

## Supplemental Materials

**Dual luciferase reporter assay.** The 1700020I14Rik cDNA was amplified with primers 5'-GCGCTCGAGCTTTCGCGCCTCCGCCCT-3' (forward) and 5'-AATGCGGCCGCGGGTTGAAGGAAGCTTATTACTT-3' (reverse) and then cloned into a pmiR-RB-REPORT™ dual-luciferase vector (Guangzhou RuiBio Corp., Guangzhou, China) with restriction endonucleases *Xho I* and *Not I* to generate a pmiR-RB-REPORT™-1700020I14Rik wild-type, named 1700020I14Rik-Wt. The mutant construct without predicting binding sequences of miR-34a-5p was generated using the QuikChange™ Site-Directed Mutagenesis kit (Stratagene) and also cloned into pmiR-RB-REPORT™ vector, named 1700020I14Rik-Mut. miR-34a-5p-inhibitor oligo acquired by annealed, was cloned in GP-miRGLO dual-luciferase vector (GenePharma Co., Shanghai, China) to generate a GP-miRGLO-miR-34a-5p-inhibitor. All the recombinant plasmids were confirmed by restriction enzyme digestion and DNA sequencing. HEK 293 cells seeded in 96-well plates at a density of  $4 \times 10^3$  cell per well, were transfected at a density of 80%-85% with 1700020I14Rik-Wt, 1700020I14Rik-Mut, miR-34a mimics or non-target control with lipofectamine 2000. 293T cells seeded in 12-well plates at a density of  $5 \times 10^5$  cell per well, were transfected at a density of 80%-90% with GP-miRGLO-miR-34a-5p-inhibitor, miR-34a mimics or non-target control with lipofectamine 2000 for positive control used. After 48 hours, cells were conducted with Dual-Luciferase® Reporter Assay System (Promega, WI, USA). Firefly luciferase activity was normalized to Renilla luciferase activity.

Annealing method was conducted to generate a pair of most stable Sirt1 oligo (sense strand: 5'-CTAGAGCCTGCATAGATCTTCACCACAAATACTGCCAAGATGTGAATATGCAAAGCC TTTCC-3', antisense strand: 5'-TCGAGGAAAGGCTTTGCATATTCACATCTTGGCAGTATTTGTGGTGAAGATCTATGCA GGCTCTAGAGCT-3'), a pair of Sirt1 mutant oligo (sense strand: 5'-CTAGAGCCTGCATAGATCTTCTGGTCAAATTGACGGAAGATGTGAATATGCAAAGCC TTTCC-3', antisense strand: 5'-TCGAGGAAAGGCTTTGCATATTCACATCTTCCGTCAATTTGACCAGAAGATCTATGCA GGCTCTAGAGCT-3') and miR-34a-5p-inhibitor sponge (sense strand: 5'-

CACAACCAGCTAAGACACTGCCAACCGGTACAACCAGCTAAGACACTGCCAC-3',  
antisense strand: 5'-  
TCGAGTGGCAGTGTCTTAGCTGGTTGTACCGGTTGGCAGTGTCTTAGCTGGTTGTGAG  
CT -3'). All the sequence fragments were cloned in GP-miRGLO dual-luciferase vector  
(GenePharma Co., Shanghai, China) respectively with restriction endonucleases *Xho I* and *Sca I* to  
generate a GP-miRGLO-Sirt1 wild-type (Sirt1-Wt), a GP-miRGLO-Sirt1 mutant (Sirt1-Mut) and  
a GP-miRGLO-miR-34a-5p-inhibitor (as positive control, PC). All the recombinant plasmids were  
confirmed by restriction enzyme digestion and DNA sequencing. 293T cells seeded in 12-well  
plates at a density of  $5 \times 10^5$  cell per well, were transfected at a density of 80%-90% with Sirt1-Wt,  
Sirt1-Mut, GP-miRGLO-miR-34a-5p-inhibitor, miR-34a mimics or non-target control with  
lipofectamine 2000. After 48 hours, cells were conducted with Dual-Luciferase<sup>®</sup> Reporter Assay  
System (Promega, WI, USA). Firefly luciferase activity was normalized to Renilla luciferase  
activity.

**ELISA Analysis.** The mouse MCs were seeded in 12-well plates at a density of  $10^5$  cell per well with  
DMEM medium containing 10% FBS and transfected with corresponding plasmids at a density of 80%.  
After 48h of treatment, cell lysis buffer Cell lysis buffer from each treatment group was collected and  
subjected to TGF- $\beta$ 1 measurement using a mouse enzyme-linked immunosorbent assay (ELISA) Kit  
(Boster Bio-engineering Co, Ltd, Wuhan, China), according to the manufacturer's instruction. The  
absorbance was measured at 450 nm using a microplate reader (iMark; Bio-Rad). Each experiment was  
repeated in triplicate.

**RNA immunoprecipitation (RIP).** RIP assays were performed using the EZMagna RIP kit (Millipore,  
Billerica, MA, USA) and the Ago2 antibody (ab32381, Abcam, Cambridge, MA, USA) following the  
manufacturer's protocol. Generally, MCs after treatment were collected at 95% confluency and were  
lysed using RIP lysis buffer. 100  $\mu$ l cell lysis buffer was incubated with 50  $\mu$ l RIP buffer containing  
magnetic beads conjugated with 5  $\mu$ g mouse anti-Ago2 antibody or negative control normal mouse IgG.  
All samples were treated with Protein K to digest the protein and the immunoprecipitated RNA was  
isolated with hopper magnet. QRT-PCR was further used for analysis of 1700020I14Rik and  
miR-34a-5p in purified RNA.

**Supplementary Fig 1.** The effect of 1700020I14Rik on the production and activation of TGF- $\beta$ 1 determined by ELISA assay. The results found that 1700020I14Rik could evaluate TGF- $\beta$  production and activation level. Data were represented as the mean  $\pm$  SD of three independent experiments. Significance was calculated using Student's *t*-test: \* $p$  < 0.05; \*\*\* $p$  < 0.001.

**Supplementary Fig 2.** Characteristics of qRT-PCR samples from db/db mice (n = 5) and db/m mice (n = 5). (a) Body weight, (b) Blood glucose and (c) Urinary microalbumin. Statistical difference was analyzed by Wilcoxon signed-rank test (n = 10, \*\* $p$  < 0.01). (d) Representative morphological photographs of HE-stained kidney specimens from db/m and db/db DN mice. Scale bar, 100  $\mu$ m.

**Supplementary Fig 3.** The effect of 1700020I14Rik on the expressions of P4ha1, P4ha2 and Plod2 was tested by real-time PCR. The results suggested that over-expression of 1700020I14Rik could decrease the expression of P4ha1, P4ha2 and Plod2. However, knockdown the expression of 1700020I14rik increased the expression of P4ha1, P4ha2 and Plod2. Data were represented as the mean  $\pm$  SD of three independent experiments. \*\* $p$  < 0.01, \*\*\* $p$  < 0.001.

**Supplementary Fig 4.** The expressions of 1700020I14Rik and miR-34-5p were tested when Sirt1 was silenced by real-time PCR. The results suggested that the expression of 1700020I14Rik was decreased and the expression of miR-34a-5p was increased in the cells under high glucose, while the expressions of 1700020I14Rik and miR-34a-5p were reversed when Sirt1 was silenced. Data were represented as the mean  $\pm$  SD of three independent experiments. \*\* $p$  < 0.01, \*\*\* $p$  < 0.001.

**Supplementary Table 1. Differently expressed lincRNAs from RNA-seq.**

| gene_name     | gene_id            | location                  | Average FPKM |            | db/db mice vs. db/m mice |                      |            | biotype           |
|---------------|--------------------|---------------------------|--------------|------------|--------------------------|----------------------|------------|-------------------|
|               |                    |                           | db/m mice    | db/db mice | <sup>b</sup> log2FC      | <sup>c</sup> p-value | q-value    |                   |
| Gm20204       | ENSMUSG00000098148 | chr8:117210777-117215997  | 1.27708      | 0.810469   | -0.656024                | 0.0026               | 0.0366798  | lincRNA           |
| Gm5101        | ENSMUSG00000097814 | chr1:96872220-96881230    | 1.5718       | 0.960778   | -0.710147                | 0.001                | 0.0172698  | antisense lincRNA |
| Snhg18        | ENSMUSG00000096956 | chr15:32240568-32244662   | 11.5791      | 6.9539     | -0.735627                | 0.00015              | 0.00371321 | lincRNA           |
| 4930556M19Rik | ENSMUSG00000096971 | chr15:10714835-10790123   | 2.09827      | 1.20338    | -0.802107                | 1.00E-04             | 0.00261518 | lincRNA           |
| AB041803      | ENSMUSG00000044471 | chr6:31165522-31218433    | 4.9634       | 2.63106    | -0.915684                | 5.00E-05             | 0.00143789 | lincRNA           |
| 9130020K20Rik | ENSMUSG00000086568 | chr4:136347285-136350334  | 0.890854     | 0.462217   | -0.94662                 | 8.00E-04             | 0.014485   | lincRNA           |
| RP23-341H6.1  | ENSMUSG00000098747 | chr9:83240480-83254540    | 11.4813      | 5.4326     | -1.07957                 | 0.00085              | 0.0152559  | lincRNA           |
| D630029K05Rik | ENSMUSG00000031294 | chr10:116956823-116972609 | 37.7919      | 17.2977    | -1.12749                 | 5.00E-05             | 0.00143789 | lincRNA           |
| 2610037D02Rik | ENSMUSG00000097536 | chr15:96134818-96284495   | 3.38625      | 1.47401    | -1.19994                 | 5.00E-05             | 0.00143789 | lincRNA           |
| Gm16685       | ENSMUSG00000097804 | chr3:7572076-7690001      | 3.91434      | 1.69891    | -1.20415                 | 5.00E-05             | 0.00143789 | antisense lincRNA |
| AV099323      | ENSMUSG00000087377 | chr2:132253356-132261333  | 1.95121      | 0.717632   | -1.44305                 | 0.00035              | 0.00745285 | antisense lincRNA |
| Gm15348       | ENSMUSG00000074469 | chr8:12706943-12719127    | 1.40459      | 0.486305   | -1.53021                 | 5.00E-05             | 0.00143789 | lincRNA           |
| Gm9951        | ENSMUSG00000054618 | chr8:34049261-34057046    | 0.760201     | 0.232949   | -1.70637                 | 0.00305              | 0.0412082  | lincRNA           |
| C330002G04Rik | ENSMUSG00000097930 | chr19:23037389-23075853   | 1.71647      | 0.478632   | -1.84246                 | 5.00E-05             | 0.00143789 | lincRNA           |
| Snhg6         | ENSMUSG00000098234 | chr1:9908637-9944118      | 11.3401      | 2.53366    | -2.16213                 | 0.00015              | 0.00371321 | lincRNA           |
| Gm15354       | ENSMUSG00000086156 | chr8:65617899-66471637    | 1.90016      | 0.328395   | -2.53261                 | 0.00175              | 0.0267907  | antisense lincRNA |
| 2610035D17Rik | ENSMUSG00000087259 | chr11:113043894-113201838 | 4.75221      | 0.808922   | -2.55453                 | 0.00015              | 0.00371321 | lincRNA           |
| 4930533I22Rik | ENSMUSG00000093535 | chr6:57476696-57497671    | 2.38779      | 0.397161   | -2.58788                 | 5.00E-05             | 0.00143789 | antisense lincRNA |
| C920006O11Rik | ENSMUSG00000097574 | chr9:78175913-78178879    | 1.90179      | 0.0972766  | -4.28912                 | 0.00065              | 0.0122617  | lincRNA           |
| Gm15611       | ENSMUSG00000084923 | chr5:8998401-8999669      | 1.27588      | 0          | -                        | 5.00E-05             | 0.00143789 | lincRNA           |
| C030037D09Rik | ENSMUSG00000087574 | chr11:88718644-88728893   | 0.366867     | 1.71025    | 2.22088                  | 5.00E-05             | 0.00143789 | lincRNA           |
| Gm26652       | ENSMUSG00000097497 | chrX:19232962-19237856    | 0.847693     | 3.22343    | 1.92698                  | 0.00385              | 0.0490365  | lincRNA           |
| 1600020E01Rik | ENSMUSG00000097048 | chr6:86526270-86564442    | 1.49555      | 5.04878    | 1.75526                  | 5.00E-05             | 0.00143789 | lincRNA           |

|               |                    |                           |          |          |           |          |             |                      |
|---------------|--------------------|---------------------------|----------|----------|-----------|----------|-------------|----------------------|
| Gm2115        | ENSMUSG00000097789 | chr7:84528974-84578337    | 0.563199 | 1.8337   | 1.70304   | 5.00E-05 | 0.00143789  | lincRNA              |
| Gm4419        | ENSMUSG00000097055 | chr12:21417910-21419803   | 0.507754 | 1.45123  | 1.51507   | 5.00E-05 | 0.00143789  | lincRNA              |
| Gm12962       | ENSMUSG00000087171 | chr4:131647047-131677845  | 1.30304  | 3.53361  | 1.43927   | 6.00E-04 | 0.0114831   | lincRNA              |
| Gm13855       | ENSMUSG00000087613 | chr6:34179231-34186392    | 9.30575  | 24.0819  | 1.37175   | 5.00E-05 | 0.00143789  | antisense lincRNA    |
| Gm15706       | ENSMUSG00000086013 | chr6:145250528-145251849  | 1.28697  | 3.30528  | 1.3608    | 5.00E-05 | 0.00143789  | lincRNA              |
| D630024D03Rik | ENSMUSG00000085772 | chr11:31790112-31824524   | 3.3665   | 7.77048  | 1.20675   | 5.00E-04 | 0.00996939  | lincRNA              |
| AW822252      | ENSMUSG00000085998 | chrX:53706027-53716578    | 0.873162 | 1.89283  | 1.11623   | 0.0027   | 0.0377186   | lincRNA              |
| 1700007L15Rik | ENSMUSG00000097318 | chr16:33379854-33380727   | 1.609    | 3.40984  | 1.08354   | 0.00105  | 0.0179263   | lincRNA              |
| 6030443J06Rik | ENSMUSG00000097207 | chr5:22550436-22807850    | 0.440961 | 0.832906 | 0.917505  | 0.0012   | 0.019969    | lincRNA              |
| 2810001G20Rik | ENSMUSG00000087497 | chr11:64079483-64083259   | 3.88733  | 7.2219   | 0.893598  | 2.00E-04 | 0.00475763  | antisense lincRNA    |
| Gm15343       | ENSMUSG00000085468 | chr10:76562271-76570532   | 6.20418  | 11.4231  | 0.880639  | 5.00E-05 | 0.00143789  | antisense lincRNA    |
| 1500026H17Rik | ENSMUSG00000097383 | chr10:89686370-89700866   | 1.41735  | 2.56977  | 0.858443  | 1.00E-04 | 0.00261518  | lincRNA              |
| Fam169b       | ENSMUSG00000074071 | chr7:68266338-68363089    | 2.16081  | 3.67712  | 0.767003  | 4.00E-04 | 0.00830783  | lincRNA              |
| Fam120aos     | ENSMUSG00000097059 | chr13:48968286-48972031   | 11.2115  | 16.3793  | 0.546893  | 0.00145  | 0.0232134   | lincRNA              |
| 1700020I14Rik | ENSMUSG00000085438 | chr2:119594296-119607502  | 16.1698  | 11.2289  | -0.526083 | 0.00145  | 0.0232134   | lincRNA              |
| 2310009A05Rik | ENSMUSG00000098332 | chr9:73039717-73042775    | 43.9643  | 24.8009  | -0.82594  | 5.00E-05 | 0.000579745 | antisense lincRNA    |
| 2610507I01Rik | ENSMUSG00000085882 | chr11:59197792-59202431   | 5.35443  | 0.238232 | -4.4903   | 5.00E-05 | 0.000579745 | processed transcript |
| 2700038G22Rik | ENSMUSG00000097180 | chr5:23850596-23855033    | 0.267309 | 0.895358 | 1.74396   | 0.00435  | 0.0224804   | lincRNA              |
| 2810001G20Rik | ENSMUSG00000087497 | chr11:64079483-64083259   | 4.62402  | 8.58899  | 0.893341  | 0.00015  | 0.00147348  | antisense lincRNA    |
| 2810002D19Rik | ENSMUSG00000045464 | chr2:94406706-94411682    | 1.7149   | 2.56812  | 0.582589  | 0.02655  | 0.0903879   | processed transcript |
| 2810008D09Rik | 76972              | chr11:117076782-117078955 | 8.60657  | 12.0774  | 0.488803  | 0.0396   | 0.121904    | lincRNA              |
| 2810408I11Rik | ENSMUSG00000087213 | chr1:64679868-64690659    | 2.36703  | 3.77629  | 0.673893  | 0.0349   | 0.110949    | antisense lincRNA    |
| 3000002C10Rik | ENSMUSG00000070282 | chr9:109830152-109831431  | 0.995344 | 0.483584 | -1.04143  | 0.0232   | 0.0817409   | pseudogene           |
| 3110045C21Rik | ENSMUSG00000097503 | chr1:169969408-170088944  | 8.73402  | 4.57137  | -0.934019 | 0.03045  | 0.100552    | antisense lincRNA    |
| 4921504A21Rik | ENSMUSG00000097626 | chr5:19202367-19226555    | 1.34522  | 0.883659 | -0.606276 | 0.03655  | 0.114753    | antisense lincRNA    |
| 5530601H04Rik | ENSMUSG00000087174 | chrX:105040853-105070124  | 1.5729   | 1.01884  | -0.62649  | 0.00845  | 0.0378529   | processed transcript |

|               |                    |                           |          |           |           |          |             |                      |
|---------------|--------------------|---------------------------|----------|-----------|-----------|----------|-------------|----------------------|
| 5930430L01Rik | ENSMUSG00000106951 | chr5:148990055-148995215  | 2.07893  | 1.29259   | -0.685575 | 0.00185  | 0.011279    | lincRNA              |
| A330035P11Rik | ENSMUSG00000085615 | chr14:122097938-122106974 | 1.09838  | 0.655455  | -0.744808 | 0.01075  | 0.0456911   | processed transcript |
| A930005H10Rik | ENSMUSG00000054426 | chr3:115881577-115888130  | 7.41662  | 12.0386   | 0.698837  | 0.00255  | 0.0147033   | antisense lincRNA    |
| AA543186      | ENSMUSG00000097345 | chr2:25327449-25332571    | 0.527142 | 0.908351  | 0.785057  | 0.04445  | 0.132933    | lincRNA              |
| AI506816      | ENSMUSG00000105987 | chr5:23692260-23712667    | 0.251955 | 1.92944   | 2.93694   | 0.02565  | 0.0882092   | processed transcript |
| B330016D10Rik | ENSMUSG00000048406 | chr4:141546161-141548313  | 1.92736  | 3.3823    | 0.811377  | 0.00035  | 0.00294773  | pseudogene           |
| BC039771      | ENSMUSG00000087594 | chr2:145701194-145753672  | 0.618325 | 0.266728  | -1.21299  | 0.0262   | 0.0895789   | processed transcript |
| C330006A16Rik | ENSMUSG00000087679 | chr2:26136806-26140506    | 23.1832  | 31.5343   | 0.443843  | 0.0054   | 0.0266045   | lincRNA              |
| D330023K18Rik | ENSMUSG00000087269 | chr2:31150247-31152291    | 3.12338  | 8.73258   | 1.4833    | 0.00025  | 0.00227238  | processed transcript |
| E130307A14Rik | ENSMUSG00000087177 | chr10:39612565-39732007   | 1.25916  | 0.192889  | -2.70662  | 0.00855  | 0.0381935   | antisense lincRNA    |
| Gm10052       | ENSMUSG00000058922 | chr9:123688847-123690275  | 7.23171  | 4.348     | -0.733984 | 0.00035  | 0.00294773  | pseudogene           |
| Gm12669       | ENSMUSG00000100863 | chr4:91805549-91806555    | 94.5234  | 128.114   | 0.43868   | 0.00555  | 0.0271839   | pseudogene           |
| Gm13483       | ENSMUSG00000085862 | chr2:50296809-50433967    | 2.22821  | 1.10878   | -1.00691  | 0.01385  | 0.0556058   | processed transcript |
| Gm15455       | ENSMUSG00000081402 | chr1:33835898-33838914    | 1.21857  | 1.76485   | 0.534352  | 0.0227   | 0.0805309   | pseudogene           |
| Gm15772       | ENSMUSG00000062353 | chr5:3236389-3236928      | 187.155  | 297.465   | 0.66849   | 5.00E-05 | 0.000579745 | pseudogene           |
| Gm1943        | 384864             | chr8:109339786-109340908  | 1.21044  | 2.21209   | 0.869881  | 0.00965  | 0.04207     | pseudogene           |
| Gm1966        | ENSMUSG00000073902 | chr7:106595548-106644645  | 1.15791  | 0.484274  | -1.25762  | 5.00E-05 | 0.000579745 | pseudogene           |
| Gm1976        | ENSMUSG00000066057 | chr17:94750099-94834799   | 0.70401  | 0.35611   | -0.983273 | 0.02775  | 0.0936335   | lincRNA              |
| Gm3219        | 100041231          | chr14:34345054-34345686   | 14.8814  | 28.9356   | 0.959339  | 5.00E-05 | 0.000579745 | pseudogene           |
| Gm3716        | ENSMUSG00000105402 | chr5:64593862-64610699    | 4.15758  | 5.58791   | 0.426564  | 0.0215   | 0.0771146   | lincRNA              |
| Gm4956        | ENSMUSG00000025936 | chr1:21275326-21298312    | 6.81471  | 11.1787   | 0.714024  | 0.0004   | 0.00328891  | pseudogene           |
| Gm5176        | 382421             | chr10:111500787-111501345 | 2.13233  | 0.949424  | -1.16731  | 0.0281   | 0.0944546   | pseudogene           |
| Gm6300        | ENSMUSG00000104375 | chr3:14363116-14377566    | 11.6027  | 0.0173284 | -9.38711  | 0.0478   | 0.14019     | pseudogene           |
| Gm6548        | ENSMUSG00000091549 | chr17:78850503-78852544   | 13.3029  | 17.756    | 0.416562  | 0.01605  | 0.0623654   | pseudogene           |
| Lhx1os        | ENSMUSG00000087211 | chr11:84525659-84535831   | 6.97024  | 2.96946   | -1.23101  | 0.00035  | 0.00294773  | lincRNA              |
| Gm33354       | ENSMUSG00000104194 | chr1:168119363-168432258  | 7.76237  | 1.84097   | -2.07603  | 0.02015  | 0.0736309   | TEC                  |

|               |                    |                          |          |            |           |          |             |                   |
|---------------|--------------------|--------------------------|----------|------------|-----------|----------|-------------|-------------------|
| Gm38197       | ENSMUSG00000102460 | chr3:30124494-30126616   | 2.20294  | 1.01046    | -1.12442  | 5.00E-05 | 0.000579745 | TEC               |
| 9230112E08Rik | ENSMUSG00000070461 | chr2:180719119-180721976 | 9.30088  | 6.84957    | -0.441353 | 0.0123   | 0.0507109   | Sense overlapping |
| Gm15459       | ENSMUSG00000100801 | chr5:5781529-5783636     | 50.3944  | 86.4201    | 0.778104  | 0.0402   | 0.123442    | pseudogene        |
| Nlrp5-ps      | ENSMUSG00000041596 | chr7:14530653-14623066   | 2.13547  | 3.34631    | 0.648016  | 0.00665  | 0.0313764   | pseudogene        |
| Cyp2j15-ps    | ENSMUSG00000084286 | chr4:96243453-96258269   | 1.93227  | 0.515422   | -1.90647  | 5.00E-05 | 0.000579745 | pseudogene        |
| Mir99ahg      | ENSMUSG00000090386 | chr16:77236561-77691644  | 3.30948  | 1.59069    | -1.05695  | 0.04895  | 0.143011    | TEC               |
| 4833413G10Rik | ENSMUSG00000104950 | chr5:3571659-3637101     | 7.08017  | 3.9065     | -0.857907 | 0.0315   | 0.102974    | antisense lincRNA |
| 1700056N10Rik | ENSMUSG00000084792 | chr16:17047612-17049204  | 1.65269  | 0.96332    | -0.778728 | 0.03485  | 0.110879    | lincRNA           |
| Gm15638       | ENSMUSG00000085826 | chr16:45945718-46010413  | 7.53584  | 3.87033    | -0.96131  | 0.00185  | 0.011279    | antisense lincRNA |
| Gm10145       | ENSMUSG00000064208 | chr10:27936241-27937484  | 2.33233  | 3.50418    | 0.587304  | 0.0228   | 0.0808138   | pseudogene        |
| Gm37315       | ENSMUSG00000104095 | chr1:20052150-20055629   | 3.40376  | 1.16444    | -1.5475   | 5.00E-05 | 0.000579745 | TEC               |
| Gm6300        | ENSMUSG00000104375 | chr3:14363116-14377566   | 0.882403 | 0.00922159 | -6.58028  | 0.0479   | 0.140406    | pseudogene        |
| Gm11548       | ENSMUSG00000085320 | chr9:90089965-90114820   | 1.27231  | 0.588932   | -1.11128  | 0.0023   | 0.0134515   | lincRNA           |
| Gm16316       | ENSMUSG00000087129 | chr8:46146055-46150772   | 0.769038 | 0.437436   | -0.813984 | 0.0224   | 0.0796617   | antisense lincRNA |
| Gm16685       | ENSMUSG00000097804 | chr6:57426690-57447665   | 1.20844  | 0.259869   | -2.21729  | 0.0003   | 0.00262508  | antisense lincRNA |
| Gm37728       | ENSMUSG00000103220 | chr6:31095127-31097419   | 1.33324  | 0.554745   | -1.26504  | 0.00035  | 0.00294773  | TEC               |
| Gm38197       | ENSMUSG00000102460 | chr8:8665074-8690537     | 22.9808  | 12.3346    | -0.897717 | 0.00605  | 0.0291405   | TEC               |
| Gm15348       | ENSMUSG00000074469 | chr8:12706943-12719127   | 1.58841  | 0.572112   | -1.47321  | 5.00E-05 | 0.000579745 | lincRNA           |
| 1810019N24Rik | ENSMUSG00000097115 | chr7:13533940-13547117   | 4.75035  | 1.06972    | -2.15079  | 0.0057   | 0.0277736   | lincRNA           |
| 4833413G10Rik | ENSMUSG00000104950 | chr5:3525611-3530998     | 2.60754  | 1.37191    | -0.9265   | 0.00105  | 0.0071877   | antisense         |
| 1700040K01Rik | ENSMUSG00000103840 | chr16:4473364-4475211    | 0.86773  | 0.451433   | -0.942736 | 0.0175   | 0.0663975   | TEC               |
| Gm37509       | ENSMUSG00000104379 | chr1:15805657-15846580   | 0.922429 | 0.448186   | -1.04134  | 0.01015  | 0.0437947   | TEC               |
| AA914427      | ENSMUSG00000103149 | chr16:17922135-17923301  | 0.639275 | 1.19391    | 0.90119   | 0.0331   | 0.106717    | TEC               |
| Gm6483        | ENSMUSG00000087153 | chr8:19682024-19698079   | 1.75602  | 1.23938    | -0.502685 | 0.0412   | 0.125641    | pseudogene        |
| Chic2         | ENSMUSG00000029229 | chr5:75006423-75044626   | 0.936926 | 0.406495   | -1.2047   | 0.02665  | 0.0906703   | Retained intron   |
| Gm37014       | ENSMUSG00000102838 | chr1:137953757-137956010 | 1.12446  | 0.71012    | -0.663098 | 0.02785  | 0.0938517   | TEC               |

|             |                    |                          |          |          |           |         |            |                  |
|-------------|--------------------|--------------------------|----------|----------|-----------|---------|------------|------------------|
| Gm16316     | ENSMUSG00000087129 | chr2:163491686-163541721 | 3.44931  | 1.8037   | -0.935346 | 0.00035 | 0.00294773 | antisense lncRNA |
| Plekhd1os   | ENSMUSG00000044062 | chr12:80686374-80692466  | 0.228388 | 0.696568 | 1.60878   | 0.0358  | 0.112932   | antisense lncRNA |
| Ppp6r1      | ENSMUSG00000052296 | chr7:4631494-4658950     | 26.3844  | 33.2771  | 0.334842  | 0.03535 | 0.111889   | pseudogene       |
| Slc2a4rg-ps | ENSMUSG00000085028 | chr2:181384249-181387596 | 1.72336  | 2.64362  | 0.617287  | 0.00555 | 0.0271839  | pseudogene       |
| Zfp862-ps   | ENSMUSG00000107476 | chr6:48504338-48534832   | 0.642447 | 0.436432 | -0.557821 | 0.02705 | 0.0916985  | pseudogene       |

<sup>a</sup>Ensembl gene IDs.

<sup>b</sup>log<sub>2</sub>FC:log<sub>2</sub> fold change.

<sup>c</sup>q-value cut-off is 0.05.

<sup>d</sup>p-value cut-off is 0.05.

<sup>e</sup>biotype from Ensembl.

**Supplementary Table 2. Characteristics of candidate lincRNAs.**

| lincRNA name  | Conservative factor | Average FPKM |           | Regulation |
|---------------|---------------------|--------------|-----------|------------|
|               |                     | db/db mice   | db/m mice |            |
| D630029K05Rik | N/A                 | 37.7919      | 17.2977   | down       |
| 1700020I14Rik | 54%                 | 16.1698      | 11.2289   | down       |
| 1500026H17Rik | 51%                 | 1.41735      | 2.56977   | up         |
| RP23-341H6.1  | N/A                 | 11.4813      | 5.4326    | down       |
| Snhg18        | 16%                 | 11.5791      | 6.9539    | down       |



**Supplementary Table 3. The alternative miRNAs predicted to target on 1700020I14Rik transcript.**

| microRNA        | NO. of targeting sites                    | $\Delta G$ |
|-----------------|---|------------|
| Mmu-miR-124-5p  | 2 (1025bp-1047bp; 1192bp-1214bp)          | -26.4      |
| Mmu-miR-135a-5p | 1 (355bp-378bp; 367bp-391bp)              | -21.7      |
| Mmu-miR-195a-5p | 1 (881bp-903bp)                           | -19.4      |
| Mmu-miR-195b    | 1 (881bp-903bp)                           | -20.4      |
| Mmu-miR-215-3p  | 1 (77bp-90bp; 1063bp-1084bp)              | -31.1      |
| Mmu-miR-221-3p  | 1 (917bp-940bp)                           | -32.5      |
| Mmu-miR-34a-3p  | 1 (41bp-62bp)                             | -24.6      |
| Mmu-miR-34a-5p  | 3 (222bp-244bp; 319bp-343bp; 971bp-993bp) | -20.5      |
| Mmu-miR-377-3p  | 1 (112bp-137bp)                           | -26.4      |
| Mmu-miR-690     | 1 (1190bp-1211bp)                         | -25.3      |

**Supplementary Table 4. The alternative plasmids sequences used in the manuscript.**

| Plasmid name         | Strand     | Sequence (5'-3')       |
|----------------------|------------|------------------------|
| miR-34a-5p mimic     | Sense      | UGGCAGUGUCUAGCUGGUUGU  |
|                      | Anti-sense | AACCAGCUAAGACACUGCCAUI |
| SiRNA-969            | Sense      | GGACAAUGCUCACCCUGAATT  |
|                      | Anti-sense | UUCAGGGUGAGCAUUGUCCTT  |
| SiRNA-961            | Sense      | GCCUGUGGCUAGUUCAGAATT  |
|                      | Anti-sense | UUCUGAACUAGCCACAGGCTT  |
| SiRNA-832            | Sense      | GGAGAAGAAACCUGUUGUUTT  |
|                      | Anti-sense | AACAACAGGUUUCUCUCCTT   |
| SiRNA-Sirt1          | Sense      | GGGAUCAAGAGGUUGUAATT   |
|                      | Anti-sense | UUAACAACCUCUUGAUCCTT   |
| miR-34a-5p inhibitor |            | ACAACCAGCUAAGACACUGCCA |

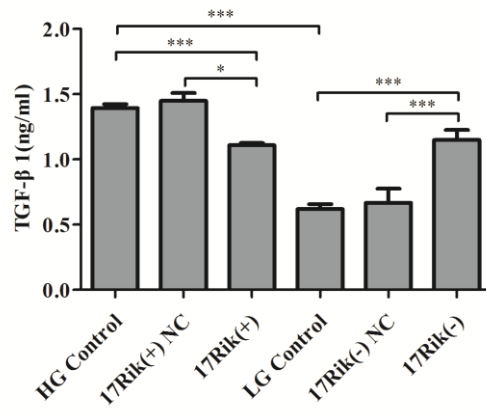
**Supplementary Table 5. Primers used for qPCR.**

| Gene ID        | Primer  | Sequence (5'-3')         |
|----------------|---------|--------------------------|
| 1700020I14Rik  | Forward | TCCTGGTTCTTCATCCTGT      |
|                | Reverse | ACGGCTTTCCTGTGTTGAGT     |
| Sirt1          | Forward | TGTCTCCTGTGGGATTCTGACTTC |
|                | Reverse | TGGCTTGAGGGTCTGGGAGGT    |
| HIF-1 $\alpha$ | Forward | GGAGATCCTTCGAGGAGCACTT   |
|                | Reverse | GGCGATTAGCAGCAGATATAAGAA |
| Col-4          | Forward | GAACTGGCAGAATCGGGACAG    |
|                | Reverse | TCCAATGGGACCCTTATCTCC    |
| FN             | Forward | ATGTGGACCCCTCCTGATAGT    |
|                | Reverse | GCCCAGTGATTCAGCAAAGG     |
| TGF- $\beta$ 1 | Forward | TGACGTCCTGGAGTTGTACGG    |
|                | Reverse | GGTTCATGTCATGGATGGTGC    |
| $\beta$ -actin | Forward | ATATCGCTGCGCTGGTCGTC     |
|                | Reverse | AGGATGGCGTGAGGGAGAGC     |

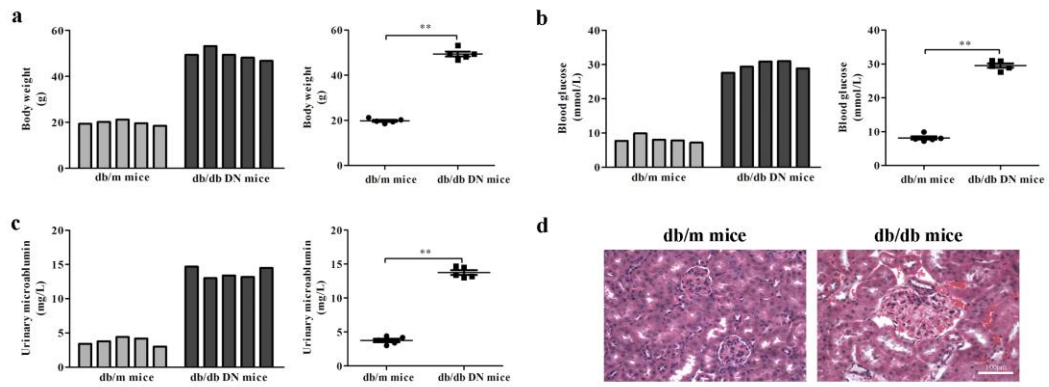
|                |         |   |
|----------------|---------|---|
| U6             | Forward | CTCGCTTCGGCAGCACA                           |
|                | Reverse | AACGCTTCACGAATTTGCGT                        |
| P4ha1          | Forward | AAGGCTGAGCCGAGCTACA                         |
|                | Reverse | GCCAAGCACTCTTAGATACTCTG                     |
| P4ha2          | Forward | TTGCTAAGCCCAAACCTGCAC                       |
|                | Reverse | GCATCTTCGTCATCGCTCCT                        |
| Plod2          | Forward | GAGAGGCGGTGATGGAATGAA                       |
|                | Reverse | ACTCGGTAAACAAGATGACCAGA                     |
| Mmu-miR-34a-5p | RT      | CTCAACTGGTGTCTGGAGTCGGCAATTCAGTTGAGACAACCAG |
|                | Forward | ACACTCCAGCTGGGTGGCAGTGTCTTAGC               |
|                | Reverse | CTCAACTGGTGTCTGGGA                          |

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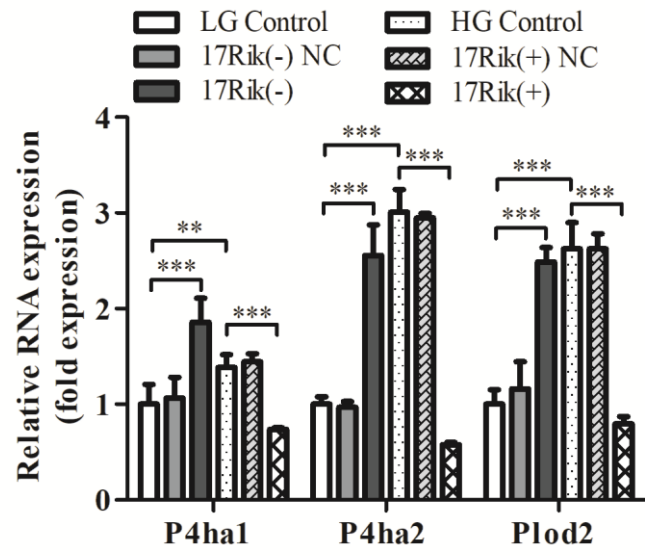
Supplementary Fig 1.



## Supplementary Fig 2.



Supplementary Fig 3.



Supplementary Fig 4.

