Electronic Supplementary Material (ESI) for Food & Function.

Supplementary Table 1. The composition of low-fat diet (g/100g of diet)

Ingredients	Low-fat diet
Water (g)	9.2
Crude protein (g)	22.1
Crude fat (g) soybean oil	5.28
Crude ash (g)	5.2
Crude fiber (g)	4.12
Calcium (g)	1.24
Phosphorus (g)	0.93

Supplementary Table 2. The composition of high-fat diet (g/100g diet)

Ingredients	High-fat diet	Crude protein (g)	Fat (g)	Carbohydrates (corn and wheat starch) (g)
Low fat diet (g)	60	13.3	3.2	31.2
Lard oil (g)	18.7		18.7	
Sucrose (g)	7			7
Casein (g)	8.4	8.4		
Cholesterol (g)	1.2		1.2	
Cholate (g)	0.2			
Maltodextrin (g)	2.9			2.9
Premix (g)	1.6			
Total	100	21.7	23.1	41.1

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Supplementary Table 3. Primer sequences for real-time PCR

Primer	Sequences
ACC1 F	5’-TTTCTTCCTTCGCCTCCTTT-3’
ACC1 R	5’-TGCCAATCTCATTTCCTCCT-3’
Adiponectin F	5’-GCCGTTCTCTTCACCTACGAC-3’
Adiponectin R	5’-CCATCCCCATACACCTGGA-3’
Aldose reductase F	5’-TCAACAACGGCACCAAGAT-3’
Aldose reductase R	5’-CCCACCTCCTTCTCATTCTG-3’
AOX F	5’-GAGGGGAACATCATCACAGG-3’
AOX R	5’-AAAGTCAAAGGCATCCACCA-3’
CYP7A1 F	5’-CTG GGC TGT GCT CTG AAG T-3’
CYP7A1 R	5’-GGG AGT TTG TGA TGA AGT GGA-3’
Fasn F	5’-CTGTCTGGGCATAACGGTCT-3’

Fasn R	5’-GCGGTGTGAAAACGAACTTT-3’
ketohexokinase F	5’-GCG TGG ATG TGT CTC AAG TG-3’
ketohexokinase R	5’-GGC AGG TTC GTG TCG TAG AG-3’
IL1-β-F	5’-CCT CCT TGC CTC TGA TGG-3’
IL1-β-R	5’-AGT GCT GCC TAA TGT CCC-3’
IL-6 F	5’-TTC CAG AAA CCG CTA TGA-3’
IL-6 R	5’-GGT TGT CAC CAG CAT CAG-3’
MCP-1 F	5’-TCT GTG CTG ACC CCA AGA A-3’
MCP-1 R	5’-TGT GGA AAA GGT AGT GGA TGC-3’
MyD88 F	5’-GCC AGA GTG GAA AGC AGT GT-3’
MyD88 R	5’-TAT CGT TGG GGC AGT AGC AG-3’
PPAR-α F	5’-ATG CCA AAA ATA TCC CTG GTTT C-3’
PPAR-α R	5’-GGA GGC CAG CAT GGT GTA GA-3’
SLC2A4 F	5’-GGT TAT CAA TGC CCC ACA GA-3’
SLC2A4 R	5’-AGA GCC CAG AGC GTA GTG AG-3’
SREBP-1c F	5’-GGA GGC AGA GAG CAG AGA TG-3’
SREBP-1c R	5’-CAC AGG TTC CCC ATA GAC AAA-3’
TLR-4 F	5’-TCA GAG CCG TTG GTG TAT CTT-3’
TLR-4 R	5’-CCT CAG CAG GGA CTT CTC AA-3’
TNF-α-F	5’-AAT AAC GCT GAT TTG GTG A-3’
TNF-α-R	5’-ACC CGT AGG GCG ATT ACA-3’

Abbreviations: ACC1, aycl-CoA carboxylase 1; AOX, acyl-coenzyme A oxidase; *CYP7A1*, cholesterol 7a-hydroxylase; Fasn, fatty acid synthase; IL-1β, interleukin-1β; IL-6, interleukin-6; MCP-1, monocyte chemoattractant protein-1; MyD88, myeloid differentiation primary response gene 88; PPAR-α, Peroxisome proliferator-activated receptor alpha; SLC2A4, solute carrier family 2 member 4; SREBP-1c, sterol regulatory element binding protein-1c; TNF-α, tumor necrosis factor-α.

Supplementary Table 4. Serum and liver biochemical parameters of male *fat-1* and wide-type mice exposed to high-fat and high-sugar interventions

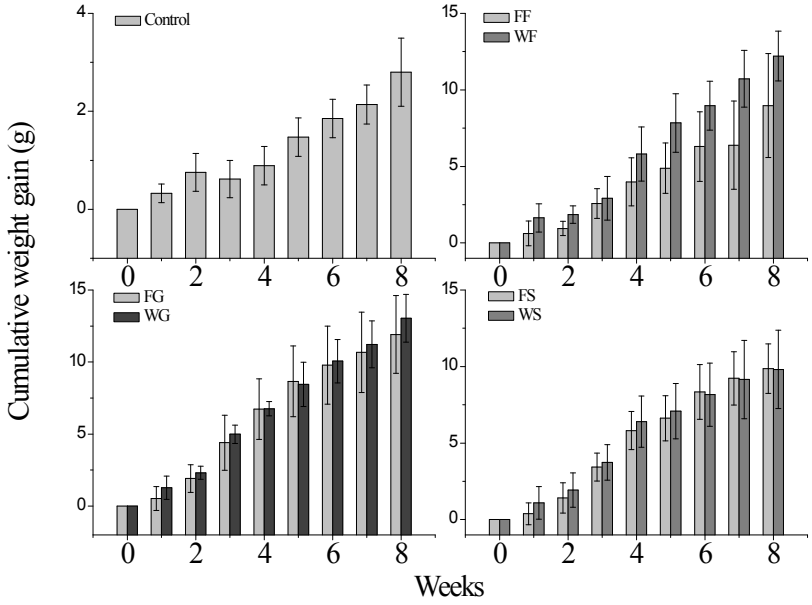
Variable	Control	FF	WF	FG	WG	FS	WS	ANOVA	$P_{for\ sugar}$	$P_{for\ genotype}$	$P_{for\ sugar*genotype}$
TC (mmol/L)	1.23 ± 0.07^{d}	2.50 ± 0.24^{c}	3.64 ± 0.25^{a}	3.02 ± 0.10^{b}	3.51 ± 0.15^{a}	2.58 ± 0.21^{c}	3.53 ± 0.27^{a}	<0.001	0.051	<0.001	<0.001
HDL-C (mmol/L)	1.10±0.10	1.20±0.15	1.23±0.19	1.29±0.14	1.22±0.11	1.40±0.06	1.21±0.28	0.204	0.219	0.488	0.306
LDL-C (mmol/L)	0.42 ± 0.01^{d}	1.02 ± 0.25^{c}	2.18 ± 0.02^{a}	1.44 ± 0.15^{b}	2.03 ± 0.03^{a}	0.94 ± 0.08^{c}	2.25 ± 0.23^{a}	<0.001	0.109	<0.001	<0.001
TAG (mmol/L)	0.478 ± 0.077^{b}	0.507 ± 0.039^{b}	0.703 ± 0.111^{a}	0.595 ± 0.057^{ab}	0.583 ± 0.053^{ab}	0.615 ± 0.015^{ab}	0.693 ± 0.095^{a}	<0.001	0.154	0.003	0.007
Glucose (mmol/L)	2.53 ± 0.50^{cd}	3.49 ± 0.29^{b}	4.16 ± 0.27^{a}	2.79 ± 0.10^{cd}	2.87 ± 0.11^{cd}	2.29 ± 0.01^{d}	3.07 ± 0.22^{bc}	<0.001	<0.001	<0.001	0.002
Insulin (mU/L)	8.8 ± 0.7^{b}	12.0 ± 0.2^{a}	13.0 ± 1.2^{a}	11.8 ± 0.4^{a}	13.5 ± 1.6^{a}	9.5 ± 0.8^{b}	11.8 ± 1.6^{a}	<0.001	0.001	<0.001	0.475
HOMA-IR	1.12 ± 0.24^{cd}	1.88 ± 0.22^{b}	2.42 ± 0.37^{a}	1.47 ± 0.09^{bcd}	1.68 ± 0.22^{b}	0.97 ± 0.08^{d}	1.61 ± 0.22^{bc}	<0.001	<0.001	<0.001	0.150
ALT (U/L)	17.4 ± 1.7^{e}	19.8 ± 4.4^{e}	60.8 ± 5.6^{b}	32.0 ± 3.3^{d}	55.3 ± 3.6^{b}	40.7 ± 2.3^{c}	84.3 ± 3.3^{a}	<0.001	<0.001	<0.001	<0.001
AST (U/L)	56.9 ± 6.5^{e}	69.3 ± 2.9^{d}	94.5 ± 3.4^{ab}	76.0 ± 6.2^{cd}	85.5±7.8bc	68.3 ± 4.0^{d}	104.0±7.9a	<0.001	0.003	<0.001	<0.001
Uric acid (μmol/L)	51.3 ± 2.9^{b}	61.7 ± 4.7^{ab}	72.8 ± 7.4^{a}	59.1 ± 6.5^{b}	57.9 ± 3.9^{b}	57.0 ± 9.9^{b}	63.4 ± 6.4^{ab}	<0.001	0.010	0.038	0097
Adiponectin (mg/L)	7.07 ± 0.67^{a}	6.81 ± 1.72^{a}	3.37 ± 1.15^{b}	6.41 ± 2.48^{a}	2.05 ± 0.24^{b}	4.14 ± 0.37^{ab}	1.99 ± 0.41^{b}	0.021	<0.001	0.021	0.293
TNF-α (ng/L)	90.4 ± 2.0^{d}	131.2 ± 7.6^{ab}	143.4 ± 10.3^{a}	113.7 ± 8.6^{bc}	147.8 ± 5.9^{a}	99.4 ± 5.62^{cd}	138.1 ± 9.4^{a}	<0.001	<0.001	<0.001	0.007
Hepatic TAG (mg/g)	0.62 ± 0.09^{e}	3.73 ± 0.24^{bc}	4.25 ± 0.62^{b}	2.44 ± 0.15^{d}	3.11 ± 0.22^{cd}	2.91 ± 0.39^{cd}	7.71 ± 0.92^{a}	<0.001	<0.001	<0.001	<0.001
Hepatic TC (mg/g)	0.73 ± 0.06^{b}	0.29 ± 0.08^{c}	1.17 ± 0.27^{a}	0.38 ± 0.07^{c}	0.81 ± 0.08^{b}	0.28 ± 0.16^{c}	1.25 ± 0.14^{a}	<0.001	0.063	<0.001	0.002

Abbreviations: ALT, alanine transaminase; AST, aspartate transaminase; TC, total cholesterol; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TAG, triglyceride; HOMA-IR, homeostasis model assessment of insulin resistance; TNF-α, tumor necrosis factor-α. Values were presented as means ± SDs. Different letters indicated significant difference between groups.

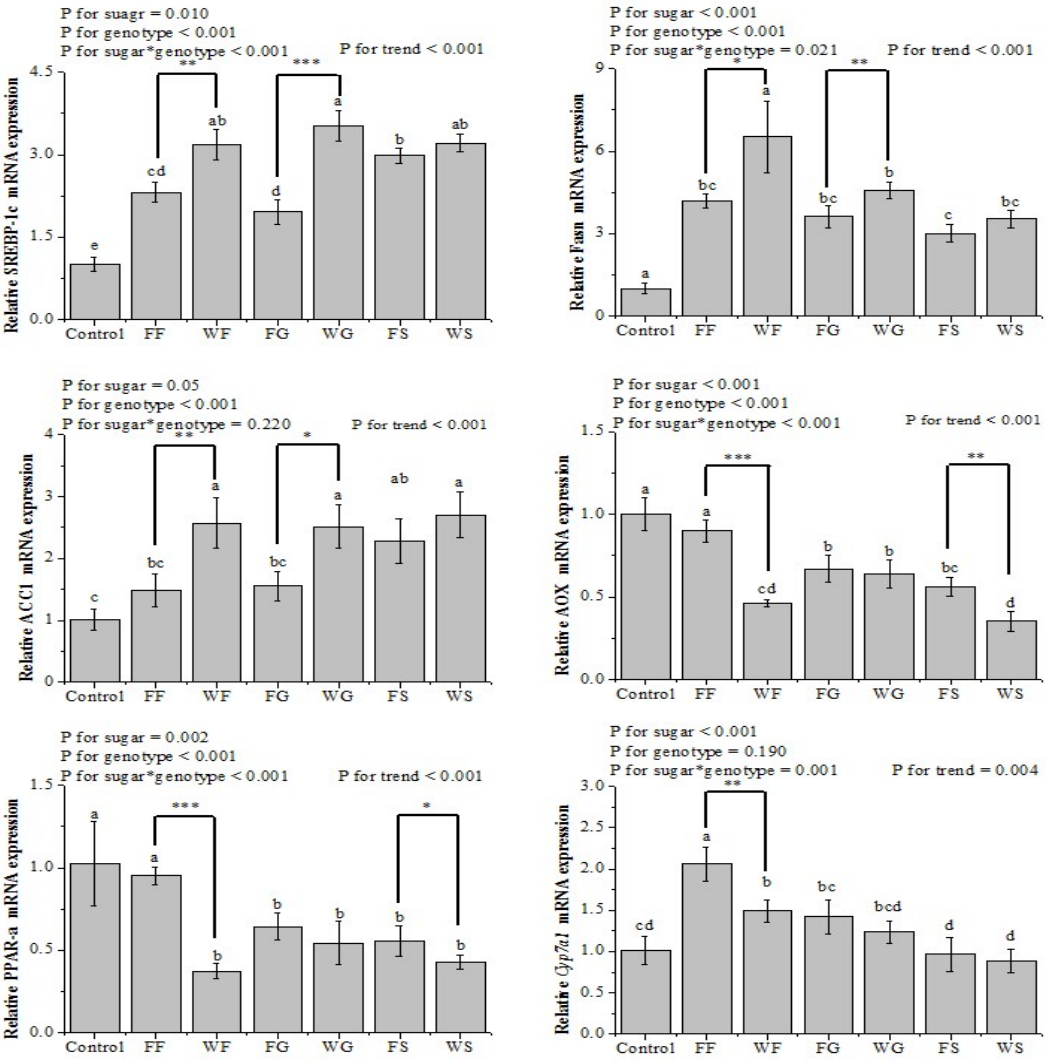
Supplementary Table 5. Liver phospholipid fatty acids composition between *fat-1* and wild-type mice exposed to the high-fat and high-sugar interventions

Fatty acid	Control	FF	WF	FG	WG	FS	WS	P value
C16:0	22.3 ± 1.4	22.5 ± 1.9	20.8 ± 0.8	21.1 ± 0.9	20.8 ± 0.6	22.1 ± 2.1	21.4 ± 0.5	0.0992
C16:1n-7	0.75 ± 0.12^{b}	1.12 ± 0.23^{ab}	1.35 ± 0.20^{a}	1.57 ± 0.38^{a}	1.30 ± 0.200^{a}	1.45 ± 0.07^{a}	1.45 ± 0.23^{a}	< 0.001
C17:0	0.24 ± 0.01^{a}	0.13 ± 0.02^{ab}	0.11 ± 0.02^{ab}	0.085 ± 0.020^{b}	0.12 ± 0.10^{ab}	0.11 ± 0.01^{ab}	0.12 ± 0.09^{ab}	0.0381
C17:1n-7	0.050 ± 0.007	0.074 ± 0.011	0.058 ± 0.015	0.080 ± 0.027	0.11 ± 0.12	0.069 ± 0.002	0.056 ± 0.019	0.5767
C18:0	18.3 ± 1.0	16.8 ± 0.8	17.4 ± 1.3	18.2 ± 3.1	18.8 ± 2.7	16.4 ± 2.1	18.0 ± 1.5	0.5315
C18:1n-9	7.5 ± 2.0^{b}	14.9 ± 2.19^{a}	15.2 ± 1.2^{a}	13.5 ± 2.8^{a}	13.7 ± 2.7^{a}	16.0 ± 0.3^{a}	14.7 ± 2.1^{a}	< 0.001
C18:2n-6	18.0 ± 3.2^{a}	14.5 ± 0.8^{ab}	10.6 ± 0.8^{c}	13.0 ± 2.0^{bc}	9.8 ± 0.8^{c}	13.3 ± 2.1^{bc}	11.2 ± 2.2^{bc}	< 0.001
C18:3n-6	0.165 ± 0.040^{a}	0.109 ± 0.031^{ab}	0.082 ± 0.030^{ab}	0.151 ± 0.065^{a}	0.055 ± 0.020^{b}	0.113 ± 0.060^{ab}	0.130 ± 0.070^{ab}	0.007
C18:3n-3	0.116 ± 0.039a	0.078 ± 0.015^{ab}	0.053 ± 0.003^{b}	0.046 ± 0.017^{b}	0.044 ± 0.0168^{b}	0.060 ± 0.023^{ab}	0.060 ± 0.022^{b}	0.0002
C20:0	0.071 ± 0.045^{ab}	0.105 ± 0.026^{ab}	0.112 ± 0.052^{ab}	0.069 ± 0.044^{ab}	0.031 ± 0.021^{b}	0.154 ± 0.075^{a}	0.130 ± 0.050^{a}	0.0043
C20:1n-9	0.300 ± 0.077^{ab}	0.282 ± 0.096^{ab}	0.444 ± 0.141^{a}	0.402 ± 0.163^{ab}	0.221 ± 0.116^{b}	0.302 ± 0.032^{ab}	0.375 ± 0.054^{ab}	0.0360
C20:2n-6	0.156 ± 0.062^{b}	0.465 ± 0.229^{a}	0.407 ± 0.120ab	0.443 ± 0.135^{a}	0.280 ± 0.047^{ab}	0.487 ± 0.020^{a}	0.376 ± 0.122^{ab}	0.0031
C20:3n-6	0.727 ± 0.414^{b}	2.44 ± 0.50^{a}	2.26 ± 0.49^{a}	2.22 ± 0.42^{a}	2.03 ± 0.67 ^{a}	1.96 ± 0.44^{ab}	1.68 ± 0.48^{ab}	0.0002
C20:4n-6	15.3 ± 3.75^{abc}	11.1 ± 1.03^{c}	18.4 ± 0.9^{ab}	13.8 ± 3.4^{bc}	19.5 ± 0.8^{a}	13.8 ± 4.1^{bc}	18.3 ± 1.2^{ab}	< 0.001
C20:5n-3	1.16 ± 0.46^{abc}	2.00 ± 0.43^{a}	1.25 ± 0.45^{bc}	1.85 ± 0.58^{ab}	0.57 ± 0.20^{c}	1.30 ± 0.50^{abc}	0.82 ± 0.22^{bc}	0.0016
C22:5n-3	0.306 ± 0.066	0.447 ± 0.037	0.220 ± 0.063	0.439 ± 0.128	0.300 ± 0.180	0.394 ± 0.210	0.261 ± 0.095	0.0259
C22:6n-3	14.6 ± 1.4^{a}	13.2 ± 1.1^{ab}	11.2 ± 0.7^{c}	13.0 ± 0.6^{abc}	12.2 ± 0.8^{bc}	12.1 ± 1.5^{bc}	11.0 ± 0.7^{c}	< 0.001

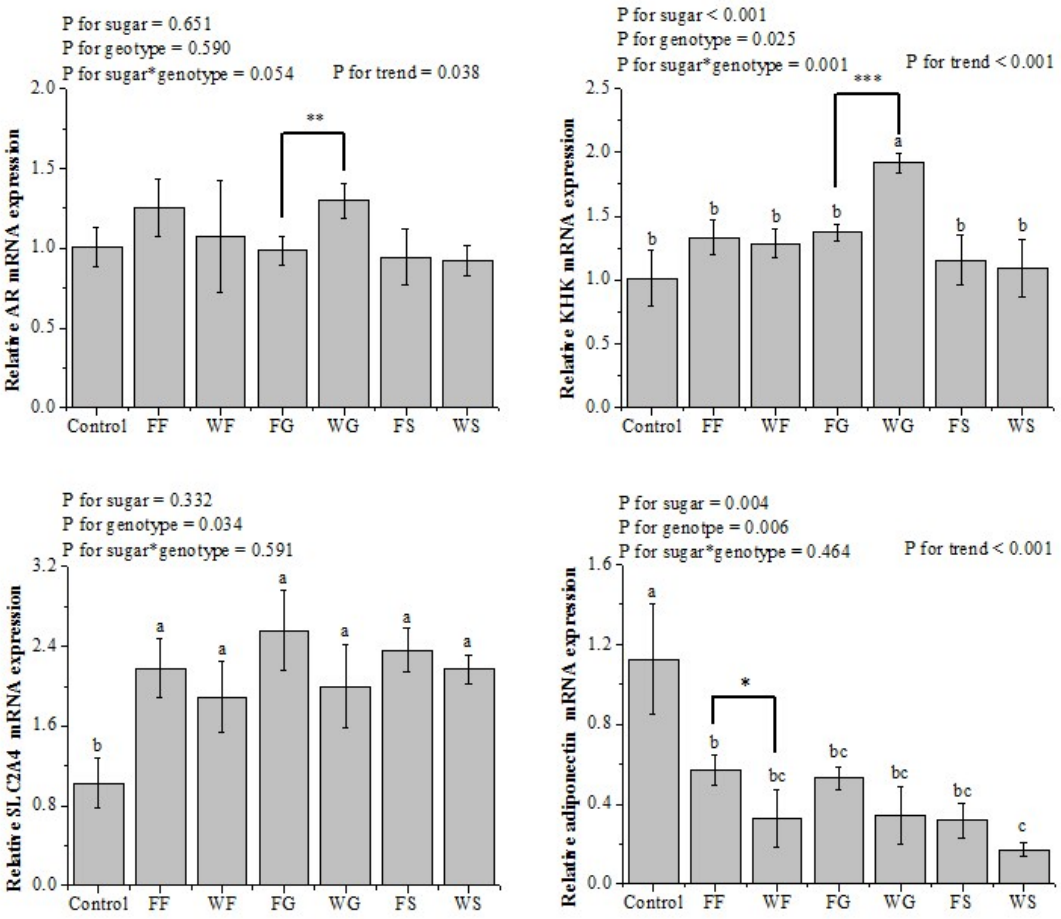
Values were presented as means ± SDs. Different letters indicated significant difference between groups.



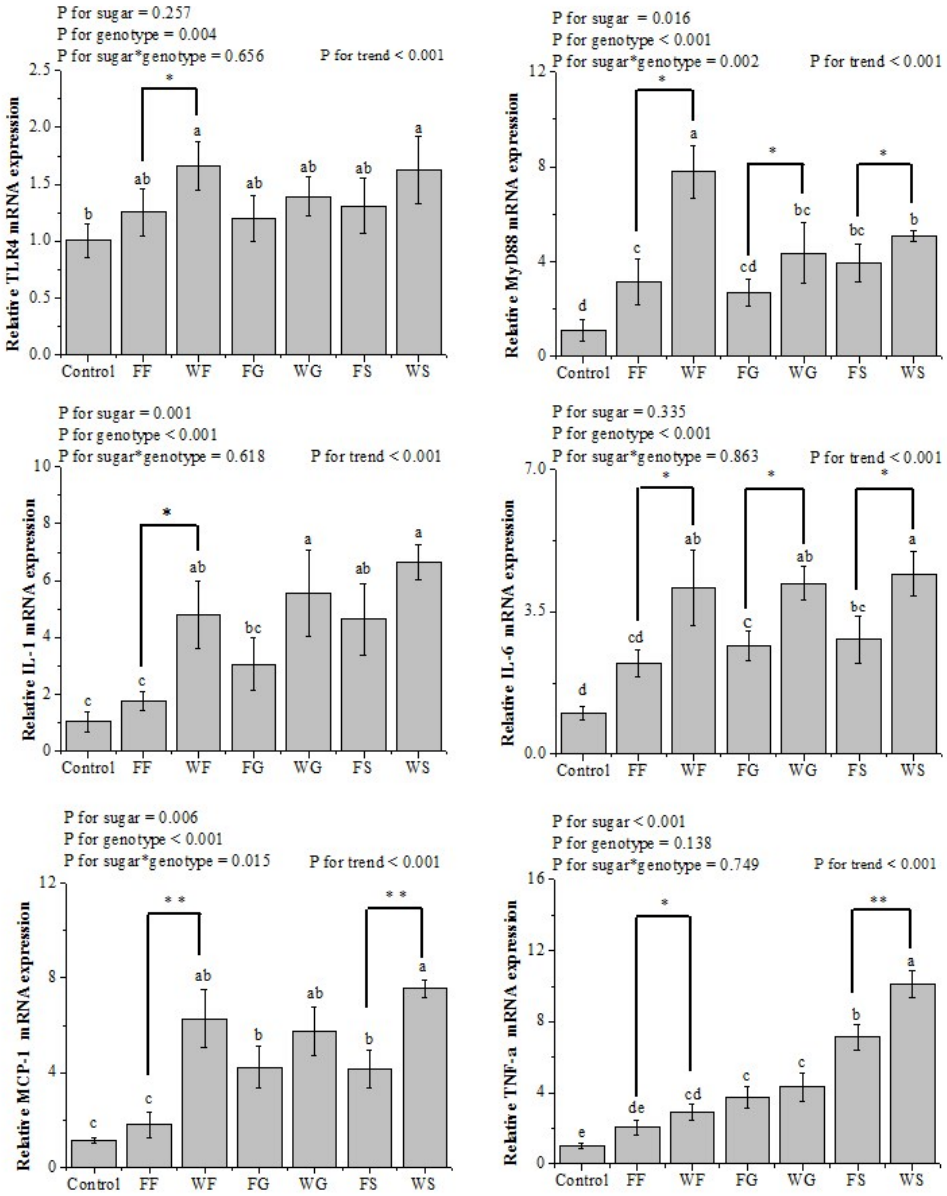
Supplementary Fig. 1. Weight gain for male *fat-1* and wild-type mice fed the high-fat and high-sugar diets. Abbreviations: Control, a low-fat diet accompanied by tap water group; FF, fat-1 mice given fructose solution accompanied by a high-fat diet group; WF, wild-type mice given fructose solution accompanied by a high-fat diet group; FG, fat-1 mice given glucose solution accompanied by a high-fat diet group; WG, wild-type mice given glucose solution accompanied by a high-fat diet group; FS, fat-1 mice given sucrose solution accompanied by a high-fat diet group; WS, wild-type mice given sucrose solution accompanied by a high-fat chow group.



Supplementary Fig. 2. The effects of the high-fat and high-sugar diets on relative mRNA expression levels of fatty acid synthesis and metabolism as determined by RT-PCR. Abbreviations: ACC1, aycl-CoA carboxylase 1; AOX, acyl-coenzyme A oxidase; *CYP7A1*, Cholesterol 7a-hydroxylase; Fasn, fatty acid synthase; PPAR-α, peroxisome proliferator-activated receptor alpha; SREBP-1c, sterol regulatory element binding protein-1c. Different letters indicated significant difference between groups. T-test was used to compare the difference between *fat-1* and wild-type mice exposed to the same intervention; * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$.



Supplementary Fig. 3. The effects of the high-fat and high-sugar diets on relative mRNA expression levels of glucose and fructose metabolism and adiponectin as determined by RT-PCR. Abbreviations: AR, aldose reductase; KHK, ketohexokinase; *SLC2A4*, solute carrier family 2 member 4. Different letters indicated significant difference between groups. T-test was used to compare the difference between *fat-1* and wild-type mice exposed to the same intervention; * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$.



Supplementary Fig. 4. The effects of the high-fat and high-sugar diets on relative mRNA expression levels of key molecules of inflammatory factors and TLR-4/NF-κB pathway as determined by RT-PCR. Abbreviations: IL-1β, interleukin-1β; IL-6, interleukin-6; MCP-1, monocyte chemoattractant protein-1; MyD88, myeloid differentiation primary response gene 88; TNF-α, tumor necrosis factor-α; TLR-4/NF-κB, toll-like receptor-4/nuclear factor-κB. Different letters indicated significant difference between groups. T-test was used to compare the difference between *fat-1* and wild-type mice exposed to the same intervention; * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$.