94(0.67-1.34) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.89-1.10) 0.778185075 134 Phosphatidylcholine (18:0_20:1) levels IVW 2 1.01(0.91-1.13) 0.816535299 135 Phosphatidylcholine (16:0_218:1) levels	123	Phosphatidylcholine (O-18:1 20:3) levels	IVW	2	0.98(0.87-1.09)	0.676095676
Instruction Instruction Instruction 125 Phosphatidylcholine (18:1_20:4) levels IVW 6 1.02(0.93-1.11) 0.688321371 126 Sterol ester (27:1/20:3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18:0_20:4) levels IVW 6 1.01(0.97-1.05) 0.727556475 128 Phosphatidylcholine (0-18:1_16:0) levels IVW 3 0.94(0.67-1.33) 0.730309613 129 Phosphatidylcholine (0-16:0_18:1) levels IVW 3 0.94(0.67-1.34) 0.74535943 130 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 0.99(0.94-1.05) 0.752732493 131 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.94-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 2 0.99(0.94-1.03) 0.767554587 134 Phosphatidylcholine (18:0_20:0) levels IVW 2 1.01(0.93-1.11) 0.778881979 135 Phosphatidylcholine (18:0_20:0) levels IVW 2 0.99(0.92-1.07) <	124	Phosphatidylcholine (16:0 18:3) levels	IVW	3	0.94(0.68- 1.29)	0.687458624
126 Sterol ester (27:1/20:3) levels IVW 6 1.04(0.83-1.30) 0.721893127 127 Phosphatidylcholine (18.0_20:4) levels IVW 6 1.01(0.97-1.05) 0.727556475 128 Phosphatidylcholine (0-18:1_16:0) levels IVW 3 0.94(0.67-1.33) 0.730309613 129 Phosphatidylcholine (0-16:1_12:0:3) levels IVW 3 0.94(0.67-1.34) 0.745359543 130 Phosphatidylcholine (0-18:1_20:4) levels IVW 3 0.94(0.67-1.34) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d3:62) levels IVW 4 1.02(0.91-1.13) 0.778281699 134 Phosphatidylcholine (18:0_20:0) levels IVW 2 0.99(0.92-1.07) 0.888163188 137 Phosphatidylcholine (18:0_22:0) levels IVW 2 0.90(0.92-1.07) 0.88163188 137 Phosphatidylcholine (16:1_18:2)	125	Phosphatidylcholine (18:1 20:4) levels	IVW	6	1.02(0.93-1.11)	0.688321371
International and the second	126	Sterol ester (27:1/20:3) levels	IVW	6	1.04(0.83-1.30)	0.721893127
128 Phosphatidylcholine (0-18:1_16:0) levels IVW 3 0.94(0.67-1.3) 0.730309613 129 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.96(0.75-1.22) 0.734376192 130 Phosphatidylcholine (0-16:0_18:1) levels IVW 3 0.94(0.67-1.34) 0.745359543 131 Phosphatidylcholine (0-16:0_18:1) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.91-1.13) 0.774221869 134 Phosphatidylcholine (16:0_20:1) levels IVW 2 1.01(0.93-1.11) 0.778881979 135 Phosphatidylcholine (16:0_20:1) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylcholine (16:0_20:1) levels WR 1 1.01(0.91-1.13) 0.8163188 137 Phosphatidylcholine (16:1_18:2) levels IVW 2 0.99(0.90-1.09) 0.826920769 138 Phosphatidylcholine (16:0_18:2)	127	Phosphatidylcholine (18:0 20:4) levels	IVW	6	1.01(0.97-1.05)	0.727556475
129 Phosphatidylcholine (18:1_20:3) levels IVW 3 0.96(0.75-1.22) 0.734376192 130 Phosphatidylcholine (O-16:0_18:1) levels IVW 3 0.94(0.67-1.34) 0.745359543 131 Phosphatidylcholine (O-16:0_18:1) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.91-1.13) 0.774221869 134 Phosphatidylcholine (16:0_20:1) levels IVW 2 1.01(0.93-1.11) 0.77881979 135 Phosphatidylcholine (16:0_20:1) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylcholine (18:0_22:0) levels IVW 2 0.99(0.92-1.07) 0.808163188 137 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 138 Phosphatidylcholine (16:1_18:2) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:1_18:2) levels WR 1 0.99(0.85-1.14) 0.849376935 <	128	Phosphatidylcholine (O-18:1 16:0) levels	IVW	3	0.94(0.67-1.33)	0.730309613
130 Phosphatidylcholine (O-16:0_18:1) levels IVW 3 0.94(0.67-1.34) 0.745359543 131 Phosphatidylchanolamine (O-18:1_20:4) levels IVW 2 0.99(0.94-1.05) 0.752732493 132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.91-1.13) 0.774221869 134 Phosphatidylcholine (16:0_20:1) levels IVW 2 1.01(0.93-1.11) 0.778816907 135 Phosphatidylcholine (16:0_20:1) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylcholine (16:0_22:5) levels IVW 2 0.99(0.92-1.07) 0.808163188 137 Phosphatidylcholine (16:1_18:2) levels IVW 2 0.9(0.90-1.09) 0.826920769 138 Phosphatidylcholine (15:0_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (15:0_18:2) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 0.10(0.91-1.12) 0.84481769	129	Phosphatidylcholine (18:1 20:3) levels	IVW	3	0.96(0.75-1.22)	0.734376192
International and the construction of the c	130	Phosphatidylcholine (O-16:0 18:1) levels	IVW	3	0.94(0.67-1.34)	0.745359543
132 Phosphatidylcholine (18:0_20:5) levels IVW 2 0.99(0.96-1.03) 0.767554587 133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.91-1.13) 0.774221869 134 Phosphatidylethanolamine (18:2_0:0) levels IVW 2 1.01(0.93-1.11) 0.778881979 135 Phosphatidylethanolamine (0:2:0:1) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylethanolamine (0-18:2_0:4) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylethanolamine (0-18:2_20:4) levels IVW 2 0.99(0.92-1.07) 0.808163188 137 Phosphatidylcholine (18:0_22:5) levels IVW 2 1.01(0.91-1.13) 0.816535299 138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (0-18:2_18:1) levels WR 1 1.01(0.91-1.12) 0.84814769 140 Phosphatidylcholine (0-18:0_18:3) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylcholine (18:0_218:1) levels WR 1 1.01(0.91-1.12) 0.8557	131	Phosphatidylethanolamine (O-18:1 20:4) levels	IVW	2	0.99(0.94-1.05)	0.752732493
133 Sphingomyelin (d36:2) levels IVW 4 1.02(0.91-1.13) 0.774221869 134 Phosphatidylethanolamine (18:2_0:0) levels IVW 2 1.01(0.93-1.11) 0.77881979 135 Phosphatidylethanolamine (18:2_0:0) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylethanolamine (O-18:2_20:4) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylethanolamine (O-18:2_20:4) levels IVW 2 0.99(0.92-1.07) 0.808163188 137 Phosphatidylcholine (18:0_22:5) levels IVW 2 1.01(0.91-1.13) 0.816535299 138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (0-18:2_18:1) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (18:0_18:3) levels WR 1 0.01(0.91-1.12) 0.844814769 141 Phosphatidylcholine (18:0_18:3) levels WR 1 0.01(0.91-1.12) 0.855722939 142 Phosphatidylcholine (18:1_20:2) levels WR 1 1.01(0.91-1.12) 0.85752	132	Phosphatidylcholine (18:0, 20:5) levels	IVW	2	0.99(0.96-1.03)	0.767554587
134Phosphatidylethanolamine (18:2_0:0) levelsIVW21.01(0.93-1.11)0.778881979135Phosphatidylethanolamine (06:0_20:1) levelsWR11.02(0.89-1.16)0.798165075136Phosphatidylethanolamine (O-18:2_20:4) levelsIVW20.99(0.92-1.07)0.808163188137Phosphatidyletholine (18:0_22:5) levelsIVW21.01(0.91-1.13)0.816535299138Phosphatidylcholine (16:1_18:2) levelsIVW80.99(0.90-1.09)0.826920769139Phosphatidylcholine (15:0_18:2) levelsIVW61.02(0.86-1.20)0.830942874140Phosphatidylcholine (0-18:2_18:1) levelsWR11.01(0.91-1.12)0.844814769141Phosphatidylcholine (18:0_18:3) levelsWR10.99(0.85-1.14)0.849376935142Phosphatidylcholine (18:0_18:3) levelsWR11.01(0.91-1.12)0.855722939143Sterol ester (27:1/16:1) levelsIVW31.03(0.72-1.48)0.858180553144Phosphatidylcholine (18:1_20:2) levelsIVW31.00(0.95-1.06)0.876467317145Phosphatidylcholine (18:0_22:6) levelsIVW20.99(0.92-1.08)0.88254596146Phosphatidylethanolamine (O-18:1_18:2) levelsWR11.01(0.93-1.09)0.887407734147Phosphatidyletholine (0-18:1_18:2) levelsWR11.01(0.93-1.09)0.88884555	133	Sphingomyelin (d36:2) levels	IVW	4	1.02(0.91-1.13)	0.774221869
135 Phosphatidylcholine (16:0_20:1) levels WR 1 1.02(0.89-1.16) 0.798165075 136 Phosphatidylethanolamine (O-18:2_20:4) levels IVW 2 0.99(0.92-1.07) 0.808163188 137 Phosphatidylcholine (18:0_22:5) levels IVW 2 1.01(0.91-1.13) 0.816535299 138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (0:18:2_18:1) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 0.99(0.85-1.14) 0.844814769 141 Phosphatidylcholine (0-18:1_18:2) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylcholine (0-16:1_18:2) levels WR 1 0.01(0.91-1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72- 1.48) 0.858180553 144 Phosphatidylcholine (18:0_22:6) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596	134	Phosphatidylethanolamine (18:2–0:0) levels	IVW	2	1.01(0.93-1.11)	0.778881979
136 Phosphatidylethanolamine (O-18:2_20:4) levels IVW 2 0.99(0.92–1.07) 0.808163188 137 Phosphatidylcholine (18:0_22:5) levels IVW 2 1.01(0.91–1.13) 0.816535299 138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90–1.09) 0.826920769 139 Phosphatidylcholine (15:0_18:2) levels IVW 6 1.02(0.86–1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 1.01(0.91–1.12) 0.844814769 141 Phosphatidylcholine (18:0_18:3) levels WR 1 0.99(0.85–1.14) 0.849376935 142 Phosphatidylcholine (18:0_18:3) levels WR 1 0.01(0.91–1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:0_22:6) levels IVW 3 1.00(0.95–1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92–1.08) 0.88254596 146 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.01(0.93–1.09) 0.887407734	135	Phosphatidylcholine (16:0_20:1) levels	WR	-	1.02(0.89–1.16)	0.798165075
137 Phosphatidylcholine (18:0_22:5) levels IVW 2 1.01(0.91-1.13) 0.816535299 138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (15:0_18:2) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 1.01(0.91-1.12) 0.844814769 141 Phosphatidylcholine (18:0_18:3) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylcholine (18:0_18:3) levels WR 1 1.01(0.91-1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	136	Phosphatidylethanolamine ($O-18:2-20:4$) levels	IVW	2	0.99(0.92–1.07)	0.808163188
138 Phosphatidylcholine (16:1_18:2) levels IVW 8 0.99(0.90-1.09) 0.826920769 139 Phosphatidylcholine (15:0_18:2) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 1.01(0.91-1.12) 0.844814769 141 Phosphatidylcholine (18:0_18:3) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylcholine (0-16:1_18:2) levels WR 1 1.01(0.91-1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	137	Phosphatidylcholine ($18:0, 22:5$) levels	IVW	2	1 01(0 91–1 13)	0.816535299
139 Phosphatidylcholine (15:0_18:2) levels IVW 6 1.02(0.86-1.20) 0.830942874 140 Phosphatidylcholine (0-18:2_18:1) levels WR 1 1.01(0.91-1.12) 0.844814769 141 Phosphatidylcholine (18:0_18:3) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylcholine (0-16:1_18:2) levels WR 1 1.01(0.91-1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72- 1.48) 0.858180553 144 Phosphatidylcholine (18:0_22:0) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:0) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	138	Phosphatidylcholine (16:1–18:2) levels	IV/W	8	0.99(0.90-1.09)	0.826920769
140Phosphatidylcholine (0-18:2_18:1) levelsWR11.01(0.91-1.12)0.844814769141Phosphatidylcholine (18:0_18:3) levelsWR10.99(0.85-1.14)0.849376935142Phosphatidylethanolamine (O-16:1_18:2) levelsWR11.01(0.91-1.12)0.855722939143Sterol ester (27:1/16:1) levelsIVW31.03(0.72-1.48)0.858180553144Phosphatidylcholine (18:1_20:2) levelsIVW31.00(0.95-1.06)0.876467317145Phosphatidylcholine (18:0_22:6) levelsIVW20.99(0.92-1.08)0.88254596146Phosphatidylcholine (O-18:1_18:2) levelsWR11.01(0.93-1.09)0.887407734147Phosphatidylcholine (O-18:1_18:2) levelsWR11.00(0.94-1.07)0.888884555	139	Phosphatidylcholine (15:0_18:2) levels	IV/W	6	1.02(0.86-1.20)	0.830942874
141 Phosphatidylcholine (0:16:2_10:1) levels WR 1 0.99(0.85-1.14) 0.849376935 142 Phosphatidylethanolamine (O-16:1_18:2) levels WR 1 1.01(0.91-1.12) 0.855722939 143 Sterol ester (27:1/16:1) levels WR 1 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	140	Phosphatidylcholine (Ω -18:2, 18:1) levels	WR	1	1.01(0.91-1.12)	0.844814769
142 Phosphatidylcholine (N.S10.5) (etchs WR 1 0.59(0.55 1.11) 0.855722939 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	141	Phosphatidylcholine (18:0, 18:3) levels	WR	1	0.99(0.85-1.14)	0.849376935
142 Phosphatidylchaladiditation mic (or 10.1_10.2) levels WR 1 1.01(0.51 1.12) 0.055722555 143 Sterol ester (27:1/16:1) levels IVW 3 1.03(0.72-1.48) 0.858180553 144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	142	Phosphatidylethanolamine (Ω -16:1 18:2) levels	WR	1	1.01(0.91-1.12)	0.855722939
144 Phosphatidylcholine (18:1_20:2) levels IVW 3 1.00(0.95-1.06) 0.876467317 145 Phosphatidylcholine (18:0_22:6) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (O-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	143	Sterol ester (27:1/16:1) levels		3	1.03(0.72-1.48)	0.858180553
145 Phosphatidylcholine (0-18:1_18:2) levels IVW 2 0.99(0.92-1.08) 0.88254596 146 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidylcholine (0-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	144	Phosphatidylcholine ($18.1 - 20.2$) levels	IVW	3	1 00(0 95-1 06)	0.876467317
146 Phosphatidylethanolamine (O-18:1_18:2) levels WR 1 1.01(0.93-1.09) 0.887407734 147 Phosphatidyleholine (O-18:1_18:2) levels WR 1 1.00(0.94-1.07) 0.888884555	145	Phosphatidylcholine ($18.0 - 22.6$) levels	IV/W	2	0.99(0.97-1.08)	0.88254596
147 Phosphatidylcholine (O-18:1 18:2) levels WR 1 1.01(0.95 1.09) 0.807407.94 147 Phosphatidylcholine (O-18:1 18:2) levels WR 1 1.00(0.94–1.07) 0.888884555	146	Phosphatidylethanolamine (Ω -18·1 18·2) levels	WR	- 1	1 01(0 93-1 09)	0.887407734
	147	Phosphatidylcholine (O-18-1 18-2) levels	WR	1	1 00(0 94–1 07)	0.888884555

Table 1 (continued)

No	Exposure	Method	nSNP	OR(95%CI)	P value
148	Phosphatidylcholine (16:0_16:0) levels	IVW	4	0.98(0.77-1.26)	0.899936549
149	Phosphatidylcholine (18:1_18:2) levels	IVW	5	0.99(0.89-1.11)	0.905095502
150	Phosphatidylinositol (18:0_20:3) levels	IVW	5	1.01(0.88-1.16)	0.91701762
151	Phosphatidylcholine (18:0_20:2) levels	WR	1	1.00(0.95-1.06)	0.918093888
152	Phosphatidylcholine (16:1_20:4) levels	WR	1	1.00(0.95-1.05)	0.933573628
153	Phosphatidylcholine (18:2_0:0) levels	IVW	3	1.00(0.93-1.09)	0.935282319
154	Phosphatidylcholine (16:0_20:5) levels	WR	1	1.00(0.96-1.04)	0.935910484
155	Phosphatidylcholine (17:0_20:4) levels	IVW	5	1.00(0.94-1.07)	0.942444677
156	Phosphatidylcholine (16:0_22:6) levels	WR	1	1.00(0.89-1.13)	0.943754227
157	Phosphatidylcholine (16:0_18:0) levels	WR	1	1.00(0.90-1.11)	0.94496326
158	Triacylglycerol (56:3) levels	IVW	4	1.01(0.65- 1.57)	0.960799264
159	Phosphatidylcholine (18:2_20:3) levels	WR	1	1.00(0.93-1.08)	0.983858771
160	Phosphatidylcholine (O-16:0_22:5) levels	WR	1	1.00(0.91-1.10)	0.983858771
161	Phosphatidylcholine (O-18:0_20:4) levels	IVW	2	1.00(0.95–1.05)	0.997478043

Exposure	Method	nSNP		OR(95%CI)	Pvalue
Cholesterol levels	WR	1		2.31(1.97-2.70)	2.06e-25
Triacylglycerol (58:8) levels	IVW	2		1.53(1.39-1.67)	9.10e-19
Diacylglycerol (16:0_18:1) levels	WR	1		1.59(1.42-1.78)	2.07e-15
Diacylglycerol (16:0_18:2) levels	WR	1	-	1.46(1.33-1.61)	2.07e-15
Diacylglycerol (18:1_18:3) levels	WR	1		1.65(1.46-1.87)	2.07e-15
Sterol ester (27:1/14:0) levels	IVW	2		1.50(1.35-1.66)	7.40e-15
Phosphatidylcholine (O-17:0_17:1) levels	WR	1 🗕		0.69(0.60-0.79)	1.69e-07
Sterol ester (27:1/18:2) levels	IVW	9		1.41(1.21-1.63)	8.98e-06
Triacylglycerol (52:4) levels	IVW	7		1.27(1.14-1.41)	9.43e-06
Sterol ester (27:1/17:1) levels	WR	1		1.43(1.21-1.69)	2.03e-05
Triacylglycerol (52:5) levels	IVW	4		1.34(1.16-1.54)	4.60e-05
Diacylglycerol (18:1_18:2) levels	IVW	6	-	1.22(1.11-1.35)	5.80e-05
Triacylglycerol (53:4) levels	IVW	4		1.32(1.15-1.51)	7.48e-05
Sterol ester (27:1/18:0) levels	IVW	7 0.5	- -	1.34(1.15-1.56)] 3	1.37e-04

Fig. 2 Forest plot of lipid metabolites on atherosclerosis risk (Finngen dataset).Note: Images from left to right the first column is Exposure, the second column is Method, the third column represents nSNP, the fourth column is OR (95% CI) value, and the last column is *P* value

Backtesting the MR hypothesis

Eventually, we concluded that the six lipid metabolites directly affected coronary atherosclerosis, and conversely, we wondered whether the six lipid metabolites increased with the development of coronary atherosclerosis. Therefore, we conducted an MR study with coronary atherosclerosis as an exposure factor and the six lipid metabolites as outcome indicators. The results were all P > 0.05, demonstrating that lipid metabolites did not increase with the development of atherosclerosis.

MR Analysis: the role of atherosclerosis on lipid metabolites (FinnGen dataset)

Through IVW analyses and weighted median methods, we explored potential causal associations between



Volcano Plot of Lipid on Coronary Atherosclerosis(UKB)

Fig. 3 Volcano Plot of Lipid on Coronary Atherosclerosis (UKB dataset). Note: The horizontal coordinate represents the relative risk of atherosclerosis and the vertical coordinate represents the p-value

atherosclerosis and lipid metabolite levels and obtained the following results:

Cholesterol levels (IVW, OR = 0.960; P = 0.472; [95% CI: 0.870-1.060]),

Sterol ester (27:1/18:2) levels (IVW, OR = 1.010; P=0.847; [95% CI: 0.910-1.120]), Triacylglycerol (52:4) levels (IVW, OR=1.010; P=0.793; [95% CI: 0.930-1.110]),

Triacylglycerol (52:5) levels (IVW, OR=0.654; *P*=0.654; [95% CI: 0.940–1.110]),

Diacylglycerol (18:1_18:2) levels (IVW, OR=1.000; P=0.969; [95% CI: 0.910-1.090]), Triacylglycerol (53:4) levels (IVW, OR=1.040; P=0.411; [95% CI: 0.950-1.140]).

Detailed information is in Table 4.

MR Analysis: the role of atherosclerosis on lipid metabolites (Ukb dataset)

Through IVW analyses and weighted median methods, we explored the potential causal association between atherosclerosis and lipid metabolite levels and obtained the following results:

Cholesterol levels (IVW, OR = 1.180; 95% CI: 0.100– 14.330; P = 0.895),

Sterol ester (27:1/18:2) levels (IVW, OR = 1.040; 95% CI: 0.090–12.420; *P*=0.975), Triacylglycerol (52:4) levels (IVW, OR = 0.420; 95% CI: 0.050–3.590; *P*=0.429),

Triacylglycerol (52:5) levels (IVW, OR = 0.770; 95% CI: 0.090-6.380; P = 0.808),

Diacylglycerol (18:1_18:2) levels (IVW, OR=0.280; 95% CI: 0.030-2.380; P=0.244), Triacylglycerol (53:4) levels (IVW, OR=1.710; 95% CI:0.190-15.750; P=0.634). Detailed information is in Table 4.

Discussions

Main findings

Atherosclerosis is attributed to the abnormal deposition of fibers and lipids throughout the endothelium, which leads to the loss of arterial elasticity and disrupts the vascular structure, resulting in ischemia [14]. The mechanism is that macrophages containing oxidized LDL particles release inflammatory substances, cytokines, and growth factors, which induce cell proliferation and promote leukocyte activation and endothelial dysfunction. Our main finding unveiled that the levels of six lipid metabolites, cholesterol, sterol ester (27:1/18:2), triacylglycerol (52:4), triacylglycerol (52:5), diacylglycerol (18:1_18:2), and triacylglycerol (53:4) directly affected the risk of coronary atherosclerosis. However, their levels did not increase with coronary atherosclerosis.

According to national and international guidelines, elevated low-density lipoprotein cholesterol (LDL-C) is a well-known risk factor for atherosclerotic cardiovascular disease [15]. Our study demonstrated that cholesterol levels were positively associated with the risk of coronary atherosclerosis. Consistently, a study reported in 2020 mentioned that crystalline cholesterol and cholesterol crystals in atherosclerosis were regular features within its

Table 2 UKB dataset of lipid metabolites on atherosclerosis risk
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No	Exposure	Method	nSNP	OR(95%CI)	Pvalue
1	Cholesterol levels	WR	1	1.03(1.02-1.04)	8.44E-11
2	Diacylglycerol (18:1_18:2) levels	IVW	6	1.01(1.01-1.01)	1.68E-09
3	Triacylglycerol (52:2) levels	IVW	4	1.01(1.01-1.01)	6.67E-07
4	Phosphatidylethanolamine (16:0_20:4) levels	IVW	5	1.00(1.00-1.01)	1.10E-06
5	Phosphatidylcholine (O-16:2_18:0) levels	IVW	2	1.01(1.01-1.01)	1.22E-06
6	Triacylglycerol (52:3) levels	IVW	6	1.01(1.00-1.01)	1.55E-06
7	Triacylglycerol (52:4) levels	IVW	7	1.01(1.00-1.01)	3.46E-06
8	Triacylglycerol (53:4) levels	IVW	4	1.01(1.00-1.01)	1.78E-05
9	Triacylglycerol (52:5) levels	IVW	4	1.01(1.00-1.01)	2.09E-05
10	Sterol ester (27:1/18:2) levels	IVW	9	1.01(1.01-1.02)	7.10E-05
11	Triacylglycerol (54:5) levels	IVW	4	1.01(1.00-1.01)	0.000117
12	Phosphatidylcholine (16:0_18:1) levels	IVW	2	1.01(1.01-1.02)	0.000126
13	Sterol ester (27:1/18:1) levels	IVW	6	1.02(1.01-1.03)	0.000261
14	Triacylglycerol (50:1) levels	IVW	3	1.01(1.00-1.01)	0.000386
15	Phosphatidylcholine (O-16:0 16:1) levels	IVW	2	0.99(0.99-1.00)	0.000537
16	Triacylalycerol (51:2) levels	IVW	2	1.01(1.00-1.01)	0.000584
17	Triacylglycerol (51:4) levels	IVW	2	1.01(1.00-1.01)	0.000591
18	Diacylglycerol (16:1-18:1) levels	IVW	2	1 01(1 00-1 02)	0.000595
19	Triacylglycerol (53:2) levels	IV/W	2	1.01(1.00-1.01)	0.000614
20	Triacylglycerol (50:2) levels	IVW	2	1.01(1.00-1.01)	0.000627
20	Triacylglycerol (49:2) levels	IV/W	2	1.01(1.00-1.02)	0.00064
21	Triacylglycerol (48:3) levels	IV/W	2	1.01(1.00-1.01)	0.000708
22	Phosphatidylethanolamine (18:1-18:1) levels		7	1.00(1.00-1.01)	0.000735
23			, >	1.01(1.00-1.02)	0.000755
27			2	1.01(1.00 1.02)	0.00075
25	Triacylglycerol (50:2) levels		2	1.01(1.00-1.01)	0.000801
20	Triacylglycerol (50:4) lovels		2	1.01(1.00-1.01)	0.001218
27	Triacylglycerol (50:4) levels		2	1.01(1.00-1.01)	0.001301
20			2	1.01(1.00-1.01)	0.001471
29	Storel aster (27:1/16:0) levels		3	1.01(1.00-1.01)	0.001075
20 21	Steroi ester (27.1710.0) levels		9	1.01(1.00-1.02)	0.002737
31	Trian deligered (52:6) levels	VVR	1	0.99(0.98-1.00)	0.00404
32	Triacylgiycerol (52:0) levels	10 00	4	1.01(1.00-1.01)	0.004911
33	Triacyigiycerol (51:3) levels		6	1.01(1.00-1.01)	0.005971
34	Phosphatidylcholine (U-17:0_17:1) levels	VVR	1	0.99(0.98-1.00)	0.006106
35	Diacylglycerol (18:1_18:1) levels	IV VV	5	1.00(1.00-1.01)	0.006147
30	Triacyigiycerol (54:7) levels	IV VV	4	1.01(1.00-1.01)	0.007843
3/	Phosphatidylcholine (18:0_18:1) levels	IV VV	2	0.99(0.98-1.00)	0.008594
38	Phosphatidylcholine (17:0_18:1) levels	WR	1	1.01(1.00-1.02)	0.008633
39	Sphingomyelin (d34:1) levels	IVVV	/	1.01(1.00-1.02)	0.008781
40	Diacylgiycerol (16:0_18:2) levels	WR	1	1.01(1.00-1.01)	0.009928
41	Diacylglycerol (16:0_18:1) levels	WR	1	1.01(1.00-1.02)	0.009928
42	Diacylglycerol (18:1_18:3) levels	WR	1	1.01(1.00-1.02)	0.009928
43	Phosphatidylethanolamine (16:0_18:2) levels	IVW	6	1.00(1.00-1.01)	0.01361
44	Sphingomyelin (d42:2) levels	IVW	9	1.01(1.00-1.02)	0.014355
45	Sterol ester (27:1/18:0) levels	IVW	7	1.01(1.00-1.02)	0.020294
46	Triacylglycerol (53:3) levels	IVW	6	1.01(1.00-1.01)	0.021034
47	Sterol ester (27:1/20:2) levels	IVW	3	1.01(1.00-1.02)	0.022305
48	Phosphatidylinositol (16:0_20:4) levels	IVW	3	1.01(1.00-1.01)	0.022424
49	Phosphatidylcholine (14:0_18:1) levels	WR	1	1.01(1.00-1.02)	0.022874

Table 2 (continued)

9b Phosphatidylcholine (161_161) levels WR 1 101(100-107) 0.02287 51 Phosphatidylcholine (161_163) levels WR 1 101(100-107) 0.02287 53 Tracyldylorol (667) levels WR 1 101(100-107) 0.02287 53 Tracyldylorol (667) levels WW 3 0.99009-1.00 0.02210 54 Stord (547 (22).161 levels WW 3 1.00(100-1.00) 0.02210 55 Sphingomyelin (352.11 levels WW 2 1.00(100-1.00) 0.03317 58 Ceramde (440.2) levels IVW 7 1.000(100-1.00) 0.03814 59 Sphingomyelin (432.10 levels IVW 2 1.00(100-1.00) 0.08848 61 Phosphatidylostof14 levels IVW 3 1.000(100-1.01) 0.08848 62 Tracyldylored (54.41) levels IVW 4 1.00(100-1.01) 0.08848 63 Phosphatidylcholine (142_0.01.82) levels IVW 7 1.01(100-1.01) 0.08448 64 <td< th=""><th>No</th><th>Exposure</th><th>Method</th><th>nSNP</th><th>OR(95%CI)</th><th>Pvalue</th></td<>	No	Exposure	Method	nSNP	OR(95%CI)	Pvalue
51 Phosphaticycholine (16.1_180) ievels WR 1 1.010(10.0-102) 00.2287 52 Triacy[q]vecr0 (66.2) levels WW 5 1.011(10.0-102) 00.2287 53 Triacy[q]vecr0 (66.7) levels WW 5 0.011(10.0-102) 00.2210 54 Steol estr0 (27.11/16.1) levels WW 3 0.9999-100) 00.2217 55 Spingonyelin (43.2) levels WW 2 1.01(10.0-101) 0.03147 57 Phosphaticy[chonic (18.0_2.0.4) levels WW 2 1.000.99-1.00 0.04100 58 Ceramide (442.2) levels WW 2 1.000.99-1.00 0.06406 60 Steol estr0 (27.11/4.0) levels WW 3 1.000.99-1.00 0.06646 61 Phosphaticy[chonic (18.2_0.0) levels WW 6 1.001.00-1.01 0.06646 62 Phosphaticy[chonic (16.1_16.0) levels WW 7 1.010(1.00-1.01) 0.06436 64 Spingonyelin (44.0) levels WW 3 1.001(1.00-1.01) 0.06436 64 Spingonyelin (44.0) levels WW 3 1.001(1.00-1.01) <t< td=""><td>50</td><td>Phosphatidylcholine (16:0_16:1) levels</td><td>WR</td><td>1</td><td>1.01(1.00-1.02)</td><td>0.022874</td></t<>	50	Phosphatidylcholine (16:0_16:1) levels	WR	1	1.01(1.00-1.02)	0.022874
52 Triacylgycerol (46.2) levels WR 1 1.01(1.00-1.02) 0.02287 53 Triacylgycerol (56.7) levels WW 3 0.09(0.90-1.01) 0.02311 54 Sterol estic (27.17hc1) levels WW 3 1.00(1.00-1.00) 0.02372 55 Triacylgycerol (58.8) levels WW 2 1.00(1.00-1.00) 0.03717 58 Creamide (40.2) levels WW 2 1.00(1.00-1.00) 0.03717 59 Sphingornyell (43.24) levels WW 2 1.00(1.00-1.00) 0.06848 61 Phosphatidylnostol (18.0_20.4) levels WW 3 1.00(1.00-1.00) 0.06844 62 Triacylgycerol (44.4) levels WW 7 1.01(1.00-1.01) 0.06844 63 Phosphatidylchinkal (18.2, 12.2) levels WW 7 1.01(1.00-1.01) 0.06848 64 Sphingornyell (48.1) levels WW 7 1.01(1.00-1.01) 0.08448 65 Phosphatidylchinkal (18.2, 12.2) levels WW 5 1.01(1.00-1.01) 0.04144	51	Phosphatidylcholine (16:1_18:0) levels	WR	1	1.01(1.00-1.02)	0.022874
53 Tracydgycerol (56.7) levels NW 5 101(100-101) 0.0231 54 Steol ester (27.11/ 61) levels NW 3 0.09(100-1.01) 0.02310 55 Sphingomyeln (38.2) levels NW 2 1.00(100-1.00) 0.03143 57 Phosphatidyinostil (8.2,204) levels NW 7 1.00(100-1.00) 0.03473 58 Caramide (440.2) levels NW 7 1.00(100-1.00) 0.03473 59 Sphingomyeln (38.2-) levels NW 5 1.00(100-1.00) 0.03804 61 Phosphatidyiothine (182_0.200 levels NW 3 1.000(100-1.00) 0.08804 62 Triacylglycerol (54.4) levels NW 7 1.00(1.00-1.01) 0.08864 63 Phosphatidyichtanolamine (180_18.2) levels NW 7 1.00(1.00-1.01) 0.08864 64 Sphingomyeln (34.40) levels NW 7 1.00(1.00-1.01) 0.04827 65 Triacylglycerol (54.8) levels NW 3 1.00(1.00-1.01) 0.04824 66	52	Triacylglycerol (46:2) levels	WR	1	1.01(1.00-1.02)	0.022874
54 Stericle serv (27.1/16.1) levels NW 3 0.901.00 0.02310 55 Sphingomyelin (32.1) levels NW 2 1.01(1.00-1.00) 0.02712 56 Triacyldycerol (58.8) levels NW 2 1.01(1.00-1.00) 0.03713 57 Phosphatidychinositol (18.0_204) levels NW 7 1.00(1.00-1.00) 0.03716 58 Ceramide (470.2) levels NW 2 1.01(1.00-1.02) 0.0669 60 Sterol ester (27.1/1.40) levels NW 2 1.00(1.00-1.01) 0.08664 61 Phosphatidycholine (18.2_01 levels NW 10 1.00(1.00-1.01) 0.08664 63 Phosphatidycholine (18.2_01 levels NW 7 1.01(1.00.1.01) 0.08664 64 Sphingornyelin (43.40) levels NW 7 1.01(1.00.1.01) 0.08664 65 Phosphatidycholine (18.0_01 levels WR 1 1.00(1.00-1.01) 0.03863 66 Triacylgycerol (54.3) levels NW 3 1.00(1.00-1.01) 0.03873 <	53	Triacylglycerol (56:7) levels	IVW	5	1.01(1.00-1.01)	0.0231
55 Sphingomycin (d321) levels IVW 3 1001 00-1.001 0.02229 56 Triacylglycend (S8.8) levels IVW 2 1.001 00-1.011 0.03171 57 Phosphatidylinosital (18.0_2.04) levels IVW 2 1.001 00-1.021 0.06170 59 Sphingomycin (d3.21) levels IVW 2 1.001 00-1.021 0.06790 60 Sterol ester (27.1/1-40) levels IVW 3 1.001 00-1.010 0.08644 61 Phosphatidylcholine (18.2_0.0) levels IVW 3 1.001 00-1.010 0.08644 62 Triacylglycerol (54.41) levels IVW 10 1.001 00-1.010 0.08646 63 Phosphatidylcholine (18.1_16.0) levels IVW 7 1.011 00-1.010 0.04634 64 Sterol ester (27.1/1.43) levels IVW 3 1.001 00-1.010 0.14837 65 Phosphatidylcholine (18.1_2.04) levels IVW 3 1.001 00-1.010 0.14837 66 Sterol ester (27.1/1.43) levels IVW 8 1.001 00-1.010 0.2249 <	54	Sterol ester (27:1/16:1) levels	IVW	3	0.99(0.99-1.00)	0.023108
56 Tracydg/ceol (38.8) levels NW 2 1.01(1.00-101) 0.03313 57 Phosphatidy/inositol (18.0_20.4) levels NW 2 1.00(1.00-1.00) 0.03717 58 Ceramide (40.02) levels NW 2 1.01(1.00-1.02) 0.06793 60 Sterol sterol (24.2) levels NW 2 1.01(1.00-1.02) 0.00864 61 Phosphatidy/chane (18.208) levels NW 6 1.00(1.00-1.01) 0.08864 62 Triacydg/cerol (54.4) levels NW 6 1.00(1.00-1.01) 0.09864 63 Phosphatidy/chanel(18.201.8evls NW 7 1.01(1.00-1.01) 0.09864 64 Spingornyeni (43.64.0) levels NW 7 1.01(1.00-1.01) 0.09863 65 Phosphatidy/chanelamelamic (18.204) levels NW 3 1.00(1.00-1.01) 0.18433 68 Sterol ester (27.1/1.8.3) levels NW 8 1.00(1.00-1.01) 0.20844 7 Phosphatidy/chanelamic (18.10.0) levels NW 2 1.00(1.00-1.01) 0.23837 <	55	Sphingomyelin (d32:1) levels	IVW	3	1.00(1.00-1.00)	0.027294
57 Phosphatighinostiol (18.0_2.04) levels NW 7 1.00(1.00-1.00) 0.03717 58 Ceramide (44.02) levels NW 2 1.00(1.00-1.00) 0.04100 60 Sterol ester (72:1/14.0) levels NW 2 1.02(1.00-1.05) 0.08404 61 Phosphatidykchalne (18.209) levels NW 6 1.00(1.00-1.01) 0.08404 63 Phosphatidykchalne (18.209) levels NW 6 1.00(1.00-1.01) 0.08404 64 Sphingongelin (40.1) levels NW 7 1.01(1.00-1.01) 0.08480 64 Sphingongelin (40.1) levels WW 7 1.00(1.00-1.01) 0.04843 65 Phosphatidykchalne (18.0204) levels WW 5 1.01(1.00-1.01) 0.1473 66 Sphingongelin (43.4) levels WW 5 1.00(1.00-1.01) 0.1897 67 Sphingongelin (43.4) levels WW 6 1.00(1.00-1.01) 0.2849 7 Phosphatidykchalne (18.204) levels WW 4 1.00(1.00-1.01) 0.25257	56	Triacylglycerol (58:8) levels	IVW	2	1.01(1.00-1.01)	0.031439
58 Caramide (d40.2) levels IVW 2 1.000.09-1.000 0.04100 59 Sphingornyelin (d34.2) levels IVW 5 1.021(.00-1.05) 0.08044 61 Phosphatidylcholine (18.2_0.0) levels IVW 6 1.001(.00-1.01) 0.08644 62 Triacydjycerol (54.4) levels IVW 6 1.001(.00-1.01) 0.08434 63 Phosphatidylcholine (16.1_16.0) levels IVW 7 1.011(.00-1.01) 0.08434 64 Sphingornyelin (d40.1) levels IVW 7 1.011(.00-1.01) 0.04434 65 Phosphatidylcholine (0-1.61_1.16.0) levels IVW 3 1.001(.00-1.01) 0.1472 67 Sphingornyelin (d34.0) levels IVW 3 1.001(.00-1.01) 0.1473 68 Sterol ester (27.1/1.8.3) levels IVW 5 1.001(.00-1.01) 0.2089 70 Phosphatidylcholine (18.2_0.4) levels IVW 4 1.001(.00-1.01) 0.22842 71 Triacydgycerol (54.3) levels IVW 6 1.001(.00-1.01) 0.22844	57	Phosphatidylinositol (18:0_20:4) levels	IVW	7	1.00(1.00-1.00)	0.037175
Sphingomyelin (d34-2) levels VW S 1.01(1.00-1.02) 0.06790 60 Sterol ester (27:11/4.0) levels VW 2 1.02(1.00-1.05) 0.00804 61 Phosphatidyhethanolamine (18:0_18:2) levels VW 6 1.00(1.00-1.01) 0.08864 62 Triacylgycerol (54:4) levels VW 10 1.00(1.00-1.01) 0.08864 63 Phosphatidyhethanolamine (18:0_18:2) levels VW 7 1.01(1.00-1.01) 0.09434 64 Sphingomyelin (d3:1) levels VW 7 1.01(1.00-1.01) 0.01473 65 Phosphatidyhethanolamine (18:0_18:2) VW 5 1.00(1.00-1.01) 0.11871 66 Strol estr (27:1.118:3) levels VW 5 1.00(1.00-1.01) 0.20149 67 Sphingomyelin (d3:4.0) levels WR 1 0.00(1.00-1.01) 0.20189 70 Phosphatidyhethanolamine (18:0_2.0.4) levels WR 1 0.00(1.00-1.01) 0.221837 71 Triacylgycerol (56:5) levels WW 3	58	Ceramide (d40:2) levels	IVW	2	1.00(0.99-1.00)	0.041006
60 Sterol ester (27:1/14.0) levels IVW 2 1.02(100-1.05) 0.08044 61 Phosphatidylcholine (184_0.0) levels IVW 3 1.00(0.09-1.01) 0.08044 63 Phosphatidylethanolamine (18.0_18.2) levels IVW 10 1.00(1.00-1.01) 0.08840 64 Sphingomyelin (49.0) levels IVW 7 1.01(1.00-1.01) 0.09434 65 Phosphatidylcholine (0-16:_1.60) levels IVW 7 1.01(1.00-1.01) 0.01472 66 Triacylgycerol (638) levels IVW 3 1.00(1.00-1.01) 0.14735 67 Sphingomyelin (34.0) levels IVW 8 1.00(1.00-1.01) 0.20898 70 Phosphatidylcholine (18.2_0.04) levels IVW 8 1.00(1.00-1.01) 0.20898 71 Triacylgycerol (63.5) levels IVW 4 1.00(1.00-1.01) 0.20898 72 Phosphatidylcholine (18.2_0.03) levels IVW 3 1.00(1.00-1.01) 0.22577 73 Phosphatidylcholine (16.0_0.202) levels IVW 4 1.00(1.00-1.01)	59	Sphingomyelin (d34:2) levels	IVW	5	1.01(1.00-1.02)	0.067901
61 Phosphatidylcholine (18.2_00) levels NW 3 1.00(0.99-1.00) 0.08064 62 Triacylgiycerol (54.4) levels NW 6 1.00(1.00-1.01) 0.08848 63 Phosphatidylchanolamine (18_18.2) levels NW 7 1.01(1.00-1.01) 0.09434 65 Phosphatidylcholine (0-16.1_16.0) levels WR 1 1.00(1.00-1.01) 0.014435 66 Triacylgiycerol (56.8) levels WW 3 1.00(1.00-1.01) 0.14172 67 Sphingomyelin (34.0) levels WW 3 1.00(1.00-1.01) 0.14835 68 Sterol ester (27.1/18.3) levels WW 8 1.00(1.00-1.01) 0.20149 70 Phosphatidylcholine (18.1_00.1evels WW 8 1.00(1.00-1.01) 0.20149 71 Triacylgiycerol (54.3) levels IWW 4 1.00(1.00-1.01) 0.20257 73 Phosphatidylcholine (18.0_2.03) levels IWW 6 1.00(1.00-1.01) 0.26257 75 Triacylgiycerol (56.5) levels IWW 2 1.00(1.00-1.01) 0.26257 75 Triacylgiycerol (56.5) levels IWW 3 <td>60</td> <td>Sterol ester (27:1/14:0) levels</td> <td>IVW</td> <td>2</td> <td>1.02(1.00-1.05)</td> <td>0.080481</td>	60	Sterol ester (27:1/14:0) levels	IVW	2	1.02(1.00-1.05)	0.080481
62 Triacylglycerol (54.4) levels NW 6 1.00(1.00-1.01) 0.08684 63 Phosphatidylethanolamine (18.0_18.2) levels NW 10 1.00(1.00-1.01) 0.09880 64 Sphingornyelin (40-0) levels WR 1 1.00(1.00-1.01) 0.09563 66 Triacylglycerol (56.8) levels WR 5 1.01(1.00-1.01) 0.14172 67 Sphingornyelin (34.0) levels NW 5 1.00(1.00-1.01) 0.18435 68 Sterol ester (27.1/18.3) levels NW 8 1.00(1.00-1.01) 0.20089 70 Phosphatidylcholine (18.1_0.0) levels NW 4 1.00(1.00-1.01) 0.20289 71 Triacylglycerol (54.3) levels NW 4 1.00(1.00-1.00) 0.25257 74 Phosphatidylcholine (18.0_2.03.3) levels NW 6 1.00(1.00-1.01) 0.25257 75 Triacylglycerol (56.5) levels IW 4 1.00(1.00-1.01) 0.25257 76 Phosphatidylcholine (0-18.202.01 levels IW 4 1.00(1.00-1.01) 0.25252<	61	Phosphatidylcholine (18:2_0:0) levels	IVW	3	1.00(0.99-1.00)	0.080643
63 Phosphatidylethanolamine (18.0_18.2) levels IVW 10 1.00(1.00-1.01) 0.08880 64 Sphingornyelin (440.1) levels IVW 7 1.01(1.00-1.01) 0.09433 65 Phosphatidylcholine (0-16.1_16.0) levels WR 1 1.00(1.00-1.01) 0.01472 66 Triacylglycerol (56.8) levels IVW 5 1.00(1.00-1.01) 0.18435 68 Sterol ester (27.171.8.3) levels IVW 5 1.00(1.00-1.01) 0.20499 70 Phosphatidylcholine (18.1_0.0) levels IVW 8 1.00(1.00-1.01) 0.20499 71 Triacylglycerol (54.3) levels IVW 4 1.00(1.00-1.01) 0.20527 74 Phosphatidylcholine (18.0_2.02) levels IVW 4 1.00(1.00-1.01) 0.26257 75 Triacylglycerol (54.3) levels IVW 6 1.00(1.00-1.01) 0.26257 74 Phosphatidylcholine (16.0_2.02.1) levels IVW 4 1.00(1.00-1.01) 0.26257 75 Triacylglycerol (54.3) levels IVW 2 1.00(1.00-1.01) 0.26257 76 Phosphatidylcholine (0-16.2_2.04) levels	62	Triacylglycerol (54:4) levels	IVW	6	1.00(1.00-1.01)	0.086445
64 Sphingomyelin (440:1) levels IVW 7 1.01(1.00-1.01) 0.09434 65 Phosphatidylcholine (0-16:1_16:0) levels WR 1 1.00(1.00-1.01) 0.01472 66 Triacylglycerol (56:8) levels IVW 3 1.00(1.00-1.01) 0.18435 67 Sphingomyelin (34:0) levels IVW 3 1.00(1.00-1.01) 0.18435 68 Sterol ester (27:1/18:3) levels IVW 8 1.00(1.00-1.01) 0.20149 70 Phosphatidylchine (18:1_0.0) levels WW 4 1.00(1.00-1.01) 0.20189 71 Triacylglycerol (54:3) levels IVW 4 1.00(1.00-1.01) 0.22527 73 Phosphatidylcholine (18:0_2.02:) levels IVW 3 1.00(1.00-1.01) 0.22537 74 Phosphatidylcholine (0.62:02:) levels IVW 4 1.00(1.00-1.01) 0.22537 75 Triacylglycerol (55:) levels IVW 2 1.00(1.00-1.01) 0.22543 76 Phosphatidylcholine (0-18:2_0:0/) levels IVW 3 0.00(1.00-1.01) 0	63	Phosphatidylethanolamine (18:0_18:2) levels	IVW	10	1.00(1.00-1.01)	0.088805
55 Phosphatidylcholine (0-16.1_16.0) levels WR 1 1.00(1.00-1.01) 0.01472 66 Triacylglycerol (56.8) levels IVW 5 1.00(1.00-1.01) 0.11472 67 Sphingomyelin (34.0) levels IVW 5 1.00(1.00-1.01) 0.118971 68 Sterol ester (27:1/18.3) levels IVW 8 1.00(1.00-1.01) 0.20149 69 Phosphatidylcholine (18.1_0.0) levels WR 1 0.90(0.90-1.00) 0.21149 71 Triacylglycerol (54.3) levels WW 2 1.00(1.00-1.01) 0.20988 72 Phosphatidylcholine (18.1_0.20.3) levels IVW 2 1.00(1.00-1.00) 0.25527 73 Phosphatidylcholine (16.0_20.2) levels IVW 4 1.00(1.00-1.01) 0.22532 74 Phosphatidylcholine (0.65) levels IVW 4 1.00(1.00-1.01) 0.22543 75 Triacylglycerol (656) levels IVW 2 1.00(1.00-1.01) 0.22543 76 Phosphatidylcholine (0-18.2_0.2) levels IVW 3 0.00(1.00-1.01) 0.32544 76 Phosphatidylcholine (0-18.2_0.2) levels	64	Sphingomyelin (d40:1) levels	IVW	7	1.01(1.00-1.01)	0.09434
66 Triacylglycerol (56.8) levels IVW 5 1.01(1.00-1.01) 0.14172 67 Sphingomyelin (d34.0) levels IVW 3 1.00(1.00-1.01) 0.18971 68 Sterol ester (27.1/18.3) levels IVW 8 1.00(1.00-1.01) 0.20089 70 Phosphatidylcholine (18.1_0.0) levels WR 1 0.99(0.99-1.00) 0.20149 71 Triacylglycerol (54.3) levels IVW 4 1.00(1.00-1.01) 0.20289 72 Phosphatidylcholine (18.1_0.20.3) levels IVW 4 1.00(1.00-1.01) 0.2527 73 Phosphatidylcholine (18.0_2.0.2) levels IVW 6 1.00(1.00-1.01) 0.2527 74 Phosphatidylcholine (0.18.2_2.0.4) levels IVW 4 1.00(1.00-1.01) 0.2527 75 Triacylglycerol (56.5) levels IVW 2 1.00(1.00-1.01) 0.2527 76 Phosphatidylcholine (0-18.2_2.0.4) levels IVW 2 1.00(1.00-1.01) 0.36265 77 Sterol ester (27.1/7.2) levels IVW 2 1.00(1.00-1.01) 0.36265 78 Phosphatidylcholine (0-16.2_0.2) levels	65	Phosphatidylcholine (O-16:1_16:0) levels	WR	1	1.00(1.00-1.01)	0.095633
67 Sphingomyelin (d34.0) levels IVW 3 1.00(1.00-1.01) 0.18435 68 Sterol ester (Z7.1/18.3) levels IVW 5 1.00(1.00-1.01) 0.20089 70 Phosphatidylcholine (18.1_0.0) levels WR 1 0.99(0.99-1.00) 0.20149 71 Triacylgycerol (54.3) levels IVW 4 1.00(1.00-1.01) 0.20289 72 Phosphatidylcholine (18.1_0.04) levels IVW 4 1.00(1.00-1.00) 0.25527 73 Phosphatidylcholine (16.0_2.0.2) levels IVW 3 1.00(1.00-1.00) 0.26257 74 Phosphatidylcholine (16.0_2.0.2) levels IVW 4 1.00(1.00-1.01) 0.26239 75 Triacylgycerol (56.5) levels IVW 4 1.00(1.00-1.01) 0.26237 76 Phosphatidylcholine (0-18.2_0.24) levels IVW 4 1.00(1.00-1.01) 0.26237 76 Phosphatidylcholine (0-16.2_0.24) levels IVW 2 1.00(1.00-1.01) 0.26257 77 Sterol ester (27.1/17.0) levels IVW 2 1.00(1.00-1.01) 0.36807 78 Phosphatidylcholine (0-18.2_0.23) levels	66	Triacylglycerol (56:8) levels	IVW	5	1.01(1.00-1.01)	0.141722
68 Sterol ester (27:1/18:3) levels IVW 5 1.00(1.00-1.01) 0.18971 69 Phosphatidylethanolamine (18:0_20:4) levels IVW 8 1.00(1.00-1.01) 0.20089 70 Phosphatidylcholine (18:1_0:0) levels WR 1 0.99(0.99-1.00) 0.20149 71 Triacylgycerol (54:3) levels IVW 4 1.00(1.00-1.01) 0.20888 72 Phosphatidylcholine (18:0_20:3) levels IVW 3 1.00(1.00-1.00) 0.25527 74 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.00(1.00-1.01) 0.22339 75 Triacylgycerol (56:5) levels IVW 2 1.00(1.00-1.01) 0.23244 76 Phosphatidylcholine (0-18:2_0:4) levels IVW 2 1.00(1.00-1.00) 0.32054 77 Sterol ester (27:1/17:0) levels IVW 3 0.99(0.98-1.01) 0.36055 80 Phosphatidylcholine (0-18:2_18:2) levels IVW 2 1.00(0.99-1.01) 0.37863 81 Phosphatidylcholine (0-16:1_2:0:4) levels IVW 3 1.	67	Sphingomyelin (d34:0) levels	IVW	3	1.00(1.00-1.01)	0.184354
69 Phosphatidylethanolamine (18.0_20.4) levels IVW 8 1.00(1.00-1.01) 0.20089 70 Phosphatidylcholine (18.1_0.0) levels WR 1 0.99(0.99-1.00) 0.20149 71 Triacylglycerol (54.3) levels IVW 4 1.00(1.00-1.01) 0.20288 72 Phosphatidylcholine (18.1_20.4) levels IVW 3 1.00(1.00-1.01) 0.2527 74 Phosphatidylcholine (16.0_20.2) levels IVW 6 1.00(1.00-1.01) 0.22384 75 Triacylglycerol (56.5) levels IVW 4 1.00(1.00-1.01) 0.22384 76 Phosphatidylcholine (0-18.2_20.4) levels IVW 2 1.00(1.00-1.01) 0.23244 77 Sterol ester (27:1/7.0) levels IVW 6 1.00(1.00-1.00) 0.32054 78 Phosphatidylcholine (O-16.0_20.3) levels IVW 6 1.00(1.00-1.01) 0.37803 80 Phosphatidylcholine (O-16.2_16.0) levels IVW 3 1.00(1.00-1.01) 0.37803 81 Phosphatidylcholine (O-16.1_20.4) levels IVW 3 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (O	68	Sterol ester (27:1/18:3) levels	IVW	5	1.00(1.00-1.01)	0.18971
70 Phosphatidylcholine (18:1_0:0) levels WR 1 0.99(0.99-1.00) 0.20149 71 Triacylglycerol (54:3) levels IVW 4 1.00(1.00-1.01) 0.20988 72 Phosphatidylcholine (18:0_20:3) levels IVW 3 1.00(1.00-1.00) 0.25527 74 Phosphatidylcholine (16:0_20:2) levels IVW 4 1.00(1.00-1.01) 0.22537 75 Triacylglycerol (56:5) levels IVW 4 1.00(1.00-1.01) 0.22537 76 Phosphatidylcholine (0-18:2_20:4) levels IVW 4 1.00(1.00-1.01) 0.22537 76 Phosphatidylcholine (0-18:2_20:4) levels IVW 2 1.00(1.00-1.01) 0.23054 77 Sterol ester (27:1/17:0) levels IVW 2 1.00(0.98-1.01) 0.32054 79 Phosphatidylcholine (0-18:2_16:0) levels IVW 3 0.99(0.98-1.01) 0.32054 79 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.00(1.00-1.01) 0.37033 80 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.00(0.99-1.01) 0.40244 81 Phosphatidylcholine (0-	69	Phosphatidylethanolamine (18:0_20:4) levels	IVW	8	1.00(1.00-1.01)	0.200899
71 Triacylglycerol (54:3) levels IVW 4 1.00(1.00-1.01) 0.20988 72 Phosphatidylinositol (18:1_20:4) levels IVW 2 1.01(0.99-1.02) 0.21837 73 Phosphatidylcholine (18:0_20:2) levels IVW 3 1.00(1.00-1.00) 0.25527 74 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.00(1.00-1.01) 0.22537 75 Triacylglycerol (56:5) levels IVW 4 1.00(1.00-1.01) 0.228340 76 Phosphatidylcholine (0-18:2_20:4) levels IVW 2 1.00(1.00-1.01) 0.23840 77 Sterol ester (27:1/17:0) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (0-16:2_0:3) levels IVW 3 0.99(0.99-1.01) 0.36205 80 Phosphatidylcholine (0-16:2_1:20:4) levels IVW 3 1.00(1.00-1.01) 0.37803 81 Phosphatidylcholine (0-18:2_1:8:2) levels IVW 3 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (0-16:1_2:0:4) levels IVW 3 1.00(1.00-1.01) 0.40244 84 Sterol ester (27	70	Phosphatidylcholine (18:1_0:0) levels	WR	1	0.99(0.99-1.00)	0.201497
Procentialitylinositol (18:1_20:4) levels IVW 2 1.01(0.99-1.02) 0.21837 73 Phosphatidylicholine (18:0_20:3) levels IVW 3 1.00(1.00-1.00) 0.25527 74 Phosphatidylcholine (16:0_20:2) levels IVW 6 1.00(1.00-1.01) 0.25257 75 Triacylglycerol (56:5) levels IVW 4 1.00(1.00-1.01) 0.2233 76 Phosphatidylcholine (0-18:2_04) levels IVW 2 1.00(1.00-1.01) 0.2234 77 Sterol ester (27:1/17:0) levels IVW 2 1.00(1.00-1.01) 0.32054 79 Phosphatidylcholine (0-16:2_0:3) levels IVW 3 0.99(0.98-1.01) 0.36057 81 Phosphatidylcholine (0-16:2_0:4) levels IVW 2 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.00(1.00-1.01) 0.37803 83 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 1.00(0.99-1.01) 0.40244 84 Sterol ester (27:1/2:6) levels IVW 8 1.00(0.99-1.0	71	Triacylglycerol (54:3) levels	IVW	4	1.00(1.00-1.01)	0.209889
73 Phosphatidylcholine (18.0_20.3) levels IVW 3 1.00(1.00-1.00) 0.25527 74 Phosphatidylcholine (16.0_20.2) levels IVW 6 1.00(1.00-1.01) 0.26257 75 Triacylglycerol (56.5) levels IVW 4 1.00(1.00-1.01) 0.27239 76 Phosphatidylcholine (0-18.2_20.4) levels IVW 2 1.00(1.00-1.01) 0.28340 77 Sterol ester (27.1/17.0) levels IVW 6 1.00(1.00-1.01) 0.32054 79 Phosphatidylcholine (0-16.0_20.3) levels IVW 3 0.99(0.98-1.01) 0.36205 80 Phosphatidylcholine (0-18.2_16.0) levels IVW 2 1.00(1.00-1.00) 0.32054 78 Phosphatidylcholine (0-18.2_18.2) levels IVW 3 0.99(0.98-1.01) 0.36205 80 Phosphatidylcholine (0-18.2_18.2) levels IVW 3 1.00(1.00-1.01) 0.37030 81 Phosphatidylcholine (0-16.1_2.0.4) levels IVW 3 1.00(1.00-1.01) 0.40783 82 Phosphatidylcholine (0-16.1_18.2) levels IVW 2 1.00(0.99-1.00) 0.40783 84 Sterol	72	Phosphatidylinositol (18:1_20:4) levels	IVW	2	1.01(0.99-1.02)	0.21837
74 Phosphatidylcholine (16.0_20:2) levels IVW 6 1.00(1.00-1.01) 0.26257 75 Triacylglycerol (56.5) levels IVW 4 1.00(1.00-1.01) 0.27239 76 Phosphatidylcholine (0-18.2_20:4) levels IVW 2 1.00(1.00-1.01) 0.28340 77 Sterol ester (27:1/17:0) levels IVW 2 1.02(0.98-1.05) 0.30719 78 Ceramide (d40:1) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (O-16.2_20:3) levels IVW 3 0.99(0.98-1.01) 0.36057 80 Phosphatidylcholine (O-16.2_16.0) levels IVW 2 1.00(1.00-1.01) 0.37080 81 Phosphatidylcholine (O-18.2_18.2) levels WR 1 1.00(1.00-1.01) 0.37080 82 Phosphatidylcholine (O-16.1_20.4) levels IVW 3 1.00(1.00-1.01) 0.37080 83 Phosphatidylcholine (O-16.1_21.8.2) levels IVW 2 1.00(0.99-1.01) 0.40244 84 Sterol ester (27:1/22.6) levels IVW 8 1.00(1.00-1.01) 0.47337 87 Sterol ester (27:1/20.4) levels	73	Phosphatidylcholine (18:0_20:3) levels	IVW	3	1.00(1.00-1.00)	0.255277
75 Triacylglycerol (56:5) levels IVW 4 1.00(1.00-1.01) 0.27239 76 Phosphatidylcholine (O-18:2_20:4) levels IVW 2 1.00(1.00-1.01) 0.28340 77 Sterol ester (27:1/17:0) levels IVW 2 1.02(0.98-1.05) 0.30719 78 Ceramide (d40:1) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (0-16:0_20:3) levels IVW 3 0.99(0.98-1.01) 0.36857 80 Phosphatidylcholine (0-18:2_16:0) levels IVW 2 1.00(1.00-1.01) 0.37803 81 Phosphatidylcholine (0-18:2_18:2) levels WR 1 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (0-16:1_20:4) levels IVW 3 1.00(1.00-1.01) 0.37803 83 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 1.01(0.9-1.03) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.00(0.99-1.00) 0.47337 85 Phosphatidylcholine (16:0_16:0) levels IVW 8 1.00(0.09-1.01) 0.42349 86 Ceramide (d42:2) levels	74	Phosphatidylcholine (16:0_20:2) levels	IVW	6	1.00(1.00-1.01)	0.262575
Phosphatidylcholine (O-18:2_20:4) levels IVW 2 1.00(1.00-1.01) 0.28340 77 Sterol ester (27:1/17:0) levels IVW 2 1.02(0.98-1.05) 0.30719 78 Ceramide (d40:1) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (O-16:0_20:3) levels IVW 3 0.99(0.98-1.01) 0.36205 80 Phosphatidylcholine (O-18:2_16:0) levels IVW 2 1.00(1.00-1.00) 0.32054 81 Phosphatidylcholine (O-18:2_18:2) levels IVW 2 1.00(0.99-1.01) 0.36857 81 Phosphatidylcholine (O-16:1_2.04) levels IVW 3 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (O-16:1_2.04) levels IVW 3 1.00(1.00-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40588 85 Phosphatidylcholine (O-16:1_18:2) levels IVW 8 1.00(0.99-1.00) 0.41337 86 Ceramide (d42:2) levels IVW 8 1.00(0.99-1.00)	75	Triacylglycerol (56:5) levels	IVW	4	1.00(1.00-1.01)	0.272391
77 Sterol ester (27:1/17:0) levels IVW 2 1.02(0.98-1.05) 0.30719 78 Ceramide (d40:1) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (O-16.0_20:3) levels IVW 3 0.99(0.98-1.01) 0.36205 80 Phosphatidylcholine (O-18:2_16:0) levels IVW 2 1.00(0.99-1.01) 0.37803 81 Phosphatidylcholine (O-16:2_18:2) levels WR 1 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (O-16:1_2.04) levels IVW 3 1.00(1.00-1.01) 0.37803 83 Phosphatidylcholine (O-16:1_2.04) levels IVW 2 1.00(0.99-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40598 85 Phosphatidylcholine (O-16:1_18:2) levels IVW 8 1.00(0.99-1.00) 0.41337 86 Ceramide (d42:2) levels IVW 8 1.00(0.99-1.00) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 3 1.00(0.99-1.01) 0.42690 90 Phosphatidylcholine (16:0_20:3) levels<	76	Phosphatidylcholine (O-18:2 20:4) levels	IVW	2	1.00(1.00-1.01)	0.283406
78 Ceramide (d40:1) levels IVW 6 1.00(1.00-1.00) 0.32054 79 Phosphatidylcholine (0-16:0_20:3) levels IVW 3 0.99(0.98-1.01) 0.36205 80 Phosphatidylcholine (0-18:2_16:0) levels IVW 2 1.00(1.00-1.01) 0.37803 81 Phosphatidylcholine (0-18:2_18:2) levels WR 1 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (0-16:1_20:4) levels WW 3 1.00(1.00-1.01) 0.39800 83 Phosphatidylcholine (0-18:2_18:2) levels WW 2 1.00(0.99-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40598 85 Phosphatidylcholamine (O-16:1_18:2) levels WR 1 1.00(0.99-1.00) 0.47337 86 Ceramide (d42:2) levels IVW 8 1.00(1.00-1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 3 1.00(0.99-1.01) 0.42349 90 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(0.99-1.01) 0.42690 91 Phosphatidylcholine (16:0_20:3) l	77	Sterol ester (27:1/17:0) levels	IVW	2	1.02(0.98-1.05)	0.307198
79 Phosphatidylcholine (0-16:0_20:3) levels IVW 3 0.99(9.88-1.01) 0.36205 80 Phosphatidylcholine (0-18:2_16:0) levels IVW 2 1.00(0.99-1.01) 0.36877 81 Phosphatidylethanolamine (0-18:2_18:2) levels WR 1 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (0-16:1_20:4) levels WR 1 1.00(1.00-1.01) 0.39800 83 Phosphatidylcholine (0-16:1_20:4) levels IVW 2 1.00(0.99-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40598 85 Phosphatidylethanolamine (0-16:1_18:2) levels WR 1 1.00(0.99-1.00) 0.40783 86 Ceramide (d42:2) levels IVW 8 1.00(1.00-1.01) 0.42349 87 Sterol ester (27:1/20:4) levels IVW 8 1.00(1.00-1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 3 1.00(0.99-1.02) 0.42414 89 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(0.99-1.01) 0.43525 91 Phosphatidylchol	78	Ceramide (d40:1) levels	IVW	6	1.00(1.00-1.00)	0.320548
80 Phosphatidylcholine (O-18:2_16:0) levels IVW 2 1.00(0.99-1.01) 0.36857 81 Phosphatidylethanolamine (O-18:2_18:2) levels WR 1 1.00(1.00-1.01) 0.37803 82 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.00(1.00-1.01) 0.39800 83 Phosphatidylcholine (O-16:1_20:4) levels IVW 2 1.00(0.99-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40598 85 Phosphatidylethanolamine (O-16:1_18:2) levels WR 1 1.00(0.99-1.00) 0.40783 86 Ceramide (d42:2) levels WR 1 1.00(0.99-1.00) 0.41337 87 Sterol ester (27:1/20:4) levels IVW 8 1.00(1.00-1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 3 1.00(0.99-1.02) 0.42414 89 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(0.99-1.01) 0.4352 91 Phosphatidylcholine (0-16:0_18:2) levels IVW 2	79	Phosphatidylcholine (O-16:0_20:3) levels	IVW	3	0.99(0.98-1.01)	0.362053
81Phosphatidylethanolamine (O-18:2_18:2) levelsWR11.00(1.00-1.01)0.3780382Phosphatidylcholine (O-16:1_20:4) levelsIVW31.00(1.00-1.01)0.3980083Phosphatidylcholine (O-18:2_18:2) levelsIVW21.00(0.99-1.01)0.4022484Sterol ester (27:1/22:6) levelsIVW21.01(0.99-1.03)0.4059885Phosphatidylethanolamine (O-16:1_18:2) levelsWR11.00(0.99-1.00)0.4078386Ceramide (d42:2) levelsIVW81.00(1.00-1.01)0.4234987Sterol ester (27:1/20:4) levelsIVW81.00(1.00-1.01)0.4234988Phosphatidylcholine (16:0_16:0) levelsIVW51.00(0.99-1.02)0.42141489Phosphatidylcholine (16:0_20:3) levelsIVW31.00(1.00-1.00)0.4335290Phosphatidylcholine (16:0_20:3) levelsIVW21.00(1.00-1.00)0.4335291Phosphatidylcholine (0-16:0_18:2) levelsIVW31.00(1.00-1.00)0.47639392Ceramide (d42:1) levelsIVW31.00(1.00-1.00)0.4762293Phosphatidylcholine (18:2_20:3) levelsWR11.00(0.99-1.00)0.4769194Phosphatidylcholine (0-16:0_22:5) levelsWR11.00(0.99-1.00)0.4930195Phosphatidylcholine (18:1_20:3) levelsWR31.00(0.99-1.00)0.49301	80	Phosphatidylcholine (O-18:2 16:0) levels	IVW	2	1.00(0.99-1.01)	0.368579
82 Phosphatidylcholine (O-16:1_20:4) levels IVW 3 1.00(1.00-1.01) 0.39800 83 Phosphatidylcholine (O-18:2_18:2) levels IVW 2 1.00(0.99-1.01) 0.40224 84 Sterol ester (27:1/22:6) levels IVW 2 1.01(0.99-1.03) 0.40598 85 Phosphatidylethanolamine (O-16:1_18:2) levels WR 1 1.00(0.99-1.00) 0.40783 86 Ceramide (d42:2) levels WR 1 1.00(0.99-1.00) 0.41337 87 Sterol ester (27:1/20:4) levels IVW 8 1.00(1.00-1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 8 1.00(0.99-1.02) 0.42414 89 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(0.99-1.01) 0.42590 90 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(0.99-1.01) 0.43522 91 Phosphatidylcholine (0-16:0_18:2) levels IVW 2 1.00(1.00-1.00) 0.43523 92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels<	81	Phosphatidylethanolamine (O-18:2 18:2) levels	WR	1	1.00(1.00-1.01)	0.378032
83Phosphatidylcholine (O-18:2_18:2) levelsIVW21.00(0.99-1.01)0.4022484Sterol ester (27:1/22:6) levelsIVW21.01(0.99-1.03)0.4059885Phosphatidylethanolamine (O-16:1_18:2) levelsWR11.00(0.99-1.00)0.4078386Ceramide (d42:2) levelsIVW81.00(1.09-1.00)0.4133787Sterol ester (27:1/20:4) levelsIVW81.00(1.00-1.01)0.4234988Phosphatidylcholine (16:0_16:0) levelsIVW51.00(0.99-1.02)0.4241489Phosphatidylcholine (16:2_20:3) levelsIVW31.00(0.99-1.01)0.4259990Phosphatidylcholine (16:0_20:3) levelsIVW21.00(1.00-1.00)0.4352291Phosphatidylcholine (16:0_18:2) levelsIVW21.00(0.99-1.01)0.47639392Ceramide (d42:1) levelsIVW31.00(0.99-1.00)0.4762293Phosphatidylcholine (18:2_20:3) levelsWR11.00(0.99-1.00)0.4769194Phosphatidylcholine (0-16:0_22:5) levelsWR11.00(1.00-1.01)0.4769195Phosphatidylcholine (18:1_20:3) levelsIVW31.00(0.99-1.00)0.49301	82	Phosphatidylcholine (O-16:1 20:4) levels	IVW	3	1.00(1.00-1.01)	0.398009
84Sterol ester (27:1/22:6) levelsIVW21.01(0.99–1.03)0.4059885Phosphatidylethanolamine (O-16:1_18:2) levelsWR11.00(0.99–1.00)0.4078386Ceramide (d42:2) levelsIVW81.00(1.09–1.00)0.4133787Sterol ester (27:1/20:4) levelsIVW81.00(1.00–1.01)0.4234988Phosphatidylcholine (16:0_16:0) levelsIVW81.00(0.99–1.02)0.42141489Phosphatidylcholine (16:2_18:2) levelsIVW31.00(0.99–1.01)0.4269090Phosphatidylcholine (16:0_20:3) levelsIVW21.00(1.00–1.00)0.4352291Phosphatidylcholine (O-16:0_18:2) levelsIVW21.00(0.99–1.01)0.4539392Ceramide (d42:1) levelsIVW31.00(1.00–1.00)0.4762293Phosphatidylcholine (18:2_20:3) levelsWR11.00(0.99–1.00)0.4769194Phosphatidylcholine (0-16:0_22:5) levelsWR11.00(0.99–1.00)0.4769195Phosphatidylcholine (18:1_20:3) levelsIVW31.00(0.99–1.00)0.49301	83	Phosphatidylcholine (O-18:2 18:2) levels	IVW	2	1.00(0.99-1.01)	0.402248
85Phosphatidylethanolamine (O-16:1_18:2) levelsWR11.00(0.99-1.00)0.4078386Ceramide (d42:2) levelsIVW81.00(0.99-1.00)0.4133787Sterol ester (27:1/20:4) levelsIVW81.00(1.00-1.01)0.4234988Phosphatidylcholine (16:0_16:0) levelsIVW51.00(0.99-1.02)0.4241489Phosphatidylcholine (16:0_20:3) levelsIVW31.00(0.99-1.01)0.4235290Phosphatidylcholine (16:0_20:3) levelsIVW21.00(1.00-1.00)0.4335291Phosphatidylcholine (0-16:0_18:2) levelsIVW21.00(0.99-1.01)0.4539392Ceramide (d42:1) levelsIVW31.00(1.00-1.00)0.4762293Phosphatidylcholine (18:2_20:3) levelsWR11.00(0.99-1.00)0.4769194Phosphatidylcholine (0-16:0_22:5) levelsWR11.00(0.99-1.00)0.4769195Phosphatidylcholine (18:1_20:3) levelsIVW31.00(0.99-1.00)0.47691	84	Sterol ester (27:1/22:6) levels	IVW	2	1.01(0.99–1.03)	0.405987
86 Ceramide (d42:2) levels IVW 8 1.00(0.99–1.00) 0.41337 87 Sterol ester (27:1/20:4) levels IVW 8 1.00(1.00–1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 5 1.00(0.99–1.02) 0.42414 89 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.00(0.99–1.01) 0.42690 90 Phosphatidylcholine (16:0_20:3) levels IVW 3 1.00(1.00–1.00) 0.43352 91 Phosphatidylcholine (O-16:0_18:2) levels IVW 2 1.00(1.00–1.00) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00–1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99–1.00) 0.47691 94 Phosphatidylcholine (0-16:0_22:5) levels WR 1 1.00(1.00–1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99–1.00) 0.49301	85	Phosphatidylethanolamine (O-16:1 18:2) levels	WR	1	1.00(0.99-1.00)	0.407836
87 Sterol ester (27:1/20:4) levels IVW 8 1.00(1.00-1.01) 0.42349 88 Phosphatidylcholine (16:0_16:0) levels IVW 5 1.00(0.99-1.02) 0.42414 89 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.00(0.99-1.01) 0.42690 90 Phosphatidylcholine (16:0_20:3) levels IVW 2 1.00(1.00-1.00) 0.43352 91 Phosphatidylcholine (0-16:0_18:2) levels IVW 2 1.00(0.99-1.01) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99-1.00) 0.47691 94 Phosphatidylcholine (0-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.47691	86	Ceramide (d42:2) levels	IVW	8	1.00(0.99-1.00)	0.413379
88 Phosphatidylcholine (16:0_16:0) levels IVW 5 1.00(0.99-1.02) 0.42414 89 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.00(0.99-1.01) 0.42690 90 Phosphatidylcholine (16:0_20:3) levels IVW 2 1.00(1.00-1.00) 0.43352 91 Phosphatidylcholine (O-16:0_18:2) levels IVW 2 1.00(0.99-1.01) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels IVW 3 1.00(0.99-1.00) 0.47691 94 Phosphatidylcholine (0-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.47691	87	Sterol ester (27:1/20:4) levels	IVW	8	1.00(1.00-1.01)	0.423497
89 Phosphatidylcholine (18:2_18:2) levels IVW 3 1.00(0.99–1.01) 0.42690 90 Phosphatidylcholine (16:0_20:3) levels IVW 2 1.00(1.00–1.00) 0.43352 91 Phosphatidylcholine (O-16:0_18:2) levels IVW 2 1.00(0.99–1.01) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00–1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99–1.01) 0.47691 94 Phosphatidylcholine (O-16:0_22:5) levels WR 1 1.00(1.00–1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99–1.00) 0.49301	88	Phosphatidylcholine (16:0 16:0) levels	IVW	5	1.00(0.99-1.02)	0.424141
90 Phosphatidylcholine (16:0_20:3) levels IVW 2 1.00(1.00-1.00) 0.43352 91 Phosphatidylcholine (O-16:0_18:2) levels IVW 2 1.00(0.99-1.01) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99-1.01) 0.47691 94 Phosphatidylcholine (O-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.49301	89	Phosphatidylcholine (18:2–18:2) levels	IVW	3	1.00(0.99–1.01)	0.426907
91 Phosphatidylcholine (O-16:0_18:2) levels IVW 2 1.00(0.99-1.01) 0.45393 92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99-1.00) 0.47691 94 Phosphatidylcholine (O-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.49301	90	Phosphatidylcholine (16:0 20:3) levels	IVW	2	1.00(1.00-1.00)	0.433529
92 Ceramide (d42:1) levels IVW 3 1.00(1.00-1.00) 0.47622 93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99-1.00) 0.47691 94 Phosphatidylcholine (0-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.49301	91	Phosphatidylcholine ($O-16:0$, 18:2) levels	IVW	2	1.00(0.99-1.01)	0.453937
93 Phosphatidylcholine (18:2_20:3) levels WR 1 1.00(0.99-1.00) 0.47691 94 Phosphatidylcholine (O-16:0_22:5) levels WR 1 1.00(1.00-1.01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.49301	92	Ceramide (d42:1) levels	IVW	3	1.00(1.00-1.00)	0.476222
94 Phosphatidylcholine (O-16:0_22:5) levels WR 1 1.00(1:00-1:01) 0.47691 95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1:00) 0.49301	93	Phosphatidylcholine (18:2–20:3) levels	WR	1	1.00(0.99-1.00)	0.476919
95 Phosphatidylcholine (18:1_20:3) levels IVW 3 1.00(0.99-1.00) 0.49301	94	Phosphatidylcholine (O-16:0-22:5) levels	WR	1	1.00(1.00-1.01)	0.476919
	95	Phosphatidylcholine (18-1, 20-3) levels	IVW	3	1.00(0.99–1.00)	0,493016
96 Sphingomyelin (d38:2) levels IVW 5 100(0.99–1.01) 0.49352	96	Sphingomyelin (d38:2) levels	IVW	5	1.00(0.99–1.01)	0,49352
97 Phosphatidylcholine (17:0-18:2) levels IVW 3 1.00(0.99-1.01) 0.49804	97	Phosphatidylcholine (17:0 18:2) levels	IVW	3	1 00(0 99–1 01)	0.498044
98 Phosphatidylcholine (18:2 20:4) levels IVW 4 1.00(1.00-1.01) 0.50001	98	Phosphatidylcholine (18:2–20:4) levels	IVW	4	1.00(1.00-1.01)	0.500011

Table 2 (continued)

No	Exposure	Method	nSNP	OR(95%CI)	Pvalue
99	Phosphatidylcholine (16:0_22:6) levels	WR	1	1.00(1.00-1.01)	0.504428
100	Triacylglycerol (56:4) levels	IVW	3	1.00(1.00-1.01)	0.523428
101	Phosphatidylinositol (18:1_18:1) levels	IVW	5	1.00(1.00-1.00)	0.525829
102	Phosphatidylcholine (O-18:1_20:3) levels	IVW	2	1.00(1.00-1.00)	0.527624
103	Phosphatidylinositol (18:0_18:2) levels	IVW	6	1.00(1.00-1.01)	0.530169
104	Phosphatidylcholine (16:0_18:0) levels	WR	1	1.00(0.99–1.00)	0.530577
105	Phosphatidylethanolamine (O-18:2_20:4) levels	IVW	2	1.00(1.00-1.01)	0.534978
106	Phosphatidylcholine (18:2_20:1) levels	WR	1	1.00(1.00-1.00)	0.55807
107	Phosphatidylcholine (16:0_18:2) levels	IVW	7	1.00(1.00-1.01)	0.579553
108	Phosphatidylcholine (16:0_20:1) levels	WR	1	1.00(0.99-1.01)	0.583773
109	Sphingomyelin (d36:1) levels	IVW	8	1.00(0.99-1.01)	0.584407
110	Phosphatidylcholine (18:0_22:5) levels	IVW	2	1.00(1.00-1.01)	0.598499
111	Triacylglycerol (56:3) levels	IVW	4	1.00(0.98-1.01)	0.59934
112	Phosphatidylcholine (17:0_20:4) levels	IVW	5	1.00(1.00-1.00)	0.636507
113	Phosphatidylinositol (16:0_18:1) levels	IVW	2	1.00(0.99-1.00)	0.636795
114	Phosphatidylcholine (18:0_20:5) levels	IVW	2	1.00(1.00-1.00)	0.639059
115	Triacylglycerol (58:7) levels	IVW	6	1.00(0.99-1.01)	0.641286
116	Phosphatidylcholine (16:0_22:5) levels	IVW	4	1.00(1.00-1.00)	0.649506
117	Phosphatidylcholine (18:0_20:4) levels	IVW	6	1.00(1.00-1.00)	0.659276
118	Phosphatidylinositol (18:0_20:3) levels	IVW	5	1.00(1.00-1.00)	0.65964
119	Phosphatidylcholine (18:1_20:2) levels	IVW	3	1.00(1.00-1.00)	0.660852
120	Phosphatidylcholine (18:0_18:3) levels	WR	1	1.00(0.99-1.01)	0.661876
121	Phosphatidylcholine (O-16:0_18:1) levels	IVW	3	1.00(0.99-1.02)	0.665832
122	Phosphatidylcholine (16:1_20:4) levels	WR	1	1.00(1.00-1.00)	0.668672
123	Phosphatidylethanolamine (O-18:1_20:4) levels	IVW	2	1.00(1.00-1.00)	0.670723
124	Phosphatidylcholine (O-18:0_20:4) levels	IVW	2	1.00(1.00-1.00)	0.697669
125	Phosphatidylcholine (O-16:1_18:1) levels	IVW	3	1.00(0.98-1.01)	0.699428
126	Sterol ester (27:1/17:1) levels	WR	1	1.00(0.98-1.02)	0.703055
127	Sphingomyelin (d38:1) levels	IVW	10	1.00(0.99-1.00)	0.733297
128	Phosphatidylcholine (O-18:1_16:0) levels	IVW	3	1.00(0.99-1.02)	0.735684
129	Phosphatidylcholine (18:0_18:2) levels	IVW	5	1.00(0.99-1.01)	0.742939
130	Sterol ester (27:1/20:3) levels	IVW	6	1.00(1.00-1.00)	0.747485
131	Phosphatidylcholine (18:0_22:6) levels	IVW	2	1.00(1.00-1.01)	0.751353
132	Phosphatidylcholine (18:1_18:2) levels	IVW	5	1.00(1.00-1.01)	0.752776
133	Phosphatidylcholine (16:0_20:5) levels	WR	1	1.00(1.00-1.00)	0.75332
134	Phosphatidylethanolamine (O-16:1_20:4) levels	IVW	2	1.00(1.00-1.00)	0.754466
135	Sphingomyelin (d36:2) levels	IVW	4	1.00(0.99-1.01)	0.761617
136	Phosphatidylethanolamine (O-18:1_18:2) levels	WR	1	1.00(0.99-1.00)	0.781696
137	Phosphatidylcholine (O-18:2_18:1) levels	WR	1	1.00(0.99-1.01)	0.783235
138	Phosphatidylcholine (18:0_20:2) levels	WR	1	1.00(1.00-1.00)	0.787546
139	Phosphatidylcholine (16:0_18:3) levels	IVW	3	1.00(0.99-1.01)	0.789306
140	Sterol ester (27:1/20:5) levels	IVW	3	1.00(1.00-1.00)	0.789929
141	Phosphatidylcholine (O-18:1 18:2) levels	WR	1	1.00(1.00-1.00)	0.791231
142	Phosphatidylethanolamine (18:0–0:0) levels	IVW	2	1.00(0.98-1.02)	0.793894
143	Phosphatidylcholine (16:0 20:4) levels	IVW	4	1.00(1.00-1.00)	0.806426
144	Phosphatidylcholine (14:0 18:2) levels	IVW	2	1.00(0.99–1.01)	0.81781
145	Phosphatidylcholine (15:0 18:2) levels	IVW	5	1.00(0.99–1.01)	0.83309
146	Phosphatidylcholine (16:1–18:1) levels	IVW	- 5	1.00(0.99–1.01)	0,849638
147	Phosphatidylcholine (O-16:1_20:3) levels	IVW	3	1.00(1.00–1.00)	0.852204

Table 2 (continued)

No	Exposure	Method	nSNP	OR(95%CI)	Pvalue
148	Triacylglycerol (56:6) levels	IVW	7	1.00(0.99–1.01)	0.858535
149	Phosphatidylcholine (16:0_0:0) levels	IVW	2	1.00(0.99–1.02)	0.859467
150	Phosphatidylcholine (O-16:0_20:4) levels	IVW	3	1.00(1.00-1.00)	0.867781
151	Phosphatidylinositol (16:0_18:2) levels	IVW	3	1.00(1.00-1.00)	0.870533
152	Phosphatidylcholine (20:4_0:0) levels	IVW	4	1.00(1.00-1.00)	0.879941
153	Phosphatidylcholine (18:1_18:1) levels	IVW	4	1.00(0.99-1.01)	0.901164
154	Phosphatidylinositol (18:0_18:1) levels	IVW	6	1.00(1.00-1.00)	0.907304
155	Phosphatidylinositol (18:1_18:2) levels	IVW	3	1.00(1.00-1.00)	0.910417
156	Phosphatidylcholine (18:1_20:4) levels	IVW	6	1.00(1.00-1.00)	0.950572
157	Phosphatidylcholine (16:1_18:2) levels	IVW	7	1.00(0.99-1.01)	0.961206
158	Phosphatidylcholine (O-18:1_20:4) levels	IVW	4	1.00(0.99-1.01)	0.972677
159	Phosphatidylethanolamine (18:2_0:0) levels	IVW	2	1.00(0.99-1.01)	0.974348
160	Phosphatidylcholine (O-16:1_18:2) levels	IVW	2	1.00(0.98-1.02)	0.979592
161	Phosphatidylcholine (16:0_22:4) levels	IVW	2	1.00(1.00-1.00)	0.987981
162	Sphingomyelin (d40:2) levels	IVW	7	1.00(0.99–1.01)	0.994432

Exposure	Method	nSNP		OR(95%CI)	Pvalue
Cholesterol levels	WR	1		1.03(1.02-1.04)	8.44e-11
Diacylglycerol (18:1_18:2) levels	IVW	6	•	1.01(1.01-1.01)	1.68e-09
Triacylglycerol (52:2) levels	IVW	4	+	1.01(1.01-1.01)	6.67e-07
Phosphatidylethanolamine (16:0_20:4) levels	IVW	5	-	1.00(1.00-1.01)	1.10e-06
Phosphatidylcholine (O-16:2_18:0) levels	IVW	2	-	1.01(1.01-1.01)	1.22e-06
Triacylglycerol (52:3) levels	IVW	6	+	1.01(1.00-1.01)	1.55e-06
Triacylglycerol (52:4) levels	IVW	7	•	1.01(1.00-1.01)	3.46e-06
Triacylglycerol (53:4) levels	IVW	4	•	1.01(1.00-1.01)	1.78e-05
Triacylglycerol (52:5) levels	IVW	4	+	1.01(1.00-1.01)	2.09e-05
Sterol ester (27:1/18:2) levels	IVW	9	-8-	1.01(1.01-1.02)	7.10e-05
Triacylglycerol (54:5) levels	IVW	4	+	1.01(1.00-1.01)	1.17e-04
Phosphatidylcholine (16:0_18:1) levels	IVW	2		1.01(1.01-1.02)	1.26e-04
Sterol ester (27:1/18:1) levels	IVW	6		1.02(1.01-1.03)	2.61e-04
		0.95	1 1.	05	

Fig. 4 Forest plot of lipid metabolites on atherosclerosis risk (UKB dataset). Note: Images from left to right the first column is Exposure, the second column is Method, the third column represents nSNP, the fourth column is OR (95% CI) value, and the last column is P value

necrotic core [16]. Likewise, a study found that Rhodiola rosea glycosides attenuated atherosclerosis in mice by reducing SREBP2 levels and cholesterol and triglyceride biosynthesis [17]. Therefore, lowering cholesterol and triglyceride levels reduces the risk of coronary atherosclerosis, which is exactly in line with the conclusion of our study.

Recently, triglyceride-glucose (TyG) has been considered an index for assessing IR and an important predictor of coronary artery disease severity [18]. It means there is a link between triglyceride levels and coronary atherosclerosis. Consistently, our finding noted that triglycerides reduced the risk of coronary atherosclerosis. A clinical study conducted in 2021 compared the TyG index of 424 patients with NAFLD and 255 patients with coronary artery disease, and it concluded that the TyG index of patients with NAFLD was positively correlated with the risk of coronary artery disease, which may reflect the severity of coronary atherosclerosis [19]. Furthermore, a recent meta-study showed that the incidence of CVD was significantly reduced by controlling factors associated with TyG index or triggers (e.g., blood) that elevate TyG





No	id.outcome	Exposure	Method	nSNP	OR(95%CI)	P value	pleiotropy	heterogeneity
1	Finngen dataset	Cholesterol levels	WR	1	2.31(1.97-2.70)	2.06E-25	SNP = 1	SNP=1
2	Finngen dataset	Sterol ester (27:1/18:2) levels	IVW	9	1.41(1.21–1.63)	8.98E-06	0.4705203	3.40E-19
3	Finngen dataset	Triacylglycerol (52:4) levels	IVW	7	1.27(1.14–1.41)	9.43E-06	0.2601441	0.103666213
4	Finngen dataset	Triacylglycerol (52:5) levels	IVW	4	1.34(1.16–1.54)	4.60E-05	0.960756	5.71E-05
5	Finngen dataset	Diacylglycerol (18:1_18:2) levels	IVW	6	1.22(1.11–1.35)	5.80E-05	0.068707	0.082441293
6	Finngen dataset	Triacylglycerol (53:4) levels	IVW	4	1.32(1.15–1.51)	7.48E-05	0.8654085	0.000136399
7	UKB dataset	Sterol ester (27:1/18:2) levels	IVW	9	1.01(1.01-1.02)	7.10E-05	0.8723856	9.77E-08
8	UKB dataset	Cholesterol levels	WR	1	1.03(1.02-1.04)	8.44E-11	SNP = 1	SNP = 1
9	UKB dataset	Diacylglycerol (18:1_18:2) levels	IVW	6	1.01(1.01-1.01)	1.68E-09	0.4028827	0.105060827
10	UKB dataset	Triacylglycerol (52:4) levels	IVW	7	1.01(1.00-1.01)	3.46E-06	0.8374066	0.115975769
11	UKB dataset	Triacylglycerol (52:5) levels	IVW	4	1.01(1.00-1.01)	2.09E-05	0.3127775	0.382396594
12	UKB dataset	Triacylglycerol (53:4) levels	IVW	4	1.01(1.00-1.01)	1.78E-05	0.4936402	0.294208307

Table 3 Intersection between Finngen dataset and UKB dataset of lipid metabolites on atherosclerosis risk

[20]. In conclusion, many of these studies support the present study's conclusion that triglycerides are positively associated with the risk of coronary atherosclerosis.

A recent study showed that long-term consumption of dietary diacylglycerol (DAG) enriched in 1,3-species reduced postprandial lipids, thereby modulating monocyte/macrophage migration and aortic lipid accumulation, eventually alleviating atherosclerosis [21], indicating the correlation between DAG levels and coronary atherosclerosis. Consistently, our study revealed a direct relationship between diacylglycerol kinase (DGK) and the risk of coronary atherosclerosis. Likewise, Toshiki Sasaki et al. elucidated the functional role of DGK α in cardiac injury after ischemia/reperfusion in mouse hearts in vivo and finally concluded that DGK α exacerbated I/R injury by inhibiting the cardioprotective effects of PKC ε , ERK1/2, and p70S6K activation [22]. These results suggest that diacylglycerol protein kinase (DGK α) has a positive cardioprotective effect on the heart.

Furthermore, we found that sterol ester levels directly affected the risk of coronary atherosclerosis. Similarly, Avery Sengupta et al. observed the composition, osmotic

No	id.exposure	outcome	exposure	method	P value	estimate
1	Finngen dataset	Cholesterol levels	Coronary atherosclerosis	IVW	0.47174743	0.96(0.87-1.06)
2	Finngen dataset	Sterol ester (27:1/18:2) levels	Coronary atherosclerosis	IVW	0.846917154	1.01(0.91-1.12)
3	Finngen dataset	Diacylglycerol (18:1_18:2) levels	Coronary atherosclerosis	IVW	0.968714183	1.00(0.91-1.09)
4	Finngen dataset	Triacylglycerol (52:4) levels	Coronary atherosclerosis	IVW	0.792861055	1.01(0.93-1.11)
5	Finngen dataset	Triacylglycerol (52:5) levels	Coronary atherosclerosis	IVW	0.653575934	1.02(0.94-1.11)
6	Finngen dataset	Triacylglycerol (53:4) levels	Coronary atherosclerosis	IVW	0.41098834	1.04(0.95-1.14)
7	UKB dataset	Cholesterol levels	Coronary atherosclerosis	IVW	0.895099957	1.18(0.10- 14.33)
8	UKB dataset	Sterol ester (27:1/18:2) levels	Coronary atherosclerosis	IVW	0.975377256	1.04(0.09- 12.42)
9	UKB dataset	Diacylglycerol (18:1_18:2) levels	Coronary atherosclerosis	IVW	0.244369169	0.28(0.03- 2.38)
10	UKB dataset	Triacylglycerol (52:4) levels	Coronary atherosclerosis	IVW	0.429450942	0.42(0.05- 3.59)
11	UKB dataset	Triacylglycerol (52:5) levels	Coronary atherosclerosis	IVW	0.808064609	0.77(0.09- 6.38)
12	UKB dataset	Triacylglycerol (53:4) levels	Coronary atherosclerosis	IVW	0.633706854	1.71(0.19–15.75)

Table 4 Intersection between Finngen dataset and UKB dataset of atherosclerosis risk on lipid metabolites

fragility, and antioxidant status of erythrocyte membranes in normal and hypercholesterolemic rats after consumption of EPA-DHA-rich and ALA-rich sterol esters, and concluded that in cholesterol-rich blood, rat erythrocytes appeared to be deformed and become more fragile. This is because sterol esters can alleviate hypercholesterolemia and thus the risk of coronary atherosclerosis, thereby partially reversing this deformity and fragility [23]. This confirms the conclusion of the present study that sterol ester levels directly influence the risk of coronary atherosclerosis.

There are several strengths of our two-sample MR study. Firstly, we used robust MR analysis methods and selected SNP with strong association as IVs, similar to the experimental framework of a randomized controlled trial. Second, we chose independent, validated genetic variants as IVs to avoid potential confounders and increase the accuracy of our results. Finally, our study pooled many MR studies and ultimately screened out the most significant six lipid metabolites, providing a theoretical basis for the clinical treatment of atherosclerosis.

Limitations

However, our study has limitations. The GWAS data include only European people, so further studies are needed to determine the generalizability of our findings to different populations. In addition, there are gender differences in the prevalence of coronary atherosclerosis. Unfortunately, the public databases from which our data were obtained do not allow for detailed subgroup analyses for specific demographics (e.g., age and sex).

Future research

In the future, we will conduct more experiments to investigate the correlation between lipid metabolites and coronary atherosclerosis, with a focus on lipid metabolites that are directly related to the occurrence and development of coronary atherosclerosis, such as cholesterol and triglycerides. The intricate nature of lipid metabolism and its metabolites is not fully understood, underscoring the necessity for additional basic and clinical studies. Improving lipid metabolites presents a promising avenue for addressing coronary atherosclerosis. These six lipid metabolites have the potential as new biomarkers for predicting the risk of atherosclerosis, providing new insights into the treatment and prevention of cardiovascular diseases.

Conclusions

In conclusion, our study comprehensively elucidates the causal relationship between lipid metabolites and the risk of coronary atherosclerosis. Cholesterol levels, sterol ester (27:1/18:2) levels, triacylglycerol (52:4) levels, triacylglycerol (52:5) levels, diacylglycerol (18:1_18. 2) levels, and triacylglycerol (53:4) levels are positively correlated with the risk of coronary atherosclerosis onset. However, the levels of these six lipid metabolites do not increase with the development of coronary atherosclerosis.

Abbreviations

- CVD Cardiovascular disease
- ACS Acute coronary syndrome
- HF Heart failure
- SCD Sudden cardiac death
- MR Mendelian randomization
- SNPs Single nucleotide polymorphisms
- IVs Instrumental variables
- ID Linkage disequilibrium IVW Inverse variance-weighting
- ORs Odds ratios Cis
- Confidence intervals
- LDL-C Low-density lipoprotein cholesterol
- TyG Triglyceride-glucose
- DGK Diacylglycerol kinase

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Authors' contributions

Conceptualization: [Lianqun Jia]; Methodology: [Qun Wang]; Formal analysis and investigation: [Qun Wang]; Writing—original draft preparation: [Yuan Cao]; Writing—review and editing: [Yuan Cao]; Funding acquisition: [Lianqun Jia]; Resources: [Qun Wang]; Supervision: [Lianqun Jia]. And all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability

All data generated or analyzed during this study are included in this published article (and its Supplementary Information files).

Declarations

Ethics approval and consent to participate

All analyses were based on previous published studies, thus no ethical approval and patient consent are required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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