**Supplementary materials**

**Table S1** Ingredients and nutrient composition of the rations

|  |  |
| --- | --- |
| Item | Dietary energy level, MJ/kg DM1 |
| 8.21 | 9.33 | 10.45 | 11.57 |
| Ingredient, g/kg dry matter (DM) |
| Corn | 92.2 | 127.5 | 160.0 | 208.5 |
| Corn starch | 23.5 | 70.0 | 124.0 | 161.5 |
| Sucrose | 5.5 | 16.5 | 22.0 | 30.0 |
| Molasses | 5.5 | 16.5 | 21.5 | 30.0 |
| Wheat bran | 25.0 | 14.6 | 12.8 | 8.0 |
| Soybean meal | 12.0 | 16.5 | 15.4 | 13.2 |
| Cotton seed meal | 15.6 | 13.6 | 13.4 | 12.5 |
| Soybean oil | 0.60 | 4.20 | 10.0 | 15.0 |
| Calcium hydrophosphate | 6.3 | 6.6 | 6.0 | 5.3 |
| Calcium carbonate | 1.8 | 2.0 | 2.9 | 4.0 |
| Sodium chloride | 6.0 | 6.0 | 6.0 | 6.0 |
| Commercial premix2 | 6.0 | 6.0 | 6.0 | 6.0 |
| Highland barley straw | 800 | 700 | 600 | 500 |
| Chemical composition3, g/kg DM |
| DE, MJ/kg | 8.21 | 9.33 | 10.45 | 11.57 |
| CP | 69.7 | 69.6 | 69.1 | 70.2 |
| NDF | 684.1 | 601.5 | 519.7 | 443.7 |
| ADF | 370.2 | 324.9 | 280.9 | 237.6 |
| Ca | 5.21 | 5.13 | 5.20 | 4.92 |
| P | 2.71 | 2.71 | 2.62 | 2.54 |

1 Digestible energy on a dry matter basis.

2 The premix provided the following per kg of diets: VA 1700 IU; VD 190 IU; VE 18 IU; Co 0.30mg; Cu 17 mg; I 1.5mg; Fe 70 mg; Mn 38 mg; Se 0.28 mg; Zn 40 mg.

3 The DE was calculated according to the Feeding Standard of Meat-producing Sheep and Goats of China, NY/T 816-2004 (Ministry of Agriculture, MOA, PRC, 2004). Others were the measured values. DM, dry matter; DE, digestible energy; CP, crude protein; NDF, neutral detergent fibre; ADF, acid detergent fibre.

**Table S2**. Sequences of oligonucleotide primers used for real-time quantitative reverse transcription PCR (Real-Time qRT-PCR)

|  |  |  |  |
| --- | --- | --- | --- |
| Target gene1 | Gene bank ID | Primer sequences2（5'→3'） | *Tm*3(ºC) |
| INSR | AY157728 | F: CGTGGCCTGTCGCAACTTCTACR: GGACGCACTTGTTGTTGTGAATGAC | 60 |
| GLUT4 | AY949177 | F: GTCAACACAGTCTTCACCTTAGTCTCGR: GCAGAAGCAGAGCCACAGTC | 58 |
| FABP4 | EU301804 | F: ACTTAGATGAAGGTGCTCTGGTACAAGR: CTCTGGTAGCAGTGACACCGTTC | 57 |
| LPL | NM\_001009394 | F: CGCCGCCGACAGGATTACAAGR: CAGTTAGCCACAGATTCCGTCACTC | 58 |
| PPARγ | AY137204 | F: TGCCGATTCCAGAAGTGCCTTGR: GTTGGTCGATGTCGCTGGAGATC | 57 |
| mTOR | NM\_001145455 | F: GGCAGCAACAGCGAGAGTGAGR: GTGACAAGGAGATGGAACGGAAGAAG | 58 |
| AMPKα | EU131097 | F: ATGATGAGGTGGTGGAGCAGAGGR: CCAGGCGAGGTGAGACAGAGG | 58 |
| β-actin | U39357.1 | F: AGCCTTCCTTCCTGGGCATGGAR: GGACAGCACCGTGTTGGCGTAGA | 58 |

1 INSR, insulin receptor; GLUT4, glucose transporter 4; FABP4, fatty acid binding protein 4; LPL, lipoprotein lipase; PPARγ, peroxisome proliferator-activated receptor-gamma; mTOR, the mammalian target of rapamycin; AMPKα, adenosine monophosphate-activated protein kinase-alpha.

2 F, forward; R, reverse.

3 *Tm*, optimal PCR annealing temperature.

**Table S3**. The nutrient intake of Tibetan (T) and Small-tailed Han (H) sheep offered diets of different energy levels1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Items2 | Breed | Dietary energy level, MJ/kg3 | SEM | *P*-value4 |
| 8.21 | 9.33 | 10.45 | 11.57 | Breed | E-L | E-Q | E-C |
| DM, g/d | T | 725 | 732 | 739 | 756 | 41.1 | 0.834 | 0.539 | 0.902 | 0.938 |
|  | H | 721 | 744 | 748 | 751 |  |  | 0.957x | 0.911x | 0.976x |
| DE, MJ BW-0.75 d-1 | T | 0.412 | 0.474 | 0.514 | 0.544 | 0.0129 | 0.275 | <0.001 | 0.127 | 0.938 |
|  | H | 0.406 | 0.463 | 0.509 | 0.532 |  |  | 0.873x | 0.772x | 0.859x |
| CP, g/d | T | 54.3 | 55.5 | 53.8 | 55.2 | 2.26 | 0.485 | 0.653 | 0.592 | 0.412 |
|  | H | 53.3 | 53.3 | 52.2 | 55.5 |  |  | 0.739x | 0.621x | 0.966x |
| NDF, g/d | T | 510 | 471 | 392 | 351 | 28.1 | 0.400 | <0.001 | 0.580 | 0.561 |
|  | H | 495 | 429 | 374 | 356 |  |  | 0.642x | 0.538x | 0.764x |
| ADF, g/d | T | 275 | 254 | 211 | 187 | 8.0 | 0.551 | <0.001 | 0.866 | 0.393 |
|  | H | 280 | 251 | 220 | 190 |  |  | 0.891x | 0.948x | 0.451x |

1 Values are means ± pooled SEM.

2 DM, dry matter; DE, digestible energy; CP, crude protein; NDF, neutral detergent fibre; ADF, acid detergent fibre.

3 Digestible energy on a dry matter basis

4 E-L = Linear effect of dietary energy level; E-Q = Quadratic effect of dietary energy level; E-C = Cubic effect of dietary energy level.

x *P*-value for the interaction of dietary energy level with breeds.

**Figure S1**.



Figure S1. The body weight change of Tibetan and Small-tailed Han sheep offered different energy level diets during the 42 d experiment period. The dietary energy levels are digestible energy on a dry matter basis. Breed *P* < 0.001, Linear effect of dietary energy level *P* < 0.001, Quadratic effect of dietary energy level *P* = 0.003, Cubic effect of dietary energy level *P* = 0.582, *P*-value for interaction of dietary energy level effect with species of linear, quadratic and cubic were 0.003, 0.208 and 0.527, respectively. \*\* *P* < 0.01, \*\*\* *P* < 0.001