

Appendix: Supplementary information

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Supplementary Table S1

Fatty acids analysis of fluid lipid after urea inclusion by GC.

Fatty acids	Area percent
9t-C16:1	1.28 ±0.06
6-8t-C18:1	0.04 ±0.00
9t-C18:1	1.08 ±0.05
11t-C18:1	8.20 ±1.84
9t12t-C18:2	0.93 ±0.03
TFA	11.52 ±1.15
C10:0	4.48 ±0.76
C11:0	0.53 ±0.10
C12:0	9.18 ±0.08
C13:0	0.47 ±0.01
C14:0	10.77 ±0.28
C15:0	0.72 ±0.02
C16:0	17.36 ±0.46
C17:0	0.20 ±0.06
C18:0	0.72 ±0.01
C19:0	0.36 ±0.11
SFA	44.79 ±4.48
9c-C14:1	3.11 ±0.11
10c-C15:1	0.08 ±0.04
9c-C16:1	6.16 ±0.18
10c-C17:1	0.17 ±0.06
6c/9c-C18:1	23.30 ±2.55
11c-C18:1	1.63 ±0.57
5c-C20:1	2.58 ±0.04
8c-C20:1	0.73 ±0.00
11c-C20:1	0.80 ±0.89
C-MUFA	38.54 ±3.85
9c12c-C18:2	3.38 ±0.01
C18:3	0.20 ±0.09
C20:2,n-6	1.92 ±0.50
PUFA	5.51 ±0.55

Supplementary Table S2

^aEnergy supply ratio of protein, carbohydrate, basal fat and butter-derived R-TFA.

Components [kcal (%)]	LFD	LFD + R-TFA	HFD	HFD + R-TFA
Protein (%)	20	20	20	20
Carbohydrate (%)	70	70	20	20
Basal Fat (%)	10	8.7	60	58.7
Butter-derived R-TFA (%)	0	1.3	0	1.3

^bFormulation of the customized feed of LFD group and HFD group.

Diet composition	LFD	HFD
Casein	205.56	258.45
L-cystine	2.84	3.88
Corn starch	489.79	0.00
Maltodextrin	168.48	175.53
Sucrose	75.21	88.91
Cellulose	47.39	64.61
Soybean oil	32.24	32.30
Lard oil	18.96	316.60
Mineral mixture	9.48	12.92
Calcium hydrogen phosphate	12.32	16.80
Calcium carbonate	5.21	7.11
Potassium citrate	15.64	21.32
Vitamin mixture	9.48	12.92
Choline tartrate	1.90	2.58

Supplementary Table S3

Primer sequences of unigene *Acot2*, *ALoxe3*, *Ephx2*, *Tbxas1* and *Cbr3* for qRT-PCR, and β -actin was used as an endogenous control.

Target	Forward Primer Sequence (5' – 3')	Reverse Primer Sequence (5' – 3')
Acot2	ATGGTGGCCTCGTCTTTTCG	GAGCGGCGGAGGTACAAAC
Aloxe3	ATGGCAGTATATCGGCTGTGT	GCTTCTGCTTAGGGCTTTCAC
Ephx2	CTTGGTGCGTACCAGACGG	TTCTCAGGTAGATTGGCTCCA
Tbxas1	GTGTTGGGGCTTCTCAAGTTT	CCGTATCGCTCTCGGAGTT
Cbr3	CATCGGCTTTGCGATCACG	GACCAGCACGTTAAGTCCCC
β -actin	GCTTCTAGGCGGACTGTTACT	GCCTTCACCGTTCCAGTTTTT

Supplementary Table S4

Differentially expressed lipid metabolites between LFD + R-TFA group and LFD group.

lipid name	log2(FC)	-log10(P-value)	VIP
CL(18:1/18:2/18:2/18:2)	2.8112	1.4842	1.68374489
CL(18:2/18:2/18:2/18:2)	1.8183	1.6112	1.727423168
SM(41:1;2O)	1.746	1.5602	1.719422002
Cer(18:1;2O/25:0)	1.5358	1.4439	1.717956667
FA(20:4)	1.4157	1.6501	1.8330894
DG(16:0/22:6)	1.3761	1.9568	1.914053396
DG(18:0/18:1)	0.8306	1.6454	1.790640217
DG(18:2/18:2)	0.70492	2.1681	2.018511489
PC(34:2)	0.61484	1.5016	1.635786893
PC(36:2)	0.60984	1.622	1.731972496
FA(16:0)	-0.58612	2.1633	2.026172036
Cer(18:1;2O/16:0)	-0.61865	2.8036	2.205774047
PE(16:0/22:5)	-0.66987	1.7722	1.99033547
LPE(18:0)	-0.83538	2.6228	2.17694391
TG(16:0/18:1/20:4)	-0.86007	1.6287	1.855206567
LPE(O-16:1)	-0.94219	1.8788	1.911467195
LPE(16:0)	-1.0178	2.1	2.029028174
TG(16:0/18:1/20:1)	-1.0457	1.694	1.715430619
FA(18:1)	-1.1727	2.595	2.229380874
Cer(18:1;2O/18:0)	-1.2437	2.4577	2.129064377
PE(18:0/22:5)	-1.4398	1.4333	1.743401275
PE(O-19:0/22:5)	-2.5948	2.6735	2.234870513

Differentially expressed lipid metabolites between LFD + R-TFA group and LFD group were identified based on the criteria of $VIP > 1$, $P < 0.05$ and fold change ($FC \geq 1.5$ or $FC \leq 0.67$). CL, cardiolipin; SM, sphingomyelin; Cer, ceramide; FA, fatty

acid; DG, diglyceride; PC, phosphatidylcholine; PE, phosphatidylethanolamine; LPE, lysophosphatidylethanolamine; TG, triglyceride; OxPE, oxidize phosphatidylethanolamine.

Supplementary Table S5

Differentially expressed lipid metabolites between HFD + R-TFA group and HFD group.

Lipid name	log2(FC)	-log10(P-value)	VIP
DG(18:1/22:5)	3.0807	4.1747	1.915660566
TG(18:1/18:2/22:4)	2.8215	2.0274	1.554581522
FA(24:5)	2.7672	4.4339	1.9297605
FA(22:3)	2.716	3.624	1.854554292
DG(18:2/20:4)	2.6454	5.7852	1.991811183
TG(18:1/20:1/22:1)	2.6179	6.0963	1.989898223
TG(16:0/18:1/24:6)	2.5513	2.1742	1.617254032
TG(18:1/18:2/22:5)	2.525	2.1518	1.60237651
TG(18:1/18:1/22:6)	2.5139	3.5219	1.844797833
TG(18:1/20:1/20:2)	2.503	6.5357	1.99997414
DG(18:2/22:5)	2.4951	2.2199	1.646132801
PE(O-16:1/22:6)	2.4535	1.976	1.528420816
FA(24:6)	2.354	5.7035	1.990427194
DG(18:1/22:4)	2.3435	2.2086	1.633568178
TG(18:0/18:1/20:1)	2.3326	2.3168	1.667869003
DG(18:1/18:3)	2.2883	2.2752	1.631921243
DG(16:0/22:6)	2.2176	2.3167	1.620421794
TG(16:0/18:1/18:4)	2.163	1.3043	1.289066408
FA(16:1)	2.1371	1.8797	1.513497398
TG(16:0/18:1/18:3)	2.1123	2.7654	1.746253458
LPE(22:4)	2.0414	1.3458	1.29120946
PE(O-16:1/22:4)	1.9515	2.7135	1.732847878
TG(18:1/20:1/18:2)	1.8939	3.0296	1.782980393
TG(20:0/18:1/20:1)	1.8894	3.0843	1.774007356
FA(20:2)	1.8868	1.3176	1.307319676

PE(18:0/20:1)	1.8447	1.3802	1.327550271
Cer(18:0;2O/24:1)	1.839	1.672	1.477289324
DG(18:1/20:3)	1.6716	3.7835	1.869987431
TG(16:0/19:1/20:1)	1.5914	2.5026	1.671465178
TG(18:1/18:1/22:1)	1.4168	3.6465	1.844926561
TG(16:0/19:1/18:2)	1.3785	1.7616	1.459539191
PG(18:1/20:4)	1.2982	1.7477	1.4894552
TG(18:1/18:1/20:4)	1.2705	2.2905	1.660057921
TG(18:1/18:2/22:6)	1.1521	2.5088	1.691303481
PG(18:1/18:1)	1.0914	2.4686	1.67556818
Cer(18:1;2O/18:0)	1.0619	1.5547	1.425751466
LPE(22:6)	1.0309	1.8223	1.465210539
LPE(22:5)	1.0207	2.3997	1.654100605
TG(18:1/18:1/20:1)	1.0074	3.0306	1.767191746
PG(18:1/22:6)	0.98061	1.7514	1.462502989
Cer(18:1;2O/16:0)	0.94963	2.1873	1.617060214
TG(18:1/18:1/19:1)	0.91783	1.9633	1.53294381
TG(16:0/18:1/20:4)	0.8633	1.4896	1.386796035
Cer(18:1;2O/24:1)	0.81941	2.2153	1.627701682
TG(16:0/18:1/22:6)	0.78686	1.5791	1.41894305
TG(18:2/18:2/22:6)	0.7804	1.6988	1.485748623
DG(18:1/20:1)	0.69837	2.834	1.73323226
TG(16:0/16:1/22:6)	0.62385	1.5724	1.416812122
PE(16:0/18:2)	-0.59817	1.495	1.392465735
PE(18:0/18:2)	-0.60141	1.5584	1.417437266
SM(18:1;2O/23:0)	-0.65055	2.5351	1.695789876
SM(18:1;2O/24:0)	-0.73058	1.335	1.324857452
PC(34:1)	-0.733	1.6028	1.401449794
PE(18:2/18:2)	-0.78948	1.3649	1.311428649

PI(38:4)	-0.84459	1.7417	1.463977248
LPC(16:0/0:0)	-0.86751	2.0754	1.572001593
PC(38:5)	-0.9303	1.8354	1.486817898
PC(40:6)	-0.93871	2.9366	1.743647141
PC(40:7)	-0.93942	1.552	1.368573662
LPC(18:0/0:0)	-0.99185	2.2862	1.62310484
PC(38:4)	-1.0187	2.8918	1.742714576
PC(38:6)	-1.0846	2.2518	1.598972438
PC(36:3)	-1.0955	1.4776	1.366945915
PC(36:4)	-1.135	2.4494	1.656268066
TG(18:2/18:2/20:4)	-1.236	1.5051	1.41109311
PC(36:2)	-1.2391	2.578	1.702867074
PC(34:2)	-1.2793	1.9945	1.550284062
TG(16:0/17:1/18:2)	-1.6268	2.1573	1.632208468
SM(41:2;2O)	-1.6496	1.4769	1.368366755
CL(18:2/18:2/18:2/18:2)	-1.6963	1.7665	1.477938908
TG(17:1/18:1/18:2)	-1.9506	1.3413	1.300992236
TG(16:0/17:0/18:1)	-1.9566	1.3067	1.317337951
FA(18:3)	-1.9783	1.3643	1.306152918
PC(16:0/16:0)	-1.9783	1.3257	1.291941581
TG(14:0/16:0/18:1)	-2.4987	6.927	2.01289121
TG(17:0/18:1/18:2)	-2.5056	2.071	1.563223026
TG(16:0/18:2/20:5)	-2.8221	1.9275	1.545303061

Differentially expressed lipid metabolites between HFD + R-TFA group and HFD group were identified based on $VIP > 1$, $P < 0.05$ and fold change ($FC \geq 1.5$ or $FC \leq 0.67$). DG, diglyceride; TG, triglyceride; FA, fatty acid; LPE, lysophosphatidylethanolamine; Cer, ceramide; OxPE, oxidize phosphatidylethanolamine; PE, phosphatidylethanolamine; SM, sphingomyelin. PG, phosphatidylglycerol; PC, phosphatidylcholine; PI, phosphatidylinositol.