

Supplementary Materials

Table S1 Diet compositions for the four groups.

Ingredient	LF		HF		TL		TH	
	gm	Kcal	gm	Kcal	gm	Kcal	gm	Kcal
Casein	200.0	800.0	200.0	800.0	200.0	800.0	200.0	800.0
Sucrose	172.8	691.2	172.8	691.2	172.8	691.2	172.8	691.2
Cellulose,BW200	50.0	0.0	50.0	0.0	50.0	0.0	50.0	0.0
Soybean Oil	25.0	225.0	25.0	225.0	25.0	225.0	25.0	225.0
Potassium Citrate, 1 H ₂ O	16.5	0.0	16.5	0.0	16.5	0.0	16.5	0.0
Vitamin mixture V10001	10.0	40.0	10.0	40.0	10.0	40.0	10.0	40.0
Mineral mixture S10026	10.0	0.0	10.0	0.0	10.0	0.0	10.0	0.0
DiCalcium Phosphate	13.0	0.0	13.0	0.0	13.0	0.0	13.0	0.0
Calcium Carbonate	5.5	0.0	5.5	0.0	5.5	0.0	5.5	0.0
L-Cystine	3.0	12.0	3.0	12.0	3.0	12.0	3.0	12.0
Choline Bitartrate	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0
Corn Starch	452.2	1808.8	72.8	291.2	72.8	291.2	72.8	291.2
Lard	20.0	180.0	177.5	1597.5	118.3	1064.7	59.2	523.8
Tomato seed oil	/	/	/	/	59.2	523.8	118.3	1064.7
Maltodextrin 10	75.0	300.0	100.0	400.0	100.0	400.0	100.0	400.0
Cholesterol	/	/	8.7	0.0	8.7	0.0	8.7	0.0
Sodium cholate	/	/	1.7	0.0	1.7	0.0	1.7	0.0
Total (g)	1055.1		868.6		868.6		868.6	
Total energy (Kcal)		4057.0		4056.9		4056.9		4056.9
Energy	gm%	Kcal%	gm%	Kcal%	gm%	Kcal%	gm%	Kcal%
Protein	19.2	20.0	23.4	20.0	23.4	20.0	23.4	20.0
Carbohydrates	67.3	70.0	40.9	35.1	40.9	35.1	40.9	35.1
Fat	4.3	10.0	23.3	44.9	23.3	44.9	23.3	44.9
Energy density (Kcal/g)	3.9		4.7		4.7		4.7	

LF: low fat group (n=8); HF: high fat group (n=6); TL: low dose TSO group (n=8); TH: high dose TSO group (n=8).

Table S2 Quantitative real time PCR primer sequences.

Gene	Forward primer	Reverse primer
LXRα	CTCAATGCCTGATGTTTCTCCT	TCCAACCCTATCCCTAAAGCAA
CYP7A1	GGGATTGCTGTGGTAGTGAGC	GGTATGGAATCAACCCGTTGTC
SREBP-2	TGGGCGATGAGCTGACTCT	CAAATCAGGGAACCTCTCCAC
LDLR	TCAGACGAACAAGGCTGTCC	CCATCTAGGCAATCTCGGTCTC
HMG-CoR	AGCTTGCCCGAATTGTATGTG	TCTGTTGTGAACCATGTGACTTC
SREBP-1c	TGACCCGGCTATTCCGTGA	CTGGGCTGAGCAATACAGTTC
PPARα	AGAGCCCCATCTGTCCTCTC	ACTGGTAGTCTGCAAAACCAAA
FASN	GGAGGTGGTGATAGCCGGTAT	TGGGTAATCCATAGAGCCAG
ACC1	ATGGGCGGAATGGTCTCTTTC	TGGGGACCTTGTCTTCATCAT
CPT1A	AGATCAATCGGACCCTAGACAC	CAGCGAGTAGCGCATAGTCA
ACADL	TCTTTTCTCGGAGCATGACA	GACCTCTCTACTCACTTCTCCAG
ABCA1	AAAACCGCAGACATCCTTCAG	CATACCGAAACTCGTTCACCC
ABCG5	AGGGCCTCACATCAACAGAG	GCTGACGCTGTAGGACACAT
ABCG8	CTGTGGAATGGGACTGTACTTC	GTTGGACTGACCACTGTAGGT
SR-B1	TTTGGAGTGGTAGTAAAAAGGGC	TGACATCAGGGACTCAGAGTAG
MTP	CTCTTGGCAGTGCTTTTCTCT	GAGCTTGTATAGCCGCTCATT
HL	ATGCCAATTTTGTGGACGCC	GTCATAGTGGGCAATGGGCT
NPC1L1	TGTCCCCGCCTATACAATGG	CCTTGGTGATAGACAGGCTACTG
ACAT2	CCTGTCTCTCGGTTTCCCAT	TGCTGCCACCTTTCAACAA
FATP4	GGGGCCAATAAACTCTGCCT	TCCCAAGGGCTAAGCGAAAG
CD36	ATGGGCTGTGATCGGAACTG	GTCTTCTCAATAAGCATGTCTCC
Apo B-48	AAGCACCTCCGAAAGTACGTG	CTCCAGCTCTACCTTACAGTTGA
β-actin	GGCTGTATCCCCTCCATCG	CCAGTTGGTAACAATGCCATGT

Table S3 Fatty acids of tomato seed oil.

	TSO
Fatty acid (%)	
16:0	12.73±0.13
18:0	5.69±0.05
20:0	0.86±0.05
Total SFA	19.28±0.22
16:1	0.31±0.00
18:1	22.31±0.18
20:1	1.66±0.12
Total MUFA	24.27±0.30
18:2	49.25±0.20
18:3	1.21±0.08
22:6	0.19±0.00
Total PUFA	50.65±0.28
Phytosterol (mg/kg)	639.45±74.66
Lycopene (mg/kg)	34.82±1.00
β-carotene (mg/kg)	37.18±0.33

Data are expressed as the mean ± SD.

Table S4 Fatty acid of diets of four groups.

Fatty acid (mg/g)	LF	HF	TL	TH
14:0	0.3±0.0	2.1±0.1	1.5±0.1	0.8±0.1
16:0	9.2±0.5	44.9±1.6	42.3±2.7	31.0±1.7
18:0	5.3±0.1	24.0±0.6	21.5±1.3	15.2±0.5
Total SFA	14.9±0.7	71.0±2.2	65.2±4.1	47.1±2.3
16:1	0.3±0.1	4.2±0.2	3.2±0.1	2.0±0.2
18:1	13.1±0.3	73.8±3.0	69.4±3.6	51.3±2.2
Total MUFA	13.4±0.3	78.0±2.8	72.6±3.7	53.2±2.1
18:2	9.0±0.6	22.7±4.4	47.3±1.6	61.9±3.3
18:3	0.6±0.0	1.0±0.3	2.2±0.1	2.7±0.1
Total PUFA	9.6±0.6	23.8±4.8	49.5±1.7	64.3±3.5
P/S ratio	0.64	0.33	0.76	1.36

Data are expressed as the mean ± SD. P/S: polyunsaturated-to-saturated fatty acid ratios

Table S5 Taxonomic information of 30 key genera.

Genus	Family	Order	Class	Phylum
<i>unclassified_f__Erysipelotrichaceae</i>	<i>Erysipelotrichaceae</i>	<i>Erysipelotrichales</i>	<i>Erysipelotrichia</i>	<i>Firmicutes</i>
<i>norank_o__Gastranaerophilales</i>	<i>norank_o__Gastranaerophilales</i>	<i>Gastranaerophilales</i>	<i>Cyanobacteria</i>	<i>Cyanobacteria</i>
<i>norank_f__Ruminococcaceae</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>norank_f__Peptococcaceae</i>	<i>Peptococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>norank_f__Erysipelotrichaceae</i>	<i>Erysipelotrichaceae</i>	<i>Erysipelotrichales</i>	<i>Erysipelotrichia</i>	<i>Firmicutes</i>
<i>norank_f__Clostridiales_vadinBB60_group</i>	<i>Clostridiales_vadinBB60_group</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>norank_f__Bacteroidales_S24-7_group</i>	<i>Bacteroidales_S24-7_group</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>[Eubacterium]_fissicatena_group</i>	<i>Lachnospiraceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Ruminococcaceae_UCG-014</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Ruminiclostridium_9</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Ruminiclostridium_5</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Roseburia</i>	<i>Lachnospiraceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Rikenellaceae_RC9_gut_group</i>	<i>Rikenellaceae</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>Rikenella</i>	<i>Rikenellaceae</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>Pseudomonas</i>	<i>Pseudomonadaceae</i>	<i>Pseudomonadales</i>	<i>Gammaproteobacteria</i>	<i>Proteobacteria</i>
<i>Phascolarctobacterium</i>	<i>Acidaminococcaceae</i>	<i>Selenomonadales</i>	<i>Negativicutes</i>	<i>Firmicutes</i>
<i>Odoribacter</i>	<i>Porphyromonadaceae</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>Lactobacillus</i>	<i>Lactobacillaceae</i>	<i>Lactobacillales</i>	<i>Bacilli</i>	<i>Firmicutes</i>
<i>Lachnospiraceae_NK4A136_group</i>	<i>Lachnospiraceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Lachnoclostridium</i>	<i>Lactobacillaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Faecalibaculum</i>	<i>Erysipelotrichaceae</i>	<i>Erysipelotrichales</i>	<i>Erysipelotrichia</i>	<i>Firmicutes</i>
<i>Desulfovibrio</i>	<i>Desulfovibrionaceae</i>	<i>Desulfovibrionales</i>	<i>Deltaproteobacteria</i>	<i>Proteobacteria</i>
<i>Coprococcus_1</i>	<i>Lachnospiraceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Caproiciproducens</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Bifidobacterium</i>	<i>Bifidobacteriaceae</i>	<i>Bifidobacteriales</i>	<i>Actinobacteria</i>	<i>Actinobacteria</i>
<i>Bacteroides</i>	<i>Bacteroidaceae</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>Anaerotruncus</i>	<i>Ruminococcaceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>
<i>Allobaculum</i>	<i>Erysipelotrichaceae</i>	<i>Erysipelotrichales</i>	<i>Erysipelotrichia</i>	<i>Firmicutes</i>
<i>Alistipes</i>	<i>Rikenellaceae</i>	<i>Bacteroidales</i>	<i>Bacteroidia</i>	<i>Bacteroidetes</i>
<i>Acetatifactor</i>	<i>Lachnospiraceae</i>	<i>Clostridiales</i>	<i>Clostridia</i>	<i>Firmicutes</i>

Fig. S1 Quantitative comparisons of bacterial OTUs among the four groups: a low fat diet (LF); a high fat diet (HF); HF with tomato seed oil replacing one-third of lard (TL); HF with tomato seed oil replacing two-thirds of lard (TH).

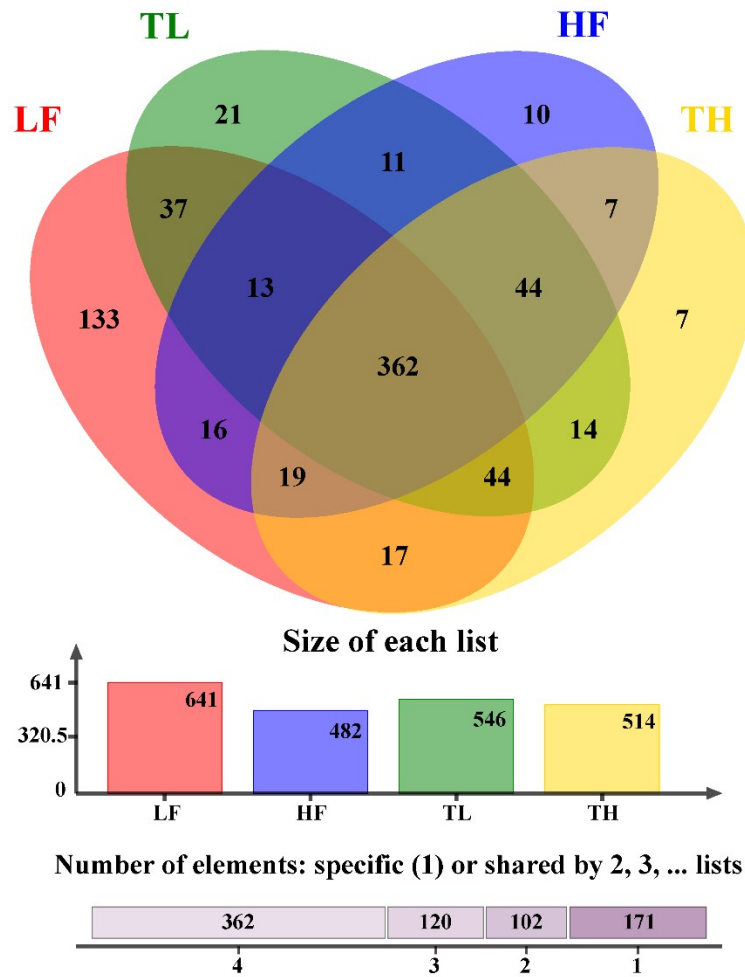


Fig. S2

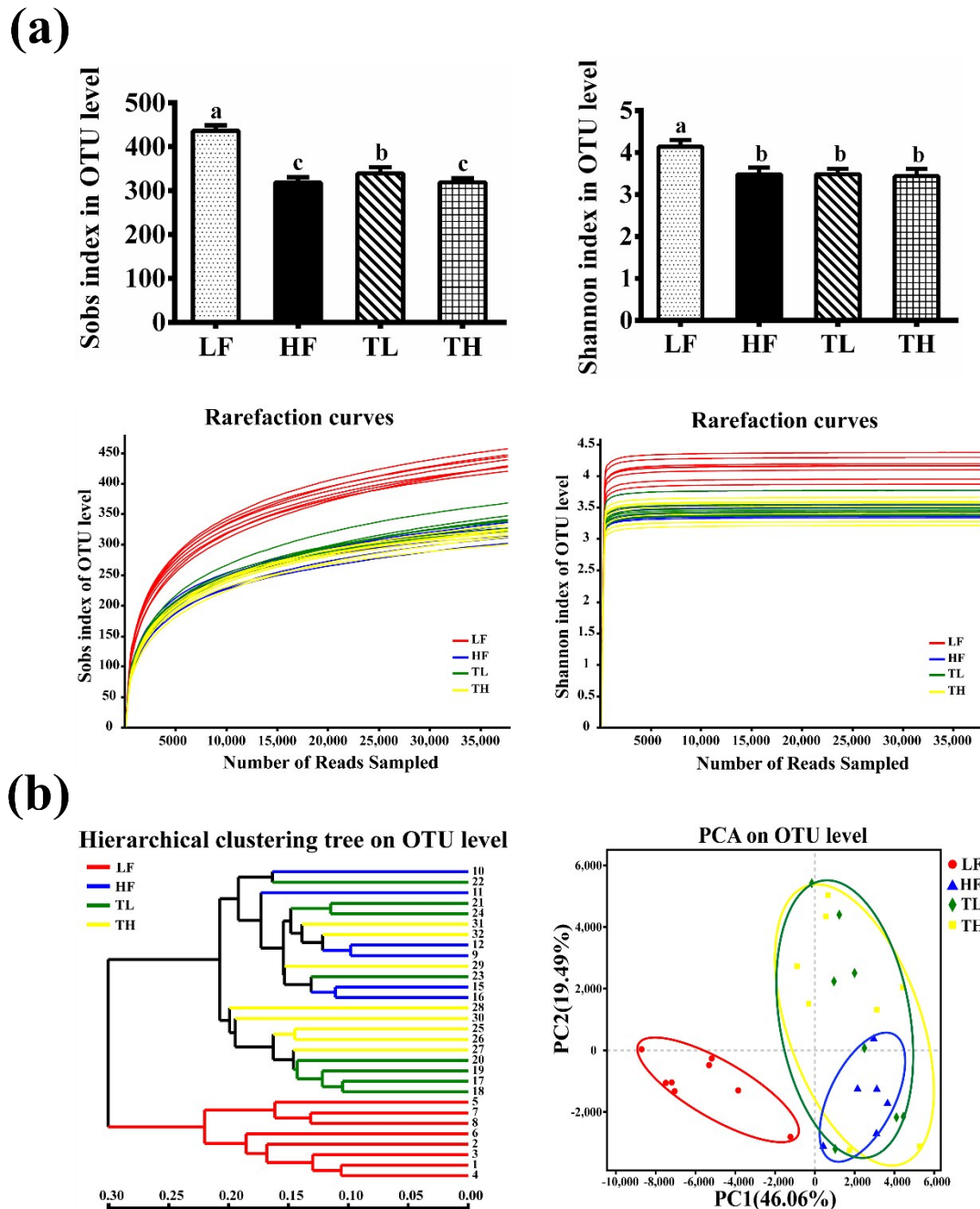


Fig. S2 Effects of a low fat diet (LF, n=8), a high fat diet (HF, n=6), HF with tomato seed oil replacing one-third of lard (TL, n=8), HF with tomato seed oil replacing two-thirds of lard (TH, n=8) on Alpha and beta diversity. (a) Alpha diversity of gut microbiota presented in the Sobs index, Shannon index and rarefaction curves (Sobs and Shannon index). One-way ANOVA followed by LSD test was used for statistical significance. Data are expressed as the means with different superscript letters (a, b, c) in the same row differ significantly at $p < 0.05$. (b) Beta diversity of gut microbiota presented in hierarchical clustering tree and principal component analysis (PCA) on OTU levels.

Fig. S3

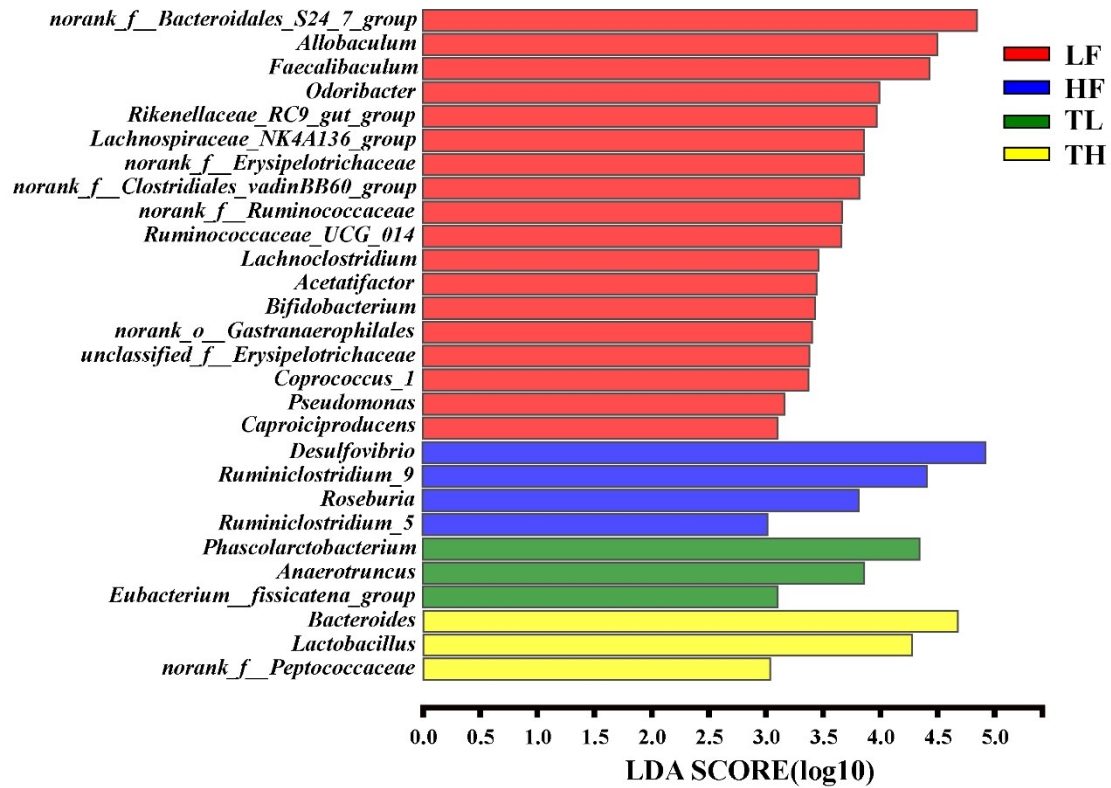


Fig. S3 Linear discriminant analysis (LDA) was combined with effect size (LEfSe) analysis. Only the genus meeting LDA score threshold ≥ 3.0 are listed.

Fig. S4 Spearman's correlation analyses between 30 key genera and parameters related to lipids metabolism in mice fed a low fat diet (LF, n=8) and a high fat diet (HF, n=6). Colors in the figure indicate the R-value of Spearman's correlation. Asterisks **"**"**, **"***"** and **"****"** indicate significant correlation of different degrees ($p < 0.05$; $p < 0.01$ and $p < 0.001$, respectively).

