Supplementary Table 1. Formulations of the diets in Experiment 2.

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| --- | --- | --- | --- | --- |
| Ingredients | HCD | HLA | HMA | HHA |
| Casein (g/kg) | 320 | 320 | 320 | 320 |
| Gelatin (g/kg) | 80 | 80 | 80 | 80 |
| Soybean oil (g/kg) | 70 | 70 | 70 | 70 |
| Corn starch (g/kg) | 450 | 450 | 450 | 450 |
| Vitamin premix 1 (g/kg) | 10 | 10 | 10 | 10 |
| Mineral premix 2 (g/kg) | 10 | 10 | 10 | 10 |
| Ca(H2PO4)2 (g/kg) | 10 | 10 | 10 | 10 |
| Carboxymethylcellulose (g/kg) | 25 | 25 | 25 | 25 |
| Cellulose (g/kg) | 17.75 | 17.75 | 17.75 | 17.75 |
| Choline chloride (g/kg) | 5 | 5 | 5 | 5 |
| Dimethyl-β-propiothetin (g/kg) | 2 | 2 | 2 | 2 |
| Butylated hydroxytoluene (g/kg) | 0.25 | 0.25 | 0.25 | 0.25 |
| Sodium acetate (mg/kg) | 0 | 900 | 1800 | 3600 |
| Total quantity (g) | 1000 | 1000 | 1000 | 1000 |
| Proximate composition (%) |  |  |  |  |
| Dry matter (%) | 88.02 | 88.02 | 88.02 | 88.02 |
| Protein (%) | 35.09 | 35.09 | 35.09 | 35.09 |
| Fat (%) | 5.71 | 5.71 | 5.71 | 5.71 |

1. Mixed vitamin (mg or IU/kg): 500,000 I.U. Vitamin A, 50,000 I.U. Vitamin D3, 2500 mg Vitamin E, 1000 mg Vitamin K3, 5000 mg Vitamin B1, 5000 mg Vitamin B2, 5000 mg Vitamin B6, 5000 mg Vitamin B12, 25,000 mg Inositol, 10,000 mg Pantothenic acid, 100,000 mg Cholin, 25,000 mg Niacin, 1000 mg Folic acid, 250 mg Biotin, 10,000 mg Vitamin C.

2. Mixed minerals (g/kg): 147.4 g MgSO4•7H2O; 49.8 g NaCl; 10.9 g Fe (II) gluconate; 3.12 g MnSO4•H2O; ZnSO4·7H2O; 0.62 g CuSO4•5H2O; 0.16 g KI; 0.08 g CoCl2·6H2O; 0.06 g NH4 molybdate; 0.02 g NaSeO3.

Supplementary Table 2. Primers used for qRT-PCR expression analysis.

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| Gene  | Primer sequence (5′-3′) | Accession number |
| *acc**α* | F: TAGCTGAAGAGGAGGGTGCAAGAR: AACCTCTGGATTGGCTTGAACA | XM\_025910668.1 |
| *atgl* | F: GACACATGCTGCAAAGCACTR: ACCAGGACGTTTTCTCCGTC | XM\_003440346.5 |
| *cpt1* | F: TTTCCAGGCCTCCTTACCCAR: TTGTACTGCTCATTGTCCAGCAGA | XM\_013268638.3 |
| *dgat2* | F: GCTTGAATTCTGTCACCCTGAAGAR: ACCTGCTTGTAGGCGTCGTTCT | XM\_003458972.5 |
| *ef1α* | F: ATCAAGAAGATCGGCTACAACCCTR: ATCCCTTGAACCAGCTCATCTTGT | AB075952.1 |
| *fas* | F: TCATCCAGCAGTTCACTGGCATTR: TGATTAGGTCCACGGCCACA | XM\_003454056.5 |
| *fatp* | F: TGAGCTGGCTGATGCTATATTGGAR: GTTGAGCAGCAAGACAGGCTAACT | XM\_003442099.5 |
| *ffar2* | F: TCTGCCCAACTTCATGTGCTR: TCCTATGTAGCGAACCACGC | XM\_019364240.2 |
| *gck* | F: GACATGAGGACATTGACAAGGGAAR: CTTGATGGCGTCTCTGAGTAAACC | XM\_003451020.5 |
| *hsl* | F: GCGCTCTGAGTGTCTTGCTAR: ACTATGTGTACAGGCGGCAG | XM\_003447253.4 |
| *ir* | F: TTCAGCTGCCACCACGTR:TCATCAGCTCCATCACCACCA | [XM\_005476595.4](https://www.ncbi.nlm.nih.gov/entrez/viewer.fcgi?db=nucleotide&id=1434979108) |
| *mtor* | F: GGCACTCAACAAGAAGGCTATTCAR: ATCCAGCGTCTCATCATGAGAGAA | XM\_005454119.4 |
| *pfk* | F: GCAGACGGCCATGAATGAGAR: GGCTTGAGGAAAGCGAGACT | [XM\_003447353.5](https://www.ncbi.nlm.nih.gov/entrez/viewer.fcgi?db=nucleotide&id=1434972161) |
| *pk* | F: CAGCATAATCTGCACCATCGGTR: ATGAGAGAAGTTAAGACGGGCGA | XM\_005472621.4 |
| *pparα* | F: GTTCCTCAAGAGTCTCCGCCR: AAAGAGCTAGGTCGCTGTCG | XM\_019346353.2  |
| *pparγ* | F: TGGACTACACAAACATGCACAGCR:CACGGGACTATCTGAGTACTGTGGA | XM\_019358463.2 |
| *s6* | F: TGATGAGCGAAAGCTGCGTAR: TGATGCGCACTACATAGCCC | XM\_003454192.4 |
| *β-actin* | F: AGCCTTCCTTCCTTGGTATGGAATR: TGTTGGCGTACAGGTCCTTACG | XM\_003443127.5  |

*accα*: acetyl-CoA carboxylase alpha; *atgl*: adipose triglyceride lipase; *cpt1*: carnitine palmitoyltransferase 1; *dgat2*: diacylglycerol acyltransferase 2; *ef1α*: elongation factor 1 alpha; *fas*: fatty acid synthase; *fatp*: fatty acid transport protein; *ffar2*: free fatty acid receptor 2; *gck*: glucokinase; *hsl*: hormone-sensitive lipase; *ir*: insulin receptor; *mtor*: mechanistic target of rapamycin; *pfk*: phosphofructokinase; *pk*: pyruvate kinase; *pparα*: peroxisome proliferator-activated receptor alpha; *pparγ*: peroxisome proliferator-activated receptor gamma; *s6*: ribosomal protein S6; *β-actin*: beta-actin.

Supplementary Table 3. The antibodies information for western blotting assay.

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| Antibodies name | Source | Identifier |
| p-PI3K p85 (Tyr458)/p55 (Tyr199) | Cell Signaling Technology | Cat #4228 |
| PI3K | Cell Signaling Technology | Cat #4292 |
| p-AKT (Ser473) | Cell Signaling Technology | Cat #4060 |
| AKT | Cell Signaling Technology | Cat #4691 |
| p-ACC (Ser79) | Abcam | ab31931 |
| p-AMPK (Thr172) | Cell Signaling Technology | Cat #2531 |
| AMPK | Cell Signaling Technology | Cat #2532 |
| p-mTOR (Ser2448) | Cell Signaling Technology | Cat #2971 |
| mTOR | Cell Signaling Technology | Cat #2972 |
| p-S6 (Ser235/236) | Cell Signaling Technology | Cat #4856 |
| S6 | Cell Signaling Technology | Cat #2217 |
| p-p38 MAPK (Thr180/Tyr182) | Affinity | AF4001 |
| P38 MAPK | Affinity | AF6456 |
| GAPDH | Abways | AB0036 |