

Protocol CMUH110-REC2-070

The Effect of Lactobacillus Delbrueckii Subsp. Bulgaricus on Human's Weight Reduction

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Background

In recent years, probiotic supplements have become increasingly popular in daily life for preventing diarrhea, easing vaginal and urinary infections, or preventing autoimmune diseases [1–3]. Probiotics cause the formation of a properly balanced gut bacterial population, with balance between pathogens and the bacteria necessary for normal functioning of the organism, and may improve immune system function and nutrient absorption. Recently, the gut microbiota was found to be involved in various metabolic pathways and energy balance regulation [4, 5]. The composition of the gut microbiota differs between obese and normal weight individuals [6, 7]. Dietary alteration of the gut microbiome is a target for treating obesity [8]. However, clinical trials examining the influence of probiotics on obesity-related factors have yielded inconsistent outcomes. Some studies have demonstrated weight loss in participants supplemented with *Lactobacilli* and *Bifidobacteria*, even while maintaining their normal diet and lifestyle over the study's duration [9,10]. In a 12-week trial, participants consuming *L. gasseri* experienced significant reductions in visceral fat, body mass index, waist and hip circumference, and body fat mass compared to the control group [11]. Conversely, another trial involving *L. rhamnosus* supplementation alongside an energy-restricted diet did not significantly impact weight loss in all participants but showed a reduction in weight in females [12]. Systematic review, encompassing 19 randomized trials with 1,412 participants, revealed diverse outcomes [13]. Some studies report significant decreases in body weight and/or body fat with probiotics, while others indicate no effect or even increased body weight. It suggests that specific probiotics have the potential to serve as health supplements for treating or preventing obesity and overweight.

Lactobacillus is a type of lactic acid bacterium commonly found in the human gastrointestinal tract and in fermented dairy products such as cheese, yogurt, and kefir [14]. The isolation of specific probiotic strains for targeted application is a strategy for improving the efficacy of probiotic supplements. Some species of *Lactobacillus*, such as *L. gasseri* and *L. rhamnosus*, have been evaluated for inducing weight loss [15]. *Lactobacillus delbrueckii* ssp. *bulgaricus* (*L. bulgaricus*) is one of the most common lactobacilli starters used in the manufacture of a large variety of fermented milk products. *L. bulgaricus* is reported to exhibit an outstanding inhibitory effect on pancreatic lipase activity in vitro and effectively managed the fat and weight accumulation and reversed the increased blood lipid, sugar, and insulin levels caused by a high-fat diet in mice [16]. Our hypothesis posits that *L. bulgaricus* can contribute to the reduction of body weight and alleviate health risk factors associated with obesity in overweight individuals. Thus, the objective of this study was to examine the effectiveness of daily *L. bulgaricus* supplementation in weight management among overweight participants. The primary goal is to evaluate its impact on lowering body weight and addressing health risk factors related to obesity, including blood lipid levels, sugar regulation, and insulin levels.

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Methods and Design

Participants:

The participants were recruited from the patients of Endocrinology and Metabolism Department at China Medical University Hospital, followed by the verification of inclusion and exclusion criteria through interviews. The inclusion criteria comprised: (1) age ≥ 20 years old; (2) overweight (BMI ≥ 23) or body fat percentage $\geq 25\%$ for males and $\geq 30\%$ for females; (3) having any of the following risk factors: atherosclerotic cardiovascular disease (ASCVD), type 2 diabetes, age ≥ 45 years for males, ≥ 55 years for females or postmenopausal, hypertension, dyslipidemia (total cholesterol(CHOL) > 200 mg/dL or low-density lipoprotein cholesterol (LDL-C) > 130 mg/dL or triglycerides (TG) > 130 mg/dL), high-density lipoprotein cholesterol (HDL-C) < 40 mg/dL; (4) if routinely taking medication for lowering blood glucose, blood pressure, or lipid levels, there should not be significant dosage changes within the past three months; (5) being willing to participate after receiving an explanation from the physician, completing the trial plan, and signing the consent form. The exclusion criteria included: (1) history of diabetic ketoacidosis; (2) medical records indicating the occurrence of cerebrovascular disease, acute myocardial infarction, coronary artery bypass surgery, placement of coronary artery stents, or peripheral vascular disease within the last 6 months; (3) occurrence of acute infectious diseases within the last month and antibiotic use for > 7 days; (4) short-term use of steroids, NSAIDs, immunosuppressive drugs, interferons, immunomodulators, or any changes in the dose of long-term medications within the last month; (5) use of any weight-loss drugs in the last three months (including Orlistat, Lorcaserin, liraglutide); (6) history of any cancer or undergoing cancer treatment in the past 5 years; (7) abnormal liver function (GOT or GPT greater than 3 times the normal upper limit) or liver cirrhosis; (8) impaired kidney function (eGFR < 30 mL/min/1.73 m²); (9) history of alcohol abuse; (10) participation in any other interventional clinical research within the last month; (11) pregnant and breastfeeding women; (12) history of allergy to the investigational product; (13) participants deemed unsuitable for inclusion by the principal investigator.

Study Design and Intervention:

Enrolled participants were randomly divided into probiotics group or placebo group. Seventeen and 19 participants were respectively assigned to the placebo group and the probiotics group. The probiotics we used were in the form of 100mg L. bulgaricus powder packets, each containing 1×10^8 CFU of probiotics (TCI CO., Taipei, Taiwan). Initially (day 1), participants underwent measurements for weight, body fat, and BMI, and fasting blood

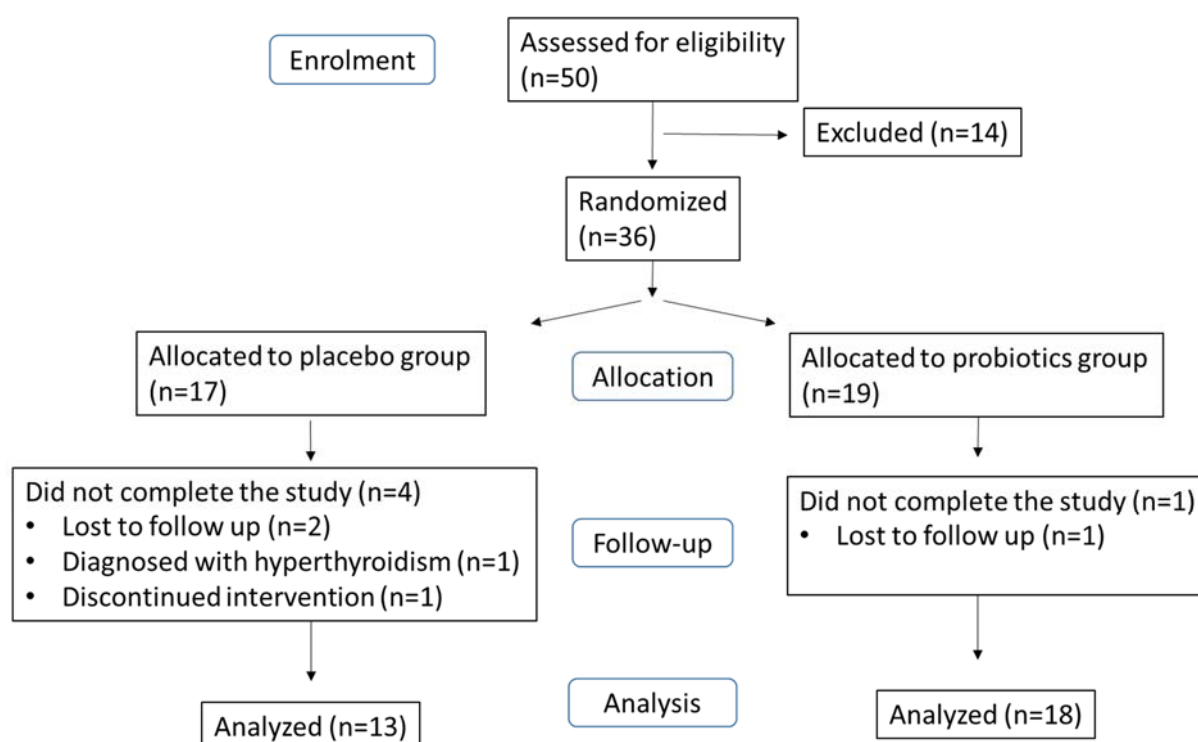
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samples were collected. Subsequently, each participant received one package of either probiotic or a placebo sample, along with drinking water on the same day. From that point onward, participants self-administered one package of the sample daily for 12 weeks and the participants' sample consumption and physical conditions were tracked by the research assistants weekly. Throughout the study duration, participants maintained their regular diet and lifestyle. At the endpoint (day 84), weight, body fat, and BMI were measured, and fasting blood samples were collected again. Weight and body fat were measured with Karada Scan 216 (OMRON, Kyoto, Japan). Alanine aminotransferase (ALT), aspartate aminotransferase (AST), blood urea nitrogen (BUN), creatinine (CRE), CHOL, HDL-C, LDL-C, TG, hemoglobin A1c (HbA1c), and Glucose-Ante Cibum (Glu-AC) levels were analyzed and reported by Laboratory Medicine in Chinese Medical University Hospital (Taichung, Taiwan). Data were expressed as the mean \pm standard error of the mean (SEM). Statistical significance between groups were done by student paired t-test or Mann-Whitney test. P-values lower than 0.05 were considered statistically significant.

Data Analysis:

The statistical analysis was conducted using GraphPad's unpaired independent samples t-test, with significance set at $*P < 0.05$.

Flow Diagram of the study:



Group	Placebo		Probiotics	
	Mean	SD	Mean	SD
Age, years	41.38	12.71	41.56	10.92
Gender, male/female	7/6		12/6	
Weight, kg	78.69	15.64	80.77	15.11
Body fat, %	32.08	6.65	30.84	5.26
BMI	29.32	5.40	28.89	3.59
ALT, U/L	26.00	15.37	32.63	18.96
AST, U/L	21.45	10.62	23.36	7.44
BUN, mg/dL	13.10	2.69	13.67	2.94
CRE, mg/dL	0.80	0.14	0.83	0.15
CHOL, mg/dL	182.18	43.04	201.60	40.97
HDL-C, mg/dL	46.82	5.82	48.50	16.26
LDL-C, mg/dL	122.82	42.15	111.01	30.40
TG, mg/dL	139.62	52.18	220.94	173.92
HbA1c, %	5.80	0.83	6.17	1.07
Glu-AC, mg/dL	93.45	16.92	109.06	34.13

Table 1: Analysis of Baseline Values of the Participants

Results

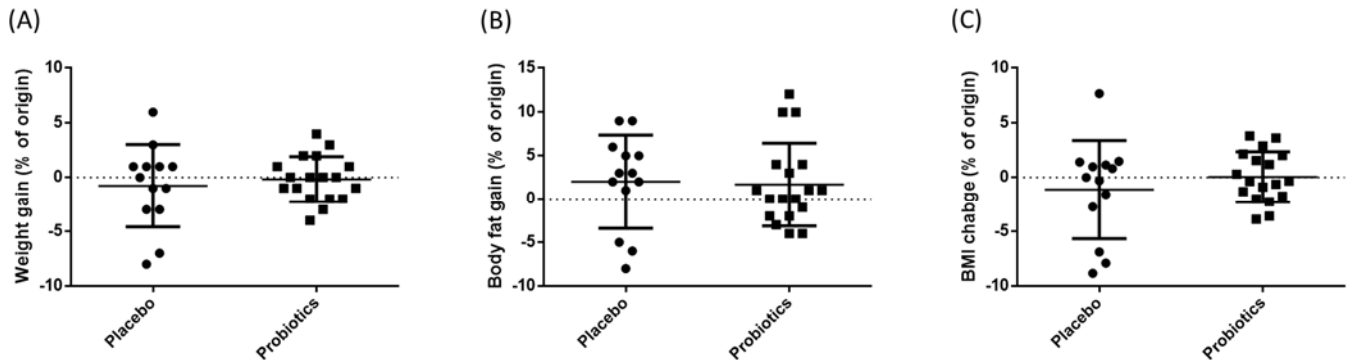


Figure 1: Changes in Body Composition

Placebo represents the placebo control group, and Probiotics represents the probiotics experimental group. The changes in body weight (A), body fat (B), and BMI (C) before and after consumption were calculated and expressed as a percentage of the initial values. No significant differences were observed between the two groups.

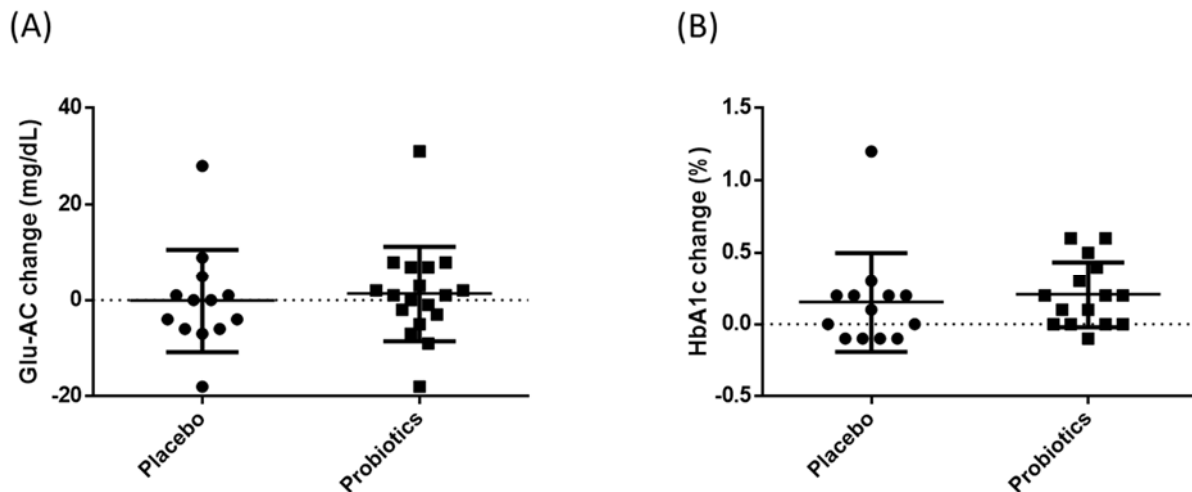


Figure 2: Changes in Blood Sugar Indices

Placebo represents the placebo control group, and Probiotics represents the probiotics experimental group. The changes in fasting blood glucose (GLU-AC) before and after sample consumption (A) and changes in glycated hemoglobin (HbA1c) expressed as a percentage of the initial values (B) were calculated. No significant differences were observed

between the two groups.

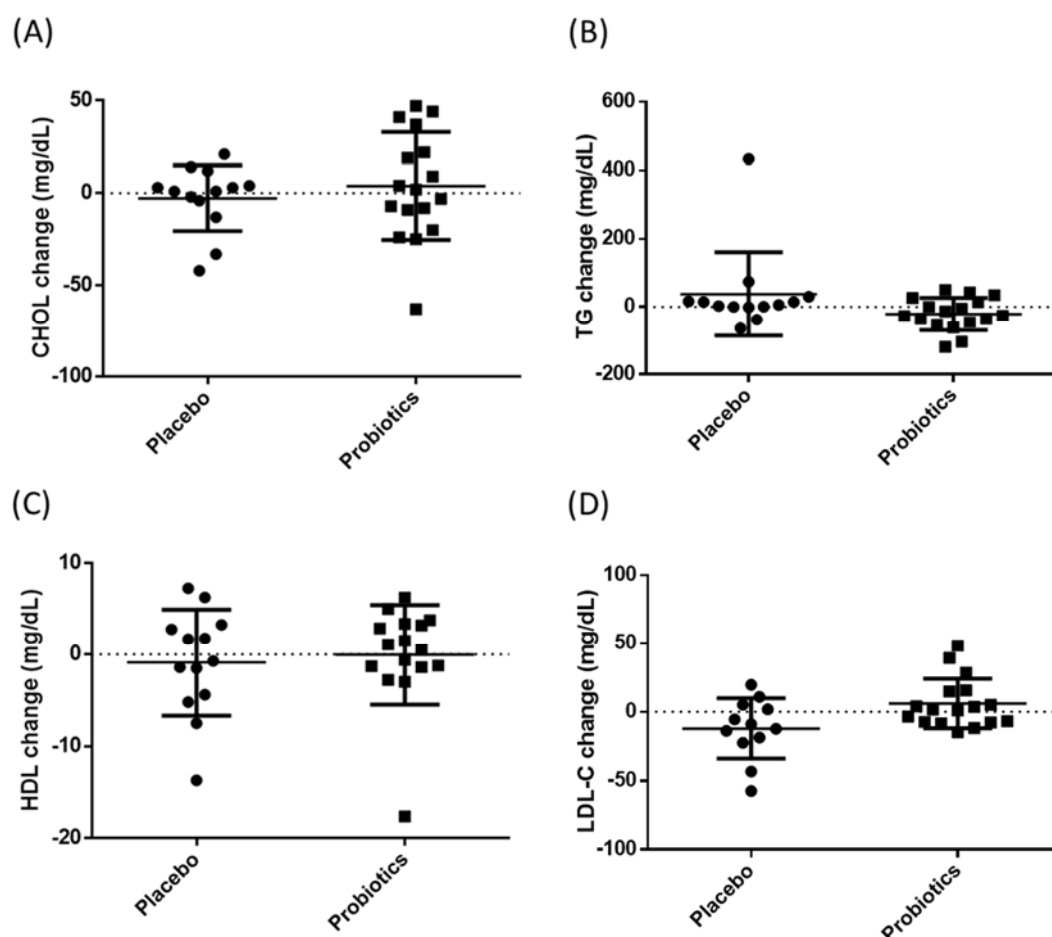


Figure 3: Changes in Blood Lipids

Placebo represents the placebo control group, and Probiotics represents the probiotics experimental group. The changes in total cholesterol (CHOL) (A), triglycerides (TG) (B), high-density lipoprotein cholesterol (HDL) (C), and low-density lipoprotein cholesterol (LDL-C) (D) before and after sample consumption were calculated. No significant differences were observed between the two groups. In the probiotics group, 65% of participants showed a decrease in TG concentration, while the placebo group had a decrease rate of 18%.

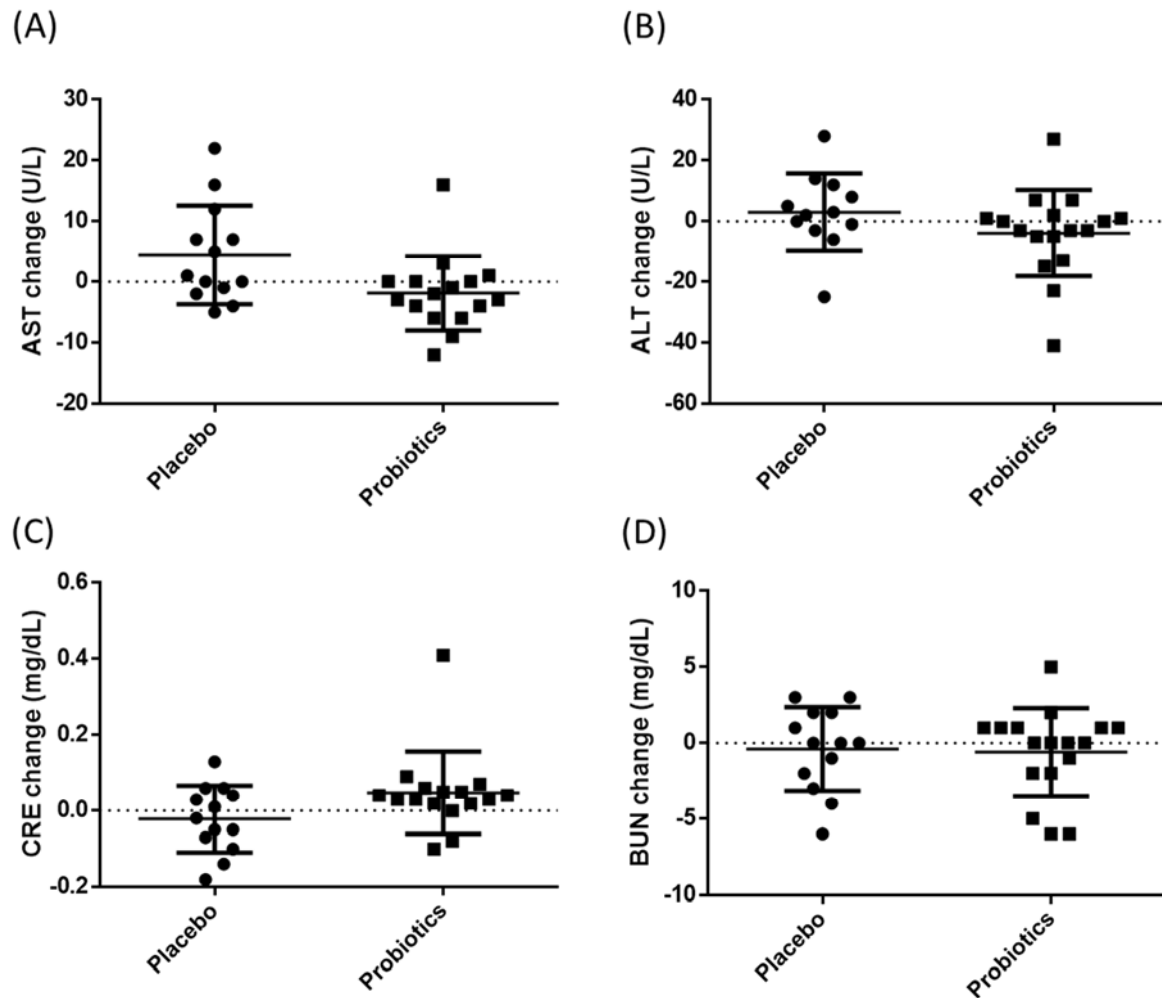


Figure 4: Changes in Liver and Kidney Function

Placebo represents the placebo control group, and Probiotics represents the probiotics experimental group. The changes in liver function indicators, aspartate aminotransferase (AST) (A) and alanine aminotransferase (ALT) (B), as well as kidney function indicators, creatinine (CRE) (C) and blood urea nitrogen (BUN) (D), before and after sample consumption were calculated. No significant differences were observed between the two groups.

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Table 2: Comparative Analysis of Blood Biochemical Indices Before and After the Experiment and Changes Before and After

Variables		Probiotics	Placebo	P-value ^b
		Mean \pm SEM	Mean \pm SEM	
ALT (U/L)	Pre	32.00 \pm 4.495	31.00 \pm 6.454	0.9897
	Post	28.12 \pm 4.853	37.69 \pm 7.946	0.7713
	Change	-3.882 \pm 3.461	6.692 \pm 6.747	0.5075
	P-value ^a	0.2462	0.3799	
AST (U/L)	Pre	24.31 \pm 1.886	22.38 \pm 3.054	0.3909
	Post	22.44 \pm 2.238	25.85 \pm 4.366	0.9053
	Change	-1.875 \pm 1.530	3.462 \pm 2.043	0.34
	P-value ^a	0.0708	0.1367	
BUN (mg/dL)	Pre	13.82 \pm 0.6765	13.17 \pm 0.8242	0.9267
	Post	12.88 \pm 0.8985	12.67 \pm 0.7914	0.9694
	Change	-0.6250 \pm 0.7465	-0.5000 \pm 0.8118	>0.999
	P-value ^a	0.5256	0.6504	
CRE (mg/dL)	Pre	0.8241 \pm 0.03584	0.7962 \pm 0.0443	0.907
	Post	0.8775 \pm 0.04979	0.7915 \pm 0.04273	0.6543
	Change	0.0475 \pm 0.02713	-0.004615 \pm 0.02087	0.34
	P-value ^a	0.0535	0.8262	
CHOL (mg/dL)	Pre	200.7 \pm 10.33	186.9 \pm 11.49	0.67
	Post	204.6 \pm 12.42	186.3 \pm 10.20	0.0719
	Change	3.882 \pm 7.086	-0.6154 \pm 3.852	0.5075
	P-value ^a	0.6526	0.8535	
Glu-AC (mg/dL)	Pre	109.3 \pm 7.834	91.77 \pm 4.590	0.3871
	Post	100.7 \pm 9.383	91.69 \pm 6.466	0.5854
	Change	1.389 \pm 2.332	-0.07692 \pm 2.962	0.7803
	P-value ^a	0.6183	0.6846	
HbA1c (%)	Pre	6.124 \pm 0.2559	5.800 \pm 0.2295	0.8619
	Post	6.407 \pm 0.3149	5.931 \pm 0.3175	0.6367
	Change	0.2067 \pm 0.05893	0.1308 \pm 0.09765	0.4821
	P-value ^a	0.0029	0.2061	
HDL-C (mg/dL)	Pre	48.55 \pm 3.820	46.82 \pm 1.613	0.3643
	Post	47.38 \pm 3.125	46.43 \pm 1.798	0.4656
	Change	-0.0125 \pm 1.362	-0.3923 \pm 1.590	0.9872
	P-value ^a	0.4037	0.7227	
LDL-C (mg/dL)	Pre	113.0 \pm 7.399	122.8 \pm 12.17	0.4531
	Post	119.0 \pm 5.992	112.4 \pm 8.306	0.5874

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	Change	6.012 ± 4.366	-12.04 ± 6.323	0.0946
	P-valuea	0.4586	0.0923	
TG (mg/dL)	Pre	220.9 ± 42.18	139.6 ± 14.47	0.5469
	Post	199.9 ± 40.46	177.4 ± 36.55	0.907
	Change	-21.00 ± 11.61	37.77 ± 34.12	0.0555
	P-valuea	0.1075	0.1577	

P-valuea **paired t-test (Pre and Post groups)**

P-valueb **unpaired t-test (Probiotics and Placebo groups)**

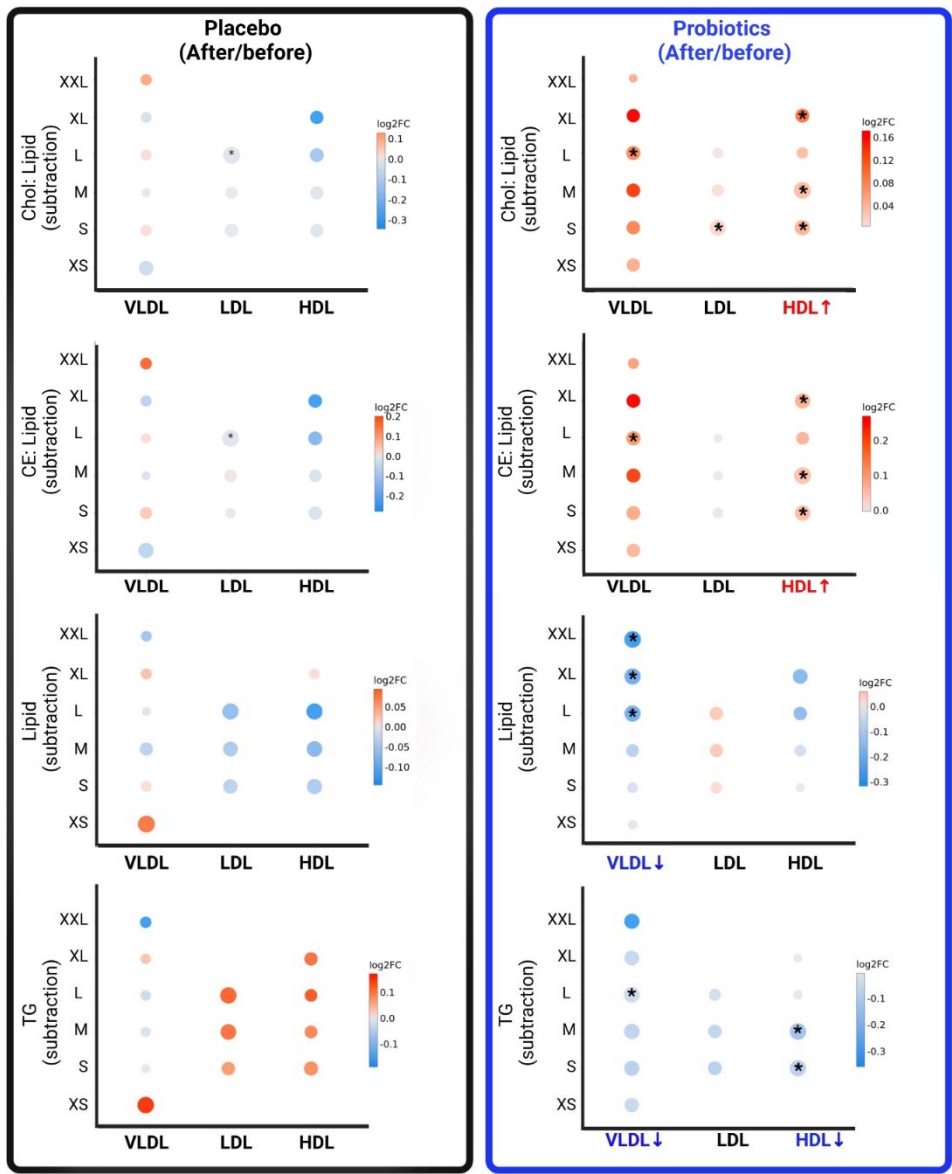


Figure 5: Changes in Lipids Carried by Serum Lipoproteins

Placebo represents the placebo control group, and Probiotics represents the probiotics experimental group. Individual comparisons of changes in lipids carried by serum lipoproteins before and after sample consumption are depicted. The size of the points in the scatter plot ($-\log_{10}$ p values) and the color (log2 fold change denoted as log2FC, with red indicating positive correlation changes and blue indicating negative correlation changes) are used to distinguish between inter-group differences and trends. Serum very low-density lipoprotein (VLDL), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) have the ability to carry cholesterol (Chol), lipids, cholesterol esters (CE), and triglycerides (TG) individually. The experimental data indicate that probiotics upregulate the content of

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lipids carried by HDL (Chol:Lipid and CE:Lipid). Simultaneously, there is a significant decrease in the total amount of lipids carried by VLDL (L-VLDL, XL-VLDL, XXL-VLDL). Additionally, there is a significant decrease in triglycerides (TG) carried by both VLDL and HDL.

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Appendix

Figure 5: Extracted Meaningful Components from Metabolomic Analysis Results, Other Results Provided in the Appendix °

Table 3: List of Name Abbreviations and Units

Excel column name	Biomarker name	Unit
Total-C	Total cholesterol	mmol/l
non-HDL-C	Total cholesterol minus HDL-C	mmol/l
Remnant-C	Remnant cholesterol (non-HDL, non-LDL -cholesterol)	mmol/l
VLDL-C	VLDL cholesterol	mmol/l
Clinical LDL-C	Clinical LDL cholesterol	mmol/l
LDL-C	LDL cholesterol	mmol/l
HDL-C	HDL cholesterol	mmol/l
Total-TG	Total triglycerides	mmol/l
VLDL-TG	Triglycerides in VLDL	mmol/l
LDL-TG	Triglycerides in LDL	mmol/l
HDL-TG	Triglycerides in HDL	mmol/l
Total-PL	Total phospholipids in lipoprotein particles	mmol/l
VLDL-PL	Phospholipids in VLDL	mmol/l
LDL-PL	Phospholipids in LDL	mmol/l
HDL-PL	Phospholipids in HDL	mmol/l
Total-CE	Total esterified cholesterol	mmol/l
VLDL-CE	Cholesteryl esters in VLDL	mmol/l
LDL-CE	Cholesteryl esters in LDL	mmol/l
HDL-CE	Cholesteryl esters in HDL	mmol/l
Total-FC	Total free cholesterol	mmol/l
VLDL-FC	Free cholesterol in VLDL	mmol/l
LDL-FC	Free cholesterol in LDL	mmol/l
HDL-FC	Free cholesterol in HDL	mmol/l
Total-L	Total lipids in lipoprotein particles	mmol/l
VLDL-L	Total lipids in VLDL	mmol/l
LDL-L	Total lipids in LDL	mmol/l
HDL-L	Total lipids in HDL	mmol/l
Total-P	Total concentration of lipoprotein particles	mmol/l
VLDL-P	Concentration of VLDL particles	mmol/l
LDL-P	Concentration of LDL particles	mmol/l
HDL-P	Concentration of HDL particles	mmol/l
VLDL size	Average diameter for VLDL particles	nm
LDL size	Average diameter for LDL particles	nm
HDL size	Average diameter for HDL particles	nm
Phosphoglyc	Phosphoglycerides	mmol/l

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TG/PG	Ratio of triglycerides to phosphoglycerides	ratio
Cholines	Total cholines	mmol/l
Phosphatidylc	Phosphatidylcholines	mmol/l
Sphingomyelins	Sphingomyelins	mmol/l
ApoB	Apolipoprotein B	g/l
ApoA1	Apolipoprotein A1	g/l
ApoB/ApoA1	Ratio of apolipoprotein B to apolipoprotein A1	ratio
Total-FA	Total fatty acids	mmol/l
Unsaturation	Degree of unsaturation	degree
Omega-3	Omega-3 fatty acids	mmol/l
Omega-6	Omega-6 fatty acids	mmol/l
PUFA	Polyunsaturated fatty acids	mmol/l
MUFA	Monounsaturated fatty acids	mmol/l
SFA	Saturated fatty acids	mmol/l
LA	Linoleic acid	mmol/l
DHA	Docosahexaenoic acid	mmol/l
Omega-3 %	Ratio of omega-3 fatty acids to total fatty acids	%
Omega-6 %	Ratio of omega-6 fatty acids to total fatty acids	%
PUFA %	Ratio of polyunsaturated fatty acids to total fatty acids	%
MUFA %	Ratio of monounsaturated fatty acids to total fatty acids	%
SFA %	Ratio of saturated fatty acids to total fatty acids	%
LA %	Ratio of linoleic acid to total fatty acids	%
DHA %	Ratio of docosahexaenoic acid to total fatty acids	%
PUFA/MUFA	Ratio of polyunsaturated fatty acids to monounsaturated fatty acids	ratio
Omega-6/Omega-3	Ratio of omega-6 fatty acids to omega-3 fatty acids	ratio
Ala	Alanine	mmol/l
Gln	Glutamine	mmol/l
Gly	Glycine	mmol/l
His	Histidine	mmol/l
Total BCAA	Total concentration of branched-chain amino acids (leucine + isoleucine + valine)	mmol/l
Ile	Isoleucine	mmol/l
Leu	Leucine	mmol/l
Val	Valine	mmol/l
Phe	Phenylalanine	mmol/l
Tyr	Tyrosine	mmol/l
Glucose	Glucose	mmol/l
Lactate	Lactate	mmol/l
Pyruvate	Pyruvate	mmol/l
Citrate	Citrate	mmol/l
Glycerol	Glycerol	mmol/l
βOHbutyrate	3-Hydroxybutyrate	mmol/l
Acetate	Acetate	mmol/l
Acetoacetate	Acetoacetate	mmol/l
Acetone	Acetone	mmol/l
Creatinine	Creatinine	μ mol/l

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Albumin	Albumin	g/l
GlycA	Glycoprotein acetyls	mmol/l
XXL-VLDL-P	Concentration of chylomicrons and extremely large VLDL particles	mmol/l
XXL-VLDL-L	Total lipids in chylomicrons and extremely large VLDL	mmol/l
XXL-VLDL-PL	Phospholipids in chylomicrons and extremely large VLDL	mmol/l
XXL-VLDL-C	Cholesterol in chylomicrons and extremely large VLDL	mmol/l
XXL-VLDL-CE	Cholesteryl esters in chylomicrons and extremely large VLDL	mmol/l
XXL-VLDL-FC	Free cholesterol in chylomicrons and extremely large VLDL	mmol/l
XXL-VLDL-TG	Triglycerides in chylomicrons and extremely large VLDL	mmol/l
XL-VLDL-P	Concentration of very large VLDL particles	mmol/l
XL-VLDL-L	Total lipids in very large VLDL	mmol/l
XL-VLDL-PL	Phospholipids in very large VLDL	mmol/l
XL-VLDL-C	Cholesterol in very large VLDL	mmol/l
XL-VLDL-CE	Cholesteryl esters in very large VLDL	mmol/l
XL-VLDL-FC	Free cholesterol in very large VLDL	mmol/l
XL-VLDL-TG	Triglycerides in very large VLDL	mmol/l
L-VLDL-P	Concentration of large VLDL particles	mmol/l
L-VLDL-L	Total lipids in large VLDL	mmol/l
L-VLDL-PL	Phospholipids in large VLDL	mmol/l
L-VLDL-C	Cholesterol in large VLDL	mmol/l
L-VLDL-CE	Cholesteryl esters in large VLDL	mmol/l
L-VLDL-FC	Free cholesterol in large VLDL	mmol/l
L-VLDL-TG	Triglycerides in large VLDL	mmol/l
M-VLDL-P	Concentration of medium VLDL particles	mmol/l
M-VLDL-L	Total lipids in medium VLDL	mmol/l
M-VLDL-PL	Phospholipids in medium VLDL	mmol/l
M-VLDL-C	Cholesterol in medium VLDL	mmol/l
M-VLDL-CE	Cholesteryl esters in medium VLDL	mmol/l
M-VLDL-FC	Free cholesterol in medium VLDL	mmol/l
M-VLDL-TG	Triglycerides in medium VLDL	mmol/l
S-VLDL-P	Concentration of small VLDL particles	mmol/l
S-VLDL-L	Total lipids in small VLDL	mmol/l
S-VLDL-PL	Phospholipids in small VLDL	mmol/l
S-VLDL-C	Cholesterol in small VLDL	mmol/l
S-VLDL-CE	Cholesteryl esters in small VLDL	mmol/l
S-VLDL-FC	Free cholesterol in small VLDL	mmol/l
S-VLDL-TG	Triglycerides in small VLDL	mmol/l
XS-VLDL-P	Concentration of very small VLDL particles	mmol/l
XS-VLDL-L	Total lipids in very small VLDL	mmol/l
XS-VLDL-PL	Phospholipids in very small VLDL	mmol/l
XS-VLDL-C	Cholesterol in very small VLDL	mmol/l
XS-VLDL-CE	Cholesteryl esters in very small VLDL	mmol/l
XS-VLDL-FC	Free cholesterol in very small VLDL	mmol/l
XS-VLDL-TG	Triglycerides in very small VLDL	mmol/l
IDL-P	Concentration of IDL particles	mmol/l
IDL-L	Total lipids in IDL	mmol/l
IDL-PL	Phospholipids in IDL	mmol/l

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IDL-C	Cholesterol in IDL	mmol/l
IDL-CE	Cholesteryl esters in IDL	mmol/l
IDL-FC	Free cholesterol in IDL	mmol/l
IDL-TG	Triglycerides in IDL	mmol/l
L-LDL-P	Concentration of large LDL particles	mmol/l
L-LDL-L	Total lipids in large LDL	mmol/l
L-LDL-PL	Phospholipids in large LDL	mmol/l
L-LDL-C	Cholesterol in large LDL	mmol/l
L-LDL-CE	Cholesteryl esters in large LDL	mmol/l
L-LDL-FC	Free cholesterol in large LDL	mmol/l
L-LDL-TG	Triglycerides in large LDL	mmol/l
M-LDL-P	Concentration of medium LDL particles	mmol/l
M-LDL-L	Total lipids in medium LDL	mmol/l
M-LDL-PL	Phospholipids in medium LDL	mmol/l
M-LDL-C	Cholesterol in medium LDL	mmol/l
M-LDL-CE	Cholesteryl esters in medium LDL	mmol/l
M-LDL-FC	Free cholesterol in medium LDL	mmol/l
M-LDL-TG	Triglycerides in medium LDL	mmol/l
S-LDL-P	Concentration of small LDL particles	mmol/l
S-LDL-L	Total lipids in small LDL	mmol/l
S-LDL-PL	Phospholipids in small LDL	mmol/l
S-LDL-C	Cholesterol in small LDL	mmol/l
S-LDL-CE	Cholesteryl esters in small LDL	mmol/l
S-LDL-FC	Free cholesterol in small LDL	mmol/l
S-LDL-TG	Triglycerides in small LDL	mmol/l
XL-HDL-P	Concentration of very large HDL particles	mmol/l
XL-HDL-L	Total lipids in very large HDL	mmol/l
XL-HDL-PL	Phospholipids in very large HDL	mmol/l
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XL-HDL-CE	Cholesteryl esters in very large HDL	mmol/l
XL-HDL-FC	Free cholesterol in very large HDL	mmol/l
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L-HDL-P	Concentration of large HDL particles	mmol/l
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L-HDL-CE	Cholesteryl esters in large HDL	mmol/l
L-HDL-FC	Free cholesterol in large HDL	mmol/l
L-HDL-TG	Triglycerides in large HDL	mmol/l
M-HDL-P	Concentration of medium HDL particles	mmol/l
M-HDL-L	Total lipids in medium HDL	mmol/l
M-HDL-PL	Phospholipids in medium HDL	mmol/l
M-HDL-C	Cholesterol in medium HDL	mmol/l
M-HDL-CE	Cholesteryl esters in medium HDL	mmol/l
M-HDL-FC	Free cholesterol in medium HDL	mmol/l
M-HDL-TG	Triglycerides in medium HDL	mmol/l

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S-HDL-P	Concentration of small HDL particles	mmol/l
S-HDL-L	Total lipids in small HDL	mmol/l
S-HDL-PL	Phospholipids in small HDL	mmol/l
S-HDL-C	Cholesterol in small HDL	mmol/l
S-HDL-CE	Cholesteryl esters in small HDL	mmol/l
S-HDL-FC	Free cholesterol in small HDL	mmol/l
S-HDL-TG	Triglycerides in small HDL	mmol/l
XXL-VLDL-PL %	Phospholipids to total lipids ratio in chylomicrons and extremely large VLDL	%
XXL-VLDL-C %	Cholesterol to total lipids ratio in chylomicrons and extremely large VLDL	%
XXL-VLDL-CE %	Cholesteryl esters to total lipids ratio in chylomicrons and extremely large VLDL	%
XXL-VLDL-FC %	Free cholesterol to total lipids ratio in chylomicrons and extremely large VLDL	%
XXL-VLDL-TG %	Triglycerides to total lipids ratio in chylomicrons and extremely large VLDL	%
XL-VLDL-PL %	Phospholipids to total lipids ratio in very large VLDL	%
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XL-VLDL-FC %	Free cholesterol to total lipids ratio in very large VLDL	%
XL-VLDL-TG %	Triglycerides to total lipids ratio in very large VLDL	%
L-VLDL-PL %	Phospholipids to total lipids ratio in large VLDL	%
L-VLDL-C %	Cholesterol to total lipids ratio in large VLDL	%
L-VLDL-CE %	Cholesteryl esters to total lipids ratio in large VLDL	%
L-VLDL-FC %	Free cholesterol to total lipids ratio in large VLDL	%
L-VLDL-TG %	Triglycerides to total lipids ratio in large VLDL	%
M-VLDL-PL %	Phospholipids to total lipids ratio in medium VLDL	%
M-VLDL-C %	Cholesterol to total lipids ratio in medium VLDL	%
M-VLDL-CE %	Cholesteryl esters to total lipids ratio in medium VLDL	%
M-VLDL-FC %	Free cholesterol to total lipids ratio in medium VLDL	%
M-VLDL-TG %	Triglycerides to total lipids ratio in medium VLDL	%
S-VLDL-PL %	Phospholipids to total lipids ratio in small VLDL	%
S-VLDL-C %	Cholesterol to total lipids ratio in small VLDL	%
S-VLDL-CE %	Cholesteryl esters to total lipids ratio in small VLDL	%
S-VLDL-FC %	Free cholesterol to total lipids ratio in small VLDL	%
S-VLDL-TG %	Triglycerides to total lipids ratio in small VLDL	%
XS-VLDL-PL %	Phospholipids to total lipids ratio in very small VLDL	%
XS-VLDL-C %	Cholesterol to total lipids ratio in very small VLDL	%
XS-VLDL-CE %	Cholesteryl esters to total lipids ratio in very small VLDL	%
XS-VLDL-FC %	Free cholesterol to total lipids ratio in very small VLDL	%
XS-VLDL-TG %	Triglycerides to total lipids ratio in very small VLDL	%
IDL-PL %	Phospholipids to total lipids ratio in IDL	%
IDL-C %	Cholesterol to total lipids ratio in IDL	%

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IDL-CE %	Cholesteryl esters to total lipids ratio in IDL	%
IDL-FC %	Free cholesterol to total lipids ratio in IDL	%
IDL-TG %	Triglycerides to total lipids ratio in IDL	%
L-LDL-PL %	Phospholipids to total lipids ratio in large LDL	%
L-LDL-C %	Cholesterol to total lipids ratio in large LDL	%
L-LDL-CE %	Cholesteryl esters to total lipids ratio in large LDL	%
L-LDL-FC %	Free cholesterol to total lipids ratio in large LDL	%
L-LDL-TG %	Triglycerides to total lipids ratio in large LDL	%
M-LDL-PL %	Phospholipids to total lipids ratio in medium LDL	%
M-LDL-C %	Cholesterol to total lipids ratio in medium LDL	%
M-LDL-CE %	Cholesteryl esters to total lipids ratio in medium LDL	%
M-LDL-FC %	Free cholesterol to total lipids ratio in medium LDL	%
M-LDL-TG %	Triglycerides to total lipids ratio in medium LDL	%
S-LDL-PL %	Phospholipids to total lipids ratio in small LDL	%
S-LDL-C %	Cholesterol to total lipids ratio in small LDL	%
S-LDL-CE %	Cholesteryl esters to total lipids ratio in small LDL	%
S-LDL-FC %	Free cholesterol to total lipids ratio in small LDL	%
S-LDL-TG %	Triglycerides to total lipids ratio in small LDL	%
XL-HDL-PL %	Phospholipids to total lipids ratio in very large HDL	%
XL-HDL-C %	Cholesterol to total lipids ratio in very large HDL	%
XL-HDL-CE %	Cholesteryl esters to total lipids ratio in very large HDL	%
XL-HDL-FC %	Free cholesterol to total lipids ratio in very large HDL	%
XL-HDL-TG %	Triglycerides to total lipids ratio in very large HDL	%
L-HDL-PL %	Phospholipids to total lipids ratio in large HDL	%
L-HDL-C %	Cholesterol to total lipids ratio in large HDL	%
L-HDL-CE %	Cholesteryl esters to total lipids ratio in large HDL	%
L-HDL-FC %	Free cholesterol to total lipids ratio in large HDL	%
L-HDL-TG %	Triglycerides to total lipids ratio in large HDL	%
M-HDL-PL %	Phospholipids to total lipids ratio in medium HDL	%
M-HDL-C %	Cholesterol to total lipids ratio in medium HDL	%
M-HDL-CE %	Cholesteryl esters to total lipids ratio in medium HDL	%
M-HDL-FC %	Free cholesterol to total lipids ratio in medium HDL	%
M-HDL-TG %	Triglycerides to total lipids ratio in medium HDL	%
S-HDL-PL %	Phospholipids to total lipids ratio in small HDL	%
S-HDL-C %	Cholesterol to total lipids ratio in small HDL	%
S-HDL-CE %	Cholesteryl esters to total lipids ratio in small HDL	%
S-HDL-FC %	Free cholesterol to total lipids ratio in small HDL	%
S-HDL-TG %	Triglycerides to total lipids ratio in small HDL	%

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Table 4: Comparative Analysis of Metabolomic Pre-test and Post-test Results for Placebo Group Blood Samples

Differential expression analysis								
Significance(p-value)	Feature	Mean(after)	Mean(before)	Method	FC	Log2(FC)	-Log10(p-value)	-Log10(padj)
yes	Creatinine	64.21	59.285	t-test	0.923	-0.115	2.023	0.103
yes	IDL_CE_pct	51.149	49.621	t-test	0.97	-0.044	2.623	0.527
yes	IDL_C_pct	67.73	66.121	t-test	0.976	-0.035	2.767	0.527
yes	IDL_TG_pct	8.787	10.075	t-test	1.147	0.197	1.332	0.06
yes	L_LDL_CE_pct	53.99	53.463	t-test	0.99	-0.014	1.562	0.06
yes	L_LDL_C_pct	71.967	71.136	t-test	0.988	-0.017	1.59	0.06
yes	L_LDL_TG_pct	5.966	6.83	t-test	1.145	0.195	1.397	0.06
yes	M_LDL_PL_pct	26.658	26.309	t-test	0.987	-0.019	1.452	0.06
no	Acetate	0.017	0.019	t-test	1.092	0.126	0.309	0.06
no	Acetoacetate	0.025	0.019	t-test	0.741	-0.432	0.366	0.06
no	Acetone	0.019	0.021	t-test	1.063	0.089	0.067	0.005
no	Ala	0.337	0.383	t-test	1.137	0.185	1.234	0.06
no	Albumin	41.434	40.602	t-test	0.98	-0.029	0.259	0.06
no	ApoA1	1.416	1.353	t-test	0.955	-0.066	0.477	0.06
no	ApoB	0.878	0.858	t-test	0.977	-0.033	0.24	0.06
no	ApoB_by_ApoA1	0.63	0.642	t-test	1.019	0.027	0.179	0.027
no	bOHbutyrate	0.094	0.103	t-test	1.1	0.137	0.063	0.005
no	Cholines	2.554	2.454	t-test	0.961	-0.058	0.361	0.06
no	Citrate	0.06	0.063	t-test	1.043	0.061	1.126	0.06
no	Clinical_LDL_C	2.787	2.6	t-test	0.933	-0.101	0.605	0.06
no	DHA	0.323	0.291	t-test	0.9	-0.152	0.271	0.06
no	DHA_pct	2.574	2.387	t-test	0.927	-0.109	0.292	0.06
no	Gln	0.487	0.495	t-test	1.016	0.022	0.099	0.005
no	Glucose	4.525	3.994	t-test	0.883	-0.18	0.749	0.06
no	Gly	0.251	0.302	t-test	1.202	0.265	1.129	0.06
no	GlycA	0.857	0.83	t-test	0.968	-0.046	0.294	0.06
no	Glycerol	0.106	0.121	t-test	1.149	0.2	0.283	0.06
no	HDL_C	1.273	1.184	t-test	0.93	-0.105	0.665	0.06
no	HDL_CE	1.006	0.931	t-test	0.925	-0.113	0.733	0.06
no	HDL_FC	0.267	0.253	t-test	0.948	-0.077	0.401	0.06
no	HDL_L	2.818	2.668	t-test	0.947	-0.079	0.466	0.06
no	HDL_P	0.016	0.015	t-test	0.945	-0.081	0.57	0.06
no	HDL_PL	1.426	1.356	t-test	0.951	-0.072	0.403	0.06
no	HDL_size	9.47	9.463	t-test	0.999	-0.001	0.142	0.01
no	HDL_TG	0.119	0.128	t-test	1.082	0.113	0.309	0.06
no	His	0.07	0.071	t-test	1.014	0.02	0.056	0.005
no	IDL_C	0.779	0.726	t-test	0.932	-0.101	0.697	0.06
no	IDL_CE	0.588	0.544	t-test	0.925	-0.112	0.755	0.06
no	IDL_FC	0.191	0.182	t-test	0.954	-0.068	0.432	0.06
no	IDL_FC_pct	16.581	16.5	t-test	0.995	-0.007	0.103	0.005
no	IDL_L	1.143	1.094	t-test	0.957	-0.063	0.413	0.06
no	IDL_P	0	0	t-test	0.959	-0.06	0.51	0.06
no	IDL_PL	0.268	0.261	t-test	0.973	-0.039	0.233	0.06
no	IDL_PL_pct	23.483	23.804	t-test	1.014	0.02	0.531	0.06

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no	IDL_TG	0.095	0.106	t-test	1.116	0.159	0.904	0.06
no	Ile	0.058	0.07	t-test	1.196	0.258	0.728	0.06
no	LA	4.198	4.005	t-test	0.954	-0.068	0.447	0.06
no	Lactate	2.987	4.773	t-test	1.598	0.676	0.666	0.06
no	LA_pct	33.798	33.094	t-test	0.979	-0.03	0.269	0.06
no	LDL_C	1.974	1.859	t-test	0.942	-0.087	0.562	0.06
no	LDL_CE	1.458	1.378	t-test	0.945	-0.082	0.526	0.06
no	LDL_FC	0.516	0.481	t-test	0.932	-0.102	0.64	0.06
no	LDL_L	2.805	2.671	t-test	0.952	-0.07	0.455	0.06
no	LDL_P	0.001	0.001	t-test	0.977	-0.034	0.233	0.06
no	LDL_PL	0.679	0.646	t-test	0.952	-0.072	0.489	0.06
no	LDL_size	23.873	23.877	t-test	1	0	0.06	0.005
no	LDL_TG	0.151	0.166	t-test	1.097	0.133	0.715	0.06
no	Leu	0.128	0.147	t-test	1.145	0.196	0.541	0.06
no	L_HDL_C	0.21	0.186	t-test	0.884	-0.178	0.729	0.06
no	L_HDL_CE	0.168	0.147	t-test	0.876	-0.191	0.809	0.06
no	L_HDL_CE_pct	35.405	31.348	t-test	0.885	-0.176	0.669	0.06
no	L_HDL_C_pct	43.805	39.532	t-test	0.902	-0.148	0.641	0.06
no	L_HDL_FC	0.043	0.039	t-test	0.916	-0.126	0.386	0.06
no	L_HDL_FC_pct	8.4	8.184	t-test	0.974	-0.038	0.283	0.06
no	L_HDL_L	0.46	0.416	t-test	0.905	-0.144	0.532	0.06
no	L_HDL_P	0.001	0.001	t-test	0.894	-0.162	0.631	0.06
no	L_HDL_PL	0.231	0.21	t-test	0.908	-0.139	0.448	0.06
no	L_HDL_PL_pct	51.036	52.628	t-test	1.031	0.044	0.609	0.06
no	L_HDL_TG	0.018	0.02	t-test	1.111	0.151	0.24	0.06
no	L_HDL_TG_pct	5.159	7.841	t-test	1.52	0.604	0.624	0.06
no	L_LDL_C	1.258	1.172	t-test	0.932	-0.101	0.64	0.06
no	L_LDL_CE	0.943	0.88	t-test	0.933	-0.1	0.626	0.06
no	L_LDL_FC	0.315	0.292	t-test	0.928	-0.107	0.664	0.06
no	L_LDL_FC_pct	17.977	17.673	t-test	0.983	-0.025	0.641	0.06
no	L_LDL_L	1.74	1.644	t-test	0.945	-0.082	0.515	0.06
no	L_LDL_P	0.001	0.001	t-test	0.978	-0.032	0.192	0.032
no	L_LDL_PL	0.383	0.362	t-test	0.946	-0.08	0.535	0.06
no	L_LDL_PL_pct	22.067	22.033	t-test	0.998	-0.002	0.105	0.005
no	L_LDL_TG	0.099	0.109	t-test	1.103	0.142	0.794	0.06
no	L_VLDL_C	0.102	0.103	t-test	1.004	0.006	0.018	0.002
no	L_VLDL_CE	0.052	0.052	t-test	0.999	-0.002	0.006	0.002
no	L_VLDL_CE_pct	14.148	14.396	t-test	1.017	0.025	0.091	0.005
no	L_VLDL_C_pct	27.766	28.219	t-test	1.016	0.023	0.13	0.007
no	L_VLDL_FC	0.05	0.051	t-test	1.01	0.015	0.038	0.002
no	L_VLDL_FC_pct	13.618	13.824	t-test	1.015	0.022	0.252	0.06
no	L_VLDL_L	0.37	0.368	t-test	0.994	-0.008	0.018	0.002
no	L_VLDL_P	0	0	t-test	1.014	0.021	0.049	0.005
no	L_VLDL_PL	0.072	0.074	t-test	1.029	0.042	0.106	0.005
no	L_VLDL_PL_pct	19.037	20.007	t-test	1.051	0.072	1.254	0.06
no	L_VLDL_TG	0.195	0.191	t-test	0.976	-0.035	0.068	0.005
no	L_VLDL_TG_pct	53.196	51.774	t-test	0.973	-0.039	0.373	0.06
no	M_HDL_C	0.496	0.457	t-test	0.923	-0.116	0.589	0.06
no	M_HDL_CE	0.412	0.381	t-test	0.924	-0.114	0.607	0.06
no	M_HDL_CE_pct	41.205	40.496	t-test	0.983	-0.025	0.385	0.06
no	M_HDL_C_pct	49.479	48.641	t-test	0.983	-0.025	0.458	0.06
no	M_HDL_FC	0.083	0.076	t-test	0.917	-0.124	0.497	0.06
no	M_HDL_FC_pct	8.274	8.145	t-test	0.984	-0.023	0.641	0.06
no	M_HDL_L	0.997	0.936	t-test	0.939	-0.09	0.444	0.06
no	M_HDL_P	0.004	0.003	t-test	0.932	-0.102	0.493	0.06
no	M_HDL_PL	0.46	0.434	t-test	0.944	-0.082	0.399	0.06
no	M_HDL_PL_pct	46.155	46.412	t-test	1.006	0.008	0.335	0.06
no	M_HDL_TG	0.042	0.045	t-test	1.079	0.109	0.259	0.06
no	M_HDL_TG_pct	4.365	4.947	t-test	1.133	0.181	0.511	0.06
no	M_LDL_C	0.507	0.485	t-test	0.957	-0.064	0.408	0.06
no	M_LDL_CE	0.364	0.351	t-test	0.965	-0.052	0.326	0.06
no	M_LDL_CE_pct	49.044	49.36	t-test	1.006	0.009	0.369	0.06

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no	M_LDL_C_pct	68.369	68.131	t-test	0.997	-0.005	0.276	0.06
no	M_LDL_FC	0.142	0.133	t-test	0.935	-0.097	0.578	0.06
no	M_LDL_FC_pct	19.325	18.771	t-test	0.971	-0.042	0.947	0.06
no	M_LDL_L	0.739	0.71	t-test	0.962	-0.056	0.352	0.06
no	M_LDL_P	0	0	t-test	0.973	-0.039	0.252	0.06
no	M_LDL_PL	0.196	0.187	t-test	0.951	-0.073	0.454	0.06
no	M_LDL_TG	0.036	0.039	t-test	1.094	0.129	0.657	0.06
no	M_LDL_TG_pct	4.974	5.559	t-test	1.118	0.161	1.087	0.06
no	MUFA	2.749	2.707	t-test	0.985	-0.022	0.086	0.005
no	MUFA_pct	22.162	22.357	t-test	1.009	0.013	0.179	0.027
no	M_VLDL_C	0.169	0.159	t-test	0.946	-0.081	0.334	0.06
no	M_VLDL_CE	0.088	0.082	t-test	0.927	-0.109	0.336	0.06
no	M_VLDL_CE_pct	13.828	13.571	t-test	0.981	-0.027	0.062	0.005
no	M_VLDL_C_pct	26.337	26.195	t-test	0.995	-0.008	0.024	0.002
no	M_VLDL_FC	0.08	0.078	t-test	0.966	-0.05	0.255	0.06
no	M_VLDL_FC_pct	12.509	12.624	t-test	1.009	0.013	0.078	0.005
no	M_VLDL_L	0.632	0.614	t-test	0.972	-0.042	0.199	0.037
no	M_VLDL_P	0	0	t-test	0.971	-0.043	0.224	0.057
no	M_VLDL_PL	0.136	0.132	t-test	0.967	-0.048	0.238	0.06
no	M_VLDL_PL_pct	21.162	21.384	t-test	1.01	0.015	0.12	0.005
no	M_VLDL_TG	0.327	0.323	t-test	0.987	-0.019	0.056	0.005
no	M_VLDL_TG_pct	52.501	52.421	t-test	0.998	-0.002	0.01	0.002
no	non_HDL_C	3.425	3.259	t-test	0.951	-0.072	0.482	0.06
no	Omega_3	0.699	0.63	t-test	0.901	-0.15	0.208	0.043
no	Omega_3_pct	5.426	5.104	t-test	0.941	-0.088	0.177	0.027
no	Omega_6	5.057	4.83	t-test	0.955	-0.066	0.533	0.06
no	Omega_6_by_Omega_3	8.451	8.3	t-test	0.982	-0.026	0.063	0.005
no	Omega_6_pct	41.033	40.101	t-test	0.977	-0.033	0.346	0.06
no	Phe	0.079	0.084	t-test	1.073	0.102	0.361	0.06
no	Phosphatidylc	2.072	2.003	t-test	0.966	-0.049	0.262	0.06
no	Phosphoglyc	2.257	2.167	t-test	0.961	-0.058	0.303	0.06
no	PUFA	5.756	5.459	t-test	0.949	-0.076	0.463	0.06
no	PUFA_by_MUFA	2.103	2.028	t-test	0.964	-0.052	0.524	0.06
no	PUFA_pct	46.459	45.205	t-test	0.973	-0.039	0.775	0.06
no	Pyruvate	0.03	0.039	t-test	1.306	0.386	0.344	0.06
no	Remnant_C	1.451	1.4	t-test	0.965	-0.052	0.325	0.06
no	SFA	3.901	3.928	t-test	1.007	0.01	0.037	0.002
no	SFA_pct	31.378	32.438	t-test	1.034	0.048	0.929	0.06
no	S_HDL_C	0.509	0.484	t-test	0.95	-0.074	0.56	0.06
no	S_HDL_CE	0.384	0.362	t-test	0.943	-0.084	0.672	0.06
no	S_HDL_CE_pct	30.584	29.951	t-test	0.979	-0.03	0.575	0.06
no	S_HDL_C_pct	40.537	40.025	t-test	0.987	-0.018	0.464	0.06
no	S_HDL_FC	0.125	0.121	t-test	0.972	-0.041	0.241	0.06
no	S_HDL_FC_pct	9.953	10.074	t-test	1.012	0.017	0.587	0.06
no	S_HDL_L	1.256	1.209	t-test	0.963	-0.055	0.4	0.06
no	S_HDL_P	0.011	0.01	t-test	0.954	-0.068	0.544	0.06
no	S_HDL_PL	0.694	0.669	t-test	0.964	-0.053	0.379	0.06
no	S_HDL_PL_pct	55.223	55.293	t-test	1.001	0.002	0.078	0.005
no	S_HDL_TG	0.053	0.057	t-test	1.072	0.101	0.426	0.06
no	S_HDL_TG_pct	4.24	4.682	t-test	1.104	0.143	0.728	0.06
no	S_LDL_C	0.21	0.202	t-test	0.962	-0.056	0.387	0.06
no	S_LDL_CE	0.15	0.146	t-test	0.97	-0.044	0.278	0.06
no	S_LDL_CE_pct	46.01	46.169	t-test	1.003	0.005	0.122	0.005
no	S_LDL_C_pct	64.221	63.76	t-test	0.993	-0.01	0.49	0.06
no	S_LDL_FC	0.059	0.056	t-test	0.941	-0.088	0.649	0.06
no	S_LDL_FC_pct	18.211	17.591	t-test	0.966	-0.05	0.88	0.06
no	S_LDL_L	0.326	0.317	t-test	0.971	-0.043	0.317	0.06
no	S_LDL_P	0	0	t-test	0.977	-0.034	0.237	0.06
no	S_LDL_PL	0.1	0.097	t-test	0.974	-0.038	0.324	0.06
no	S_LDL_PL_pct	30.746	30.719	t-test	0.999	-0.001	0.026	0.002
no	S_LDL_TG	0.016	0.017	t-test	1.063	0.088	0.325	0.06
no	S_LDL_TG_pct	5.032	5.521	t-test	1.097	0.134	0.61	0.06
no	Sphingomyelins	0.448	0.428	t-test	0.957	-0.064	0.433	0.06
no	S_VLDL_C	0.159	0.162	t-test	1.019	0.028	0.127	0.006
no	S_VLDL_CE	0.097	0.101	t-test	1.042	0.059	0.297	0.06

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no	S_VLDL_CE_pct	21.678	22.506	t-test	1.038	0.054	0.325	0.06
no	S_VLDL_C_pct	35.59	36.258	t-test	1.019	0.027	0.146	0.01
no	S_VLDL_FC	0.062	0.061	t-test	0.985	-0.022	0.101	0.005
no	S_VLDL_FC_pct	13.911	13.752	t-test	0.989	-0.017	0.086	0.005
no	S_VLDL_L	0.452	0.456	t-test	1.008	0.012	0.051	0.005
no	S_VLDL_P	0	0	t-test	1.011	0.016	0.073	0.005
no	S_VLDL_PL	0.106	0.106	t-test	0.995	-0.008	0.035	0.002
no	S_VLDL_PL_pct	23.642	23.475	t-test	0.993	-0.01	0.095	0.005
no	S_VLDL_TG	0.186	0.188	t-test	1.006	0.009	0.024	0.002
no	S_VLDL_TG_pct	40.768	40.267	t-test	0.988	-0.018	0.076	0.005
no	TG_by_PG	0.592	0.63	t-test	1.064	0.089	0.267	0.06
no	Total_BCAA	0.431	0.479	t-test	1.111	0.152	0.524	0.06
no	Total_C	4.698	4.442	t-test	0.946	-0.081	0.59	0.06
no	Total_CE	3.445	3.242	t-test	0.941	-0.088	0.625	0.06
no	Total_FA	12.405	12.095	t-test	0.975	-0.037	0.175	0.027
no	Total_FC	1.253	1.2	t-test	0.958	-0.062	0.473	0.06
no	Total_L	8.87	8.54	t-test	0.963	-0.055	0.394	0.06
no	Total_P	0.018	0.017	t-test	0.948	-0.077	0.562	0.06
no	Total_PL	2.834	2.73	t-test	0.963	-0.054	0.386	0.06
no	Total_TG	1.338	1.367	t-test	1.022	0.031	0.078	0.005
no	Tyr	0.055	0.061	t-test	1.109	0.15	0.463	0.06
no	Unsaturation	1.44	1.407	t-test	0.977	-0.033	0.814	0.06
no	Val	0.245	0.263	t-test	1.073	0.101	0.39	0.06
no	VLDL_C	0.672	0.674	t-test	1.003	0.004	0.016	0.002
no	VLDL_CE	0.394	0.396	t-test	1.004	0.005	0.021	0.002
no	VLDL_FC	0.278	0.278	t-test	1.001	0.002	0.008	0.002
no	VLDL_L	2.106	2.107	t-test	1.001	0.001	0.003	0.002
no	VLDL_P	0	0	t-test	1.016	0.022	0.111	0.005
no	VLDL_PL	0.461	0.467	t-test	1.013	0.019	0.07	0.005
no	VLDL_size	38.998	39.008	t-test	1	0	0.014	0.002
no	VLDL_TG	0.973	0.967	t-test	0.994	-0.009	0.018	0.002
no	XL_HDL_C	0.059	0.057	t-test	0.968	-0.047	0.31	0.06
no	XL_HDL_CE	0.042	0.04	t-test	0.956	-0.066	0.391	0.06
no	XL_HDL_CE_pct	40.214	33.187	t-test	0.825	-0.277	0.605	0.06
no	XL_HDL_C_pct	58.772	46.379	t-test	0.789	-0.342	0.52	0.06
no	XL_HDL_FC	0.016	0.016	t-test	1.001	0.002	0.009	0.002
no	XL_HDL_FC_pct	18.557	13.192	t-test	0.711	-0.492	0.429	0.06
no	XL_HDL_L	0.105	0.106	t-test	1.008	0.011	0.052	0.005
no	XL_HDL_P	0	0	t-test	0.985	-0.022	0.141	0.01
no	XL_HDL_PL	0.041	0.043	t-test	1.053	0.074	0.239	0.06
no	XL_HDL_PL_pct	33.404	33.946	t-test	1.016	0.023	0.143	0.01
no	XL_HDL_TG	0.006	0.006	t-test	1.095	0.131	0.319	0.06
no	XL_HDL_TG_pct	7.824	5.389	t-test	0.689	-0.538	0.301	0.06
no	XL_VLDL_C	0.054	0.055	t-test	1.019	0.027	0.072	0.005
no	XL_VLDL_CE	0.033	0.033	t-test	1.024	0.034	0.119	0.005
no	XL_VLDL_CE_pct	18.462	17.45	t-test	0.945	-0.081	0.188	0.031
no	XL_VLDL_C_pct	28.74	27.987	t-test	0.974	-0.038	0.109	0.005
no	XL_VLDL_FC	0.022	0.022	t-test	1.012	0.017	0.03	0.002
no	XL_VLDL_FC_pct	10.278	10.537	t-test	1.025	0.036	0.153	0.013
no	XL_VLDL_L	0.203	0.207	t-test	1.024	0.034	0.062	0.005
no	XL_VLDL_P	0	0	t-test	1.03	0.043	0.083	0.005
no	XL_VLDL_PL	0.036	0.036	t-test	1.014	0.019	0.032	0.002
no	XL_VLDL_PL_pct	16.268	17.052	t-test	1.048	0.068	0.342	0.06
no	XL_VLDL_TG	0.113	0.116	t-test	1.03	0.042	0.065	0.005
no	XL_VLDL_TG_pct	54.992	54.962	t-test	0.999	-0.001	0.003	0.002
no	XS_VLDL_C	0.142	0.144	t-test	1.018	0.026	0.137	0.01
no	XS_VLDL_CE	0.096	0.095	t-test	0.992	-0.011	0.053	0.005
no	XS_VLDL_CE_pct	32.455	30.476	t-test	0.939	-0.091	1	0.06
no	XS_VLDL_C_pct	47.868	46.003	t-test	0.961	-0.057	0.812	0.06
no	XS_VLDL_FC	0.046	0.049	t-test	1.073	0.102	0.693	0.06
no	XS_VLDL_FC_pct	15.413	15.527	t-test	1.007	0.011	0.23	0.06
no	XS_VLDL_L	0.293	0.313	t-test	1.068	0.095	0.627	0.06
no	XS_VLDL_P	0	0	t-test	1.055	0.078	0.522	0.06

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no	XS_VLDL_PL	0.084	0.093	t-test	1.104	0.143	0.918	0.06
no	XS_VLDL_PL_pct	28.565	29.508	t-test	1.033	0.047	1.022	0.06
no	XS_VLDL_TG	0.067	0.076	t-test	1.127	0.173	0.818	0.06
no	XS_VLDL_TG_pct	23.567	24.49	t-test	1.039	0.055	0.322	0.06
no	XXL_VLDL_C	0.046	0.049	t-test	1.084	0.116	0.161	0.018
no	XXL_VLDL_CE	0.028	0.032	t-test	1.137	0.185	0.331	0.06
no	XXL_VLDL_CE_pct	23.207	26.711	t-test	1.151	0.203	0.268	0.06
no	XXL_VLDL_C_pct	36.128	39.55	t-test	1.095	0.131	0.171	0.026
no	XXL_VLDL_FC	0.018	0.018	t-test	1.001	0.001	0.001	0.001
no	XXL_VLDL_FC_pct	12.921	12.839	t-test	0.994	-0.009	0.011	0.002
no	XXL_VLDL_L	0.156	0.149	t-test	0.957	-0.064	0.054	0.005
no	XXL_VLDL_P	0	0	t-test	0.992	-0.012	0.01	0.002
no	XXL_VLDL_PL	0.026	0.026	t-test	0.986	-0.021	0.017	0.002
no	XXL_VLDL_PL_pct	14.889	16.636	t-test	1.117	0.16	0.527	0.06
no	XXL_VLDL_TG	0.084	0.074	t-test	0.879	-0.187	0.136	0.01
no	XXL_VLDL_TG_pct	34.697	43.814	t-test	1.263	0.337	0.413	0.06

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Table 5: Comparative Analysis of Metabolomic Pre-test and Post-test Results for Probiotics Group Blood Samples

Differential expression analysis								
Significance(p-value)	Feature	Mean(after)	Mean(before)	Method	FC	Log2(FC)	-Log10(p-value)	-Log10(padj)
yes	Acetate	0.017	0.019	t-test	1.156	0.209	1.329	0.407
yes	Gly	0.263	0.295	t-test	1.123	0.167	1.447	0.407
yes	HDL_size	9.573	9.508	t-test	0.993	-0.01	1.433	0.407
yes	Lactate	4.175	5.984	t-test	1.433	0.519	1.441	0.407
yes	L_VLDL_CE_pct	14.036	15.354	t-test	1.094	0.129	1.363	0.407
yes	L_VLDL_C_pct	28.119	29.999	t-test	1.067	0.093	1.505	0.407
yes	L_VLDL_FC_pct	14.083	14.645	t-test	1.04	0.056	1.643	0.421
yes	L_VLDL_L	0.563	0.48	t-test	0.853	-0.229	1.334	0.407
yes	L_VLDL_TG	0.288	0.233	t-test	0.81	-0.304	2.037	0.533
yes	L_VLDL_TG_pct	51.128	49.056	t-test	0.959	-0.06	1.429	0.407
yes	M_HDL_CE_pct	37.7	39.269	t-test	1.042	0.059	2.902	0.805
yes	M_HDL_C_pct	46.11	47.515	t-test	1.03	0.043	3.121	0.805
yes	M_HDL_PL_pct	47.018	46.34	t-test	0.986	-0.021	1.977	0.533
yes	M_HDL_TG_pct	6.873	6.145	t-test	0.894	-0.161	1.715	0.463
yes	M_VLDL_PL_pct	21.414	22.043	t-test	1.029	0.042	1.319	0.407
yes	S_HDL_CE_pct	27.533	28.901	t-test	1.05	0.07	1.987	0.533
yes	S_HDL_C_pct	37.973	39.337	t-test	1.036	0.051	2.162	0.533
yes	S_HDL_PL_pct	55.964	55.036	t-test	0.983	-0.024	1.839	0.52
yes	S_HDL_TG_pct	6.063	5.628	t-test	0.928	-0.107	1.571	0.407
yes	S_LDL_C_pct	62.862	63.718	t-test	1.014	0.019	2.566	0.645
yes	TG_by_PG	0.778	0.696	t-test	0.895	-0.161	1.792	0.508
yes	VLDL_size	39.666	39.173	t-test	0.988	-0.018	2.006	0.533
yes	VLDL_TG	1.623	1.384	t-test	0.853	-0.229	1.355	0.407
yes	XL_HDL_CE_pct	36.249	38.447	t-test	1.061	0.085	1.922	0.524
yes	XL_HDL_C_pct	52.182	56.422	t-test	1.081	0.113	1.345	0.407
yes	XL_VLDL_L	0.381	0.323	t-test	0.847	-0.239	1.334	0.407
yes	XL_VLDL_TG	0.221	0.181	t-test	0.818	-0.291	1.843	0.52
yes	XXL_VLDL_L	0.467	0.375	t-test	0.804	-0.315	1.494	0.407
yes	XXL_VLDL_P	0	0	t-test	0.817	-0.292	1.395	0.407
yes	XXL_VLDL_TG	0.267	0.202	t-test	0.756	-0.403	2.073	0.533
no	Acetoacetate	0.026	0.017	t-test	0.651	-0.619	0.697	0.243
no	Acetone	0.016	0.02	t-test	1.238	0.308	0.6	0.219
no	Ala	0.373	0.401	t-test	1.074	0.103	0.738	0.264
no	Albumin	41.766	43.735	t-test	1.047	0.066	1.025	0.384
no	ApoA1	1.521	1.487	t-test	0.978	-0.032	0.18	0.068
no	ApoB	1.001	1.016	t-test	1.015	0.021	0.123	0.039
no	ApoB_by_ApoA1	0.669	0.698	t-test	1.044	0.062	0.667	0.227
no	boHbutyrate	0.074	0.09	t-test	1.218	0.284	0.375	0.158
no	Cholines	2.989	2.88	t-test	0.963	-0.054	0.368	0.158
no	Citrate	0.062	0.062	t-test	1.012	0.017	0.143	0.052
no	Clinical_LDL_C	2.854	3	t-test	1.051	0.072	0.548	0.211
no	Creatinine	72.354	68.671	t-test	0.949	-0.075	0.784	0.275
no	DHA	0.287	0.269	t-test	0.94	-0.09	0.163	0.057
no	DHA_pct	1.763	1.862	t-test	1.056	0.079	0.258	0.111
no	Gln	0.546	0.549	t-test	1.006	0.009	0.072	0.024
no	Glucose	4.989	4.441	t-test	0.89	-0.168	0.66	0.227
no	GlycA	0.94	0.938	t-test	0.998	-0.003	0.029	0.004
no	Glycerol	0.099	0.119	t-test	1.202	0.265	0.326	0.144
no	HDL_C	1.29	1.262	t-test	0.978	-0.032	0.151	0.054
no	HDL_CE	0.986	0.971	t-test	0.985	-0.022	0.103	0.029
no	HDL_FC	0.303	0.291	t-test	0.957	-0.063	0.324	0.144
no	HDL_L	3.102	2.984	t-test	0.962	-0.056	0.286	0.122
no	HDL_P	0.016	0.016	t-test	0.997	-0.004	0.021	0.004
no	HDL_PL	1.592	1.515	t-test	0.952	-0.071	0.39	0.158
no	HDL_TG	0.22	0.208	t-test	0.942	-0.085	0.361	0.158

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no	His	0.075	0.083 t-test	1.115	0.157	0.962	0.364
no	IDL_C	0.867	0.864 t-test	0.997	-0.004	0.022	0.004
no	IDL_CE	0.654	0.648 t-test	0.991	-0.013	0.086	0.027
no	IDL_CE_pct	49.557	49.108 t-test	0.991	-0.013	0.588	0.219
no	IDL_C_pct	65.567	65.379 t-test	0.997	-0.004	0.198	0.074
no	IDL_FC	0.212	0.216 t-test	1.018	0.025	0.156	0.057
no	IDL_FC_pct	16.01	16.271 t-test	1.016	0.023	0.405	0.158
no	IDL_L	1.321	1.326 t-test	1.004	0.006	0.036	0.004
no	IDL_P	0	0 t-test	0.96	-0.059	0.352	0.158
no	IDL_PL	0.305	0.313 t-test	1.026	0.036	0.298	0.127
no	IDL_PL_pct	23.096	23.591 t-test	1.021	0.031	0.914	0.337
no	IDL_TG	0.149	0.149 t-test	0.998	-0.003	0.013	0.004
no	IDL_TG_pct	11.338	11.03 t-test	0.973	-0.04	0.297	0.127
no	Ile	0.072	0.076 t-test	1.053	0.074	0.458	0.179
no	LA	5.312	5.015 t-test	0.944	-0.083	0.6	0.219
no	LA_pct	33.147	34.014 t-test	1.026	0.037	0.435	0.172
no	LDL_C	2.043	2.135 t-test	1.045	0.064	0.627	0.222
no	LDL_CE	1.542	1.603 t-test	1.039	0.055	0.518	0.189
no	LDL_FC	0.5	0.532 t-test	1.064	0.09	0.967	0.364
no	LDL_L	2.992	3.111 t-test	1.04	0.056	0.496	0.184
no	LDL_P	0.001	0.001 t-test	1.035	0.05	0.367	0.158
no	LDL_PL	0.714	0.741 t-test	1.037	0.052	0.43	0.172
no	LDL_size	23.826	23.839 t-test	1.001	0.001	0.188	0.073
no	LDL_TG	0.235	0.235 t-test	1.002	0.003	0.013	0.004
no	Leu	0.142	0.157 t-test	1.101	0.139	1.113	0.396
no	L_HDL_C	0.239	0.211 t-test	0.881	-0.183	0.507	0.189
no	L_HDL_CE	0.183	0.162 t-test	0.889	-0.169	0.455	0.179
no	L_HDL_CE_pct	30.952	32.79 t-test	1.059	0.083	0.807	0.29
no	L_HDL_C_pct	40.163	41.444 t-test	1.032	0.045	0.471	0.183
no	L_HDL_FC	0.057	0.049 t-test	0.855	-0.226	0.69	0.242
no	L_HDL_FC_pct	9.212	8.653 t-test	0.939	-0.09	1.2	0.407
no	L_HDL_L	0.575	0.506 t-test	0.88	-0.184	0.564	0.215
no	L_HDL_P	0.001	0.001 t-test	0.876	-0.192	0.504	0.189
no	L_HDL_PL	0.289	0.253 t-test	0.873	-0.196	0.643	0.224
no	L_HDL_PL_pct	51.142	49.923 t-test	0.976	-0.035	1.046	0.384
no	L_HDL_TG	0.046	0.042 t-test	0.921	-0.119	0.359	0.158
no	L_HDL_TG_pct	8.695	8.634 t-test	0.993	-0.01	0.027	0.004
no	L_LDL_C	1.274	1.333 t-test	1.046	0.064	0.644	0.224
no	L_LDL_CE	0.961	1.001 t-test	1.042	0.059	0.575	0.219
no	L_LDL_CE_pct	52.644	52.638 t-test	1	0	0.007	0.004
no	L_LDL_C_pct	69.77	70.032 t-test	1.004	0.005	0.282	0.122
no	L_LDL_FC	0.313	0.331 t-test	1.057	0.08	0.859	0.308
no	L_LDL_FC_pct	17.127	17.394 t-test	1.016	0.022	0.781	0.275
no	L_LDL_L	1.825	1.903 t-test	1.043	0.06	0.556	0.214
no	L_LDL_P	0.001	0.001 t-test	1.042	0.06	0.401	0.158
no	L_LDL_PL	0.4	0.417 t-test	1.044	0.062	0.555	0.214
no	L_LDL_PL_pct	21.932	21.951 t-test	1.001	0.001	0.054	0.013
no	L_LDL_TG	0.151	0.153 t-test	1.015	0.021	0.089	0.027
no	L_LDL_TG_pct	8.298	8.017 t-test	0.966	-0.05	0.355	0.158
no	L_VLDL_C	0.155	0.141 t-test	0.912	-0.132	0.51	0.189
no	L_VLDL_CE	0.075	0.07 t-test	0.932	-0.102	0.326	0.144
no	L_VLDL_FC	0.08	0.072 t-test	0.894	-0.162	0.742	0.264
no	L_VLDL_P	0	0 t-test	0.866	-0.208	1.116	0.396
no	L_VLDL_PL	0.12	0.105 t-test	0.879	-0.186	0.933	0.348
no	L_VLDL_PL_pct	20.753	20.945 t-test	1.009	0.013	0.269	0.114
no	M_HDL_C	0.496	0.488 t-test	0.984	-0.023	0.094	0.027
no	M_HDL_CE	0.404	0.4 t-test	0.991	-0.013	0.053	0.013
no	M_HDL_FC	0.092	0.088 t-test	0.954	-0.068	0.272	0.115
no	M_HDL_FC_pct	8.409	8.246 t-test	0.981	-0.028	0.83	0.307
no	M_HDL_L	1.091	1.056 t-test	0.968	-0.048	0.219	0.086
no	M_HDL_P	0.004	0.004 t-test	0.967	-0.048	0.201	0.074
no	M_HDL_PL	0.515	0.493 t-test	0.957	-0.063	0.329	0.144
no	M_HDL_TG	0.08	0.074 t-test	0.931	-0.102	0.427	0.172
no	M_LDL_C	0.544	0.57 t-test	1.048	0.068	0.625	0.222
no	M_LDL_CE	0.408	0.424 t-test	1.038	0.054	0.47	0.183
no	M_LDL_CE_pct	50.244	50.189 t-test	0.999	-0.002	0.047	0.009

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no	M_LDL_C_pct	67.302	67.855	t-test	1.008	0.012	0.601	0.219
no	M_LDL_FC	0.136	0.146	t-test	1.079	0.109	1.039	0.384
no	M_LDL_FC_pct	17.057	17.667	t-test	1.036	0.051	1.151	0.407
no	M_LDL_L	0.809	0.843	t-test	1.042	0.059	0.474	0.183
no	M_LDL_P	0	0	t-test	1.028	0.039	0.291	0.123
no	M_LDL_PL	0.209	0.217	t-test	1.038	0.054	0.365	0.158
no	M_LDL_PL_pct	25.892	25.737	t-test	0.994	-0.009	0.322	0.144
no	M_LDL_TG	0.057	0.056	t-test	0.995	-0.007	0.025	0.004
no	M_LDL_TG_pct	6.806	6.408	t-test	0.941	-0.087	0.703	0.245
no	MUFA	4.058	3.815	t-test	0.94	-0.089	0.587	0.219
no	MUFA_pct	24.27	23.809	t-test	0.981	-0.028	0.376	0.158
no	M_VLDL_C	0.186	0.192	t-test	1.032	0.046	0.145	0.052
no	M_VLDL_CE	0.088	0.096	t-test	1.091	0.126	0.459	0.179
no	M_VLDL_CE_pct	12.017	14.183	t-test	1.18	0.239	1.276	0.407
no	M_VLDL_C_pct	24.376	27.164	t-test	1.114	0.156	1.262	0.407
no	M_VLDL_FC	0.098	0.096	t-test	0.979	-0.03	0.092	0.027
no	M_VLDL_FC_pct	12.359	12.981	t-test	1.05	0.071	1.168	0.407
no	M_VLDL_L	0.816	0.762	t-test	0.934	-0.099	0.434	0.172
no	M_VLDL_P	0	0	t-test	0.954	-0.068	0.265	0.112
no	M_VLDL_PL	0.172	0.166	t-test	0.963	-0.055	0.195	0.074
no	M_VLDL_TG	0.457	0.404	t-test	0.883	-0.18	0.97	0.364
no	M_VLDL_TG_pct	54.21	50.792	t-test	0.937	-0.094	1.284	0.407
no	non_HDL_C	3.838	3.908	t-test	1.018	0.026	0.159	0.057
no	Omega_3	0.782	0.689	t-test	0.881	-0.183	0.48	0.183
no	Omega_3_pct	4.53	4.276	t-test	0.944	-0.083	0.325	0.144
no	Omega_6	6.048	5.767	t-test	0.953	-0.069	0.581	0.219
no	Omega_6_by_Omega_3	9.266	10.779	t-test	1.163	0.218	0.864	0.308
no	Omega_6_pct	38.082	39.375	t-test	1.034	0.048	0.837	0.308
no	Phe	0.085	0.086	t-test	1.011	0.016	0.12	0.038
no	Phosphatidylc	2.461	2.323	t-test	0.944	-0.084	0.612	0.219
no	Phosphoglyc	2.716	2.594	t-test	0.955	-0.066	0.441	0.173
no	PUFA	6.83	6.456	t-test	0.945	-0.081	0.636	0.224
no	PUFA_by_MUFA	1.789	1.877	t-test	1.049	0.069	0.571	0.218
no	PUFA_pct	42.612	43.651	t-test	1.024	0.035	0.58	0.219
no	Pyruvate	0.04	0.058	t-test	1.456	0.542	0.37	0.158
no	Remnant_C	1.796	1.773	t-test	0.988	-0.018	0.079	0.026
no	SFA	5.491	5.167	t-test	0.941	-0.088	0.472	0.183
no	SFA_pct	33.118	32.54	t-test	0.983	-0.025	0.505	0.189
no	S_HDL_C	0.486	0.5	t-test	1.029	0.041	0.354	0.158
no	S_HDL_CE	0.351	0.364	t-test	1.038	0.054	0.534	0.2
no	S_HDL_FC	0.135	0.136	t-test	1.005	0.007	0.042	0.008
no	S_HDL_FC_pct	10.441	10.436	t-test	1	-0.001	0.017	0.004
no	S_HDL_L	1.295	1.3	t-test	1.004	0.005	0.03	0.004
no	S_HDL_P	0.011	0.011	t-test	1.025	0.035	0.284	0.122
no	S_HDL_PL	0.727	0.72	t-test	0.991	-0.013	0.079	0.026
no	S_HDL_TG	0.082	0.08	t-test	0.967	-0.049	0.238	0.1
no	S_LDL_C	0.225	0.232	t-test	1.035	0.05	0.388	0.158
no	S_LDL_CE	0.173	0.178	t-test	1.026	0.037	0.24	0.1
no	S_LDL_CE_pct	48.121	48.302	t-test	1.004	0.005	0.188	0.073
no	S_LDL_FC	0.051	0.055	t-test	1.067	0.093	1.031	0.384
no	S_LDL_FC_pct	14.741	15.416	t-test	1.046	0.065	0.854	0.308
no	S_LDL_L	0.358	0.365	t-test	1.021	0.029	0.212	0.081
no	S_LDL_P	0	0	t-test	1.021	0.03	0.194	0.074
no	S_LDL_PL	0.106	0.107	t-test	1.009	0.012	0.089	0.027
no	S_LDL_PL_pct	29.648	29.377	t-test	0.991	-0.013	0.371	0.158
no	S_LDL_TG	0.028	0.026	t-test	0.948	-0.076	0.358	0.158
no	S_LDL_TG_pct	7.49	6.906	t-test	0.922	-0.117	0.774	0.274
no	Sphingomyelins	0.477	0.472	t-test	0.989	-0.015	0.088	0.027
no	S_VLDL_C	0.199	0.206	t-test	1.033	0.047	0.162	0.057
no	S_VLDL_CE	0.126	0.131	t-test	1.04	0.056	0.193	0.074
no	S_VLDL_CE_pct	21.368	22.914	t-test	1.072	0.101	1.147	0.407
no	S_VLDL_C_pct	33.978	36.404	t-test	1.071	0.1	1.189	0.407
no	S_VLDL_FC	0.073	0.074	t-test	1.022	0.031	0.105	0.03
no	S_VLDL_FC_pct	12.61	13.49	t-test	1.07	0.097	1.238	0.407
no	S_VLDL_L	0.61	0.595	t-test	0.975	-0.037	0.123	0.039

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no	S_VLDL_P	0	0	t-test	0.966	-0.05	0.165	0.057
no	S_VLDL_PL	0.133	0.133	t-test	0.998	-0.003	0.008	0.004
no	S_VLDL_PL_pct	22.398	23.208	t-test	1.036	0.051	1.163	0.407
no	S_VLDL_TG	0.279	0.257	t-test	0.922	-0.117	0.453	0.179
no	S_VLDL_TG_pct	43.624	40.388	t-test	0.926	-0.111	1.19	0.407
no	Total_BCAA	0.486	0.521	t-test	1.071	0.099	0.842	0.308
no	Total_C	5.128	5.17	t-test	1.008	0.012	0.07	0.024
no	Total_CE	3.693	3.734	t-test	1.011	0.016	0.1	0.028
no	Total_FA	16.38	15.438	t-test	0.943	-0.085	0.618	0.22
no	Total_FC	1.435	1.436	t-test	1.001	0.001	0.005	0.003
no	Total_L	10.668	10.37	t-test	0.972	-0.041	0.248	0.103
no	Total_P	0.018	0.018	t-test	0.999	-0.001	0.008	0.004
no	Total_PL	3.313	3.224	t-test	0.973	-0.039	0.239	0.1
no	Total_TG	2.227	1.976	t-test	0.887	-0.172	1.011	0.384
no	Tyr	0.066	0.07	t-test	1.046	0.065	0.448	0.177
no	Unsaturation	1.369	1.37	t-test	1	0.001	0.018	0.004
no	Val	0.272	0.288	t-test	1.06	0.084	0.657	0.227
no	VLDL_C	0.929	0.909	t-test	0.978	-0.031	0.107	0.03
no	VLDL_CE	0.523	0.526	t-test	1.004	0.006	0.02	0.004
no	VLDL_FC	0.406	0.383	t-test	0.945	-0.082	0.314	0.139
no	VLDL_L	3.254	2.949	t-test	0.906	-0.142	0.708	0.245
no	VLDL_P	0	0	t-test	0.958	-0.063	0.261	0.111
no	VLDL_PL	0.702	0.655	t-test	0.934	-0.099	0.411	0.159
no	XL_HDL_C	0.068	0.062	t-test	0.918	-0.123	0.731	0.262
no	XL_HDL_CE	0.049	0.044	t-test	0.909	-0.138	0.636	0.224
no	XL_HDL_FC	0.019	0.018	t-test	0.943	-0.085	0.756	0.264
no	XL_HDL_FC_pct	15.933	17.975	t-test	1.128	0.174	0.844	0.308
no	XL_HDL_L	0.141	0.123	t-test	0.875	-0.193	0.897	0.331
no	XL_HDL_P	0	0	t-test	0.913	-0.132	0.662	0.227
no	XL_HDL_PL	0.06	0.049	t-test	0.814	-0.297	1.022	0.384
no	XL_HDL_PL_pct	37.258	33.048	t-test	0.887	-0.173	1.267	0.407
no	XL_HDL_TG	0.012	0.012	t-test	0.933	-0.1	0.376	0.158
no	XL_HDL_TG_pct	10.56	10.531	t-test	0.997	-0.004	0.015	0.004
no	XL_VLDL_C	0.089	0.081	t-test	0.918	-0.124	0.471	0.183
no	XL_VLDL_CE	0.047	0.046	t-test	0.966	-0.05	0.149	0.054
no	XL_VLDL_CE_pct	14.714	17.751	t-test	1.206	0.271	1.142	0.407
no	XL_VLDL_C_pct	25.817	29.087	t-test	1.127	0.172	1.084	0.385
no	XL_VLDL_FC	0.041	0.036	t-test	0.863	-0.213	0.988	0.368
no	XL_VLDL_FC_pct	11.103	11.336	t-test	1.021	0.03	0.48	0.183
no	XL_VLDL_P	0	0	t-test	0.857	-0.222	1.223	0.407
no	XL_VLDL_PL	0.071	0.061	t-test	0.851	-0.232	1.151	0.407
no	XL_VLDL_PL_pct	18.5	18.311	t-test	0.99	-0.015	0.376	0.158
no	XL_VLDL_TG_pct	55.683	52.602	t-test	0.945	-0.082	1.051	0.384
no	XS_VLDL_C	0.183	0.184	t-test	1.01	0.014	0.074	0.024
no	XS_VLDL_CE	0.12	0.122	t-test	1.015	0.021	0.137	0.049
no	XS_VLDL_CE_pct	29.837	31.525	t-test	1.057	0.079	1.028	0.384
no	XS_VLDL_C_pct	44.926	46.821	t-test	1.042	0.06	1.089	0.385
no	XS_VLDL_FC	0.062	0.062	t-test	1	0.001	0.003	0.003
no	XS_VLDL_FC_pct	15.089	15.296	t-test	1.014	0.02	0.738	0.264
no	XS_VLDL_L	0.417	0.414	t-test	0.992	-0.011	0.045	0.009
no	XS_VLDL_P	0	0	t-test	0.997	-0.005	0.021	0.004
no	XS_VLDL_PL	0.124	0.122	t-test	0.985	-0.021	0.078	0.026
no	XS_VLDL_PL_pct	29.481	28.941	t-test	0.982	-0.027	0.738	0.264
no	XS_VLDL_TG	0.111	0.107	t-test	0.971	-0.042	0.157	0.057
no	XS_VLDL_TG_pct	25.593	24.238	t-test	0.947	-0.078	0.909	0.337
no	XXL_VLDL_C	0.118	0.104	t-test	0.885	-0.177	0.589	0.219
no	XXL_VLDL_CE	0.067	0.061	t-test	0.913	-0.131	0.372	0.158
no	XXL_VLDL_CE_pct	17.383	18.837	t-test	1.084	0.116	0.223	0.088
no	XXL_VLDL_C_pct	28.919	30.122	t-test	1.042	0.059	0.106	0.03
no	XXL_VLDL_FC	0.051	0.043	t-test	0.847	-0.239	0.937	0.348
no	XXL_VLDL_FC_pct	11.537	11.284	t-test	0.978	-0.032	0.055	0.013
no	XXL_VLDL_PL	0.082	0.069	t-test	0.842	-0.248	1.017	0.384
no	XXL_VLDL_PL_pct	17.037	16.536	t-test	0.971	-0.043	0.081	0.026
no	XXL_VLDL_TG_pct	54.043	42.231	t-test	0.781	-0.356	1.188	0.407