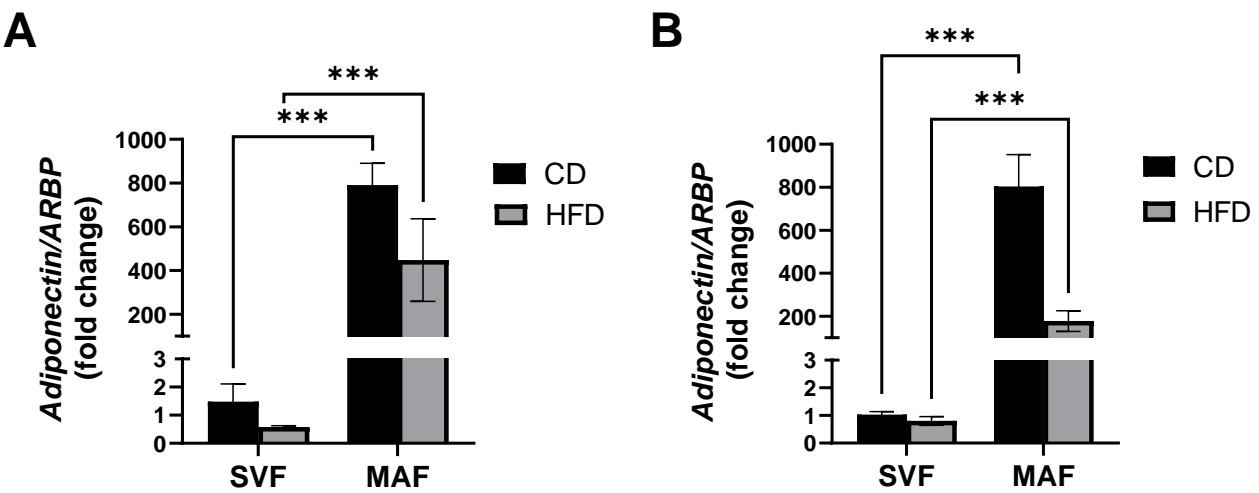
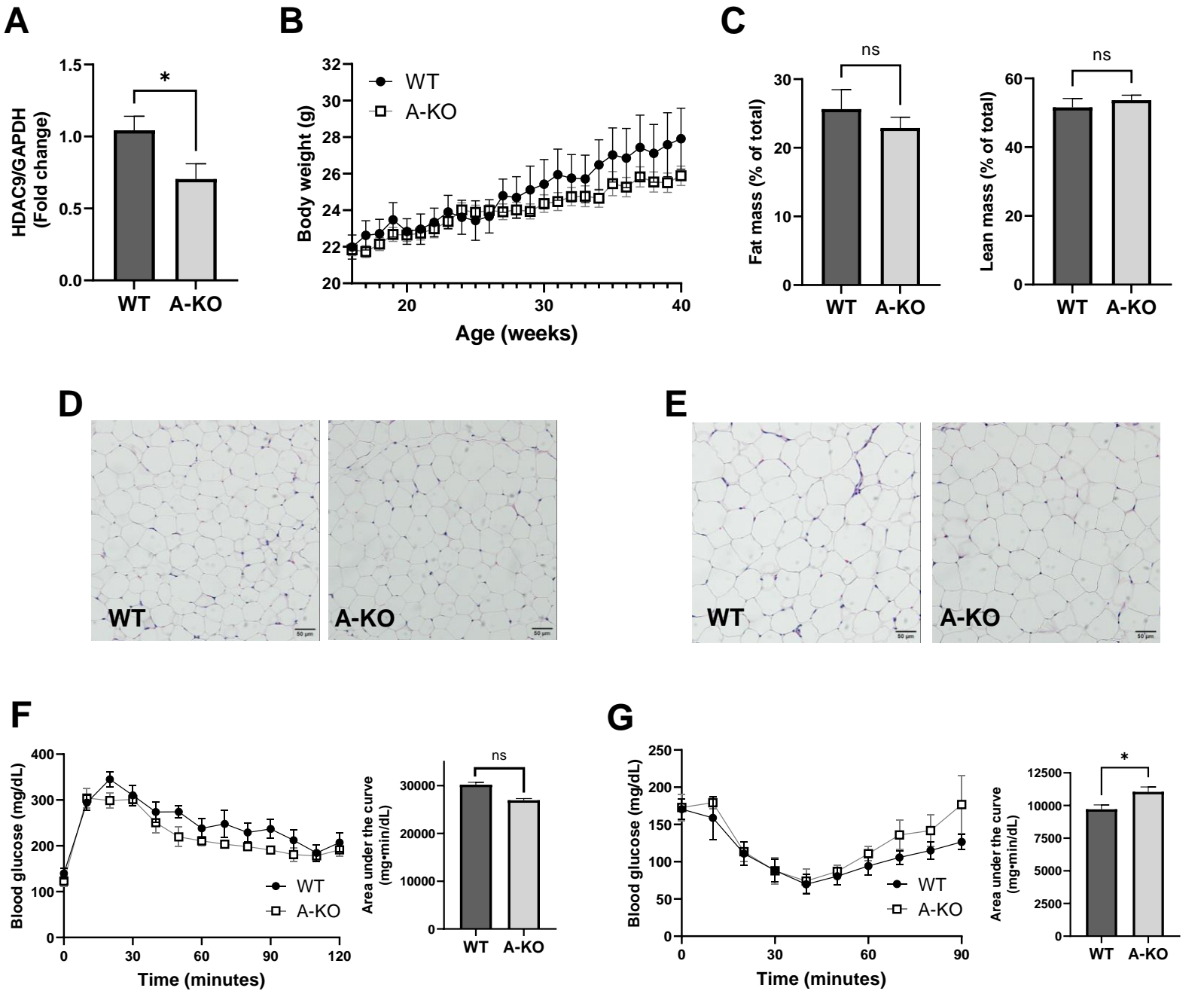


# Supplemental Figure S1



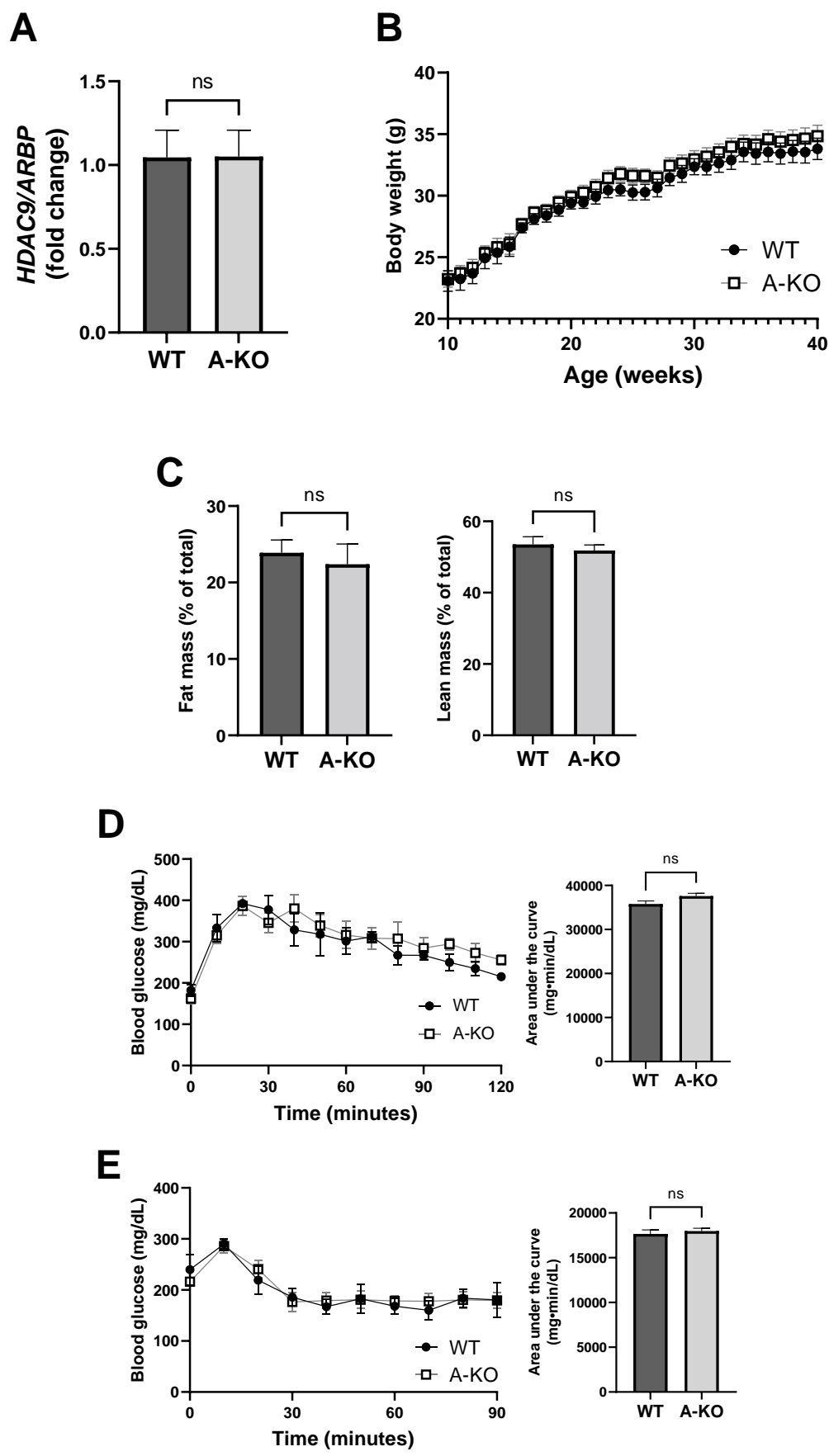
**Figure S1.** Validation of adipose fractionation. *Adiponectin* mRNA expression in SVF and MAF from SQ **(A)** and VF **(B)** of female WT mice either on CD or HFD (n=5-6). Data represent mean  $\pm$  SEM. \*\*\*p<0.001. SQ, subcutaneous adipose tissue; VF, visceral adipose tissue; CD, chow diet; HFD, high fat diet; SVF, stromovascular fraction; MAF, mature adipocyte fraction.

# Supplemental Figure S2



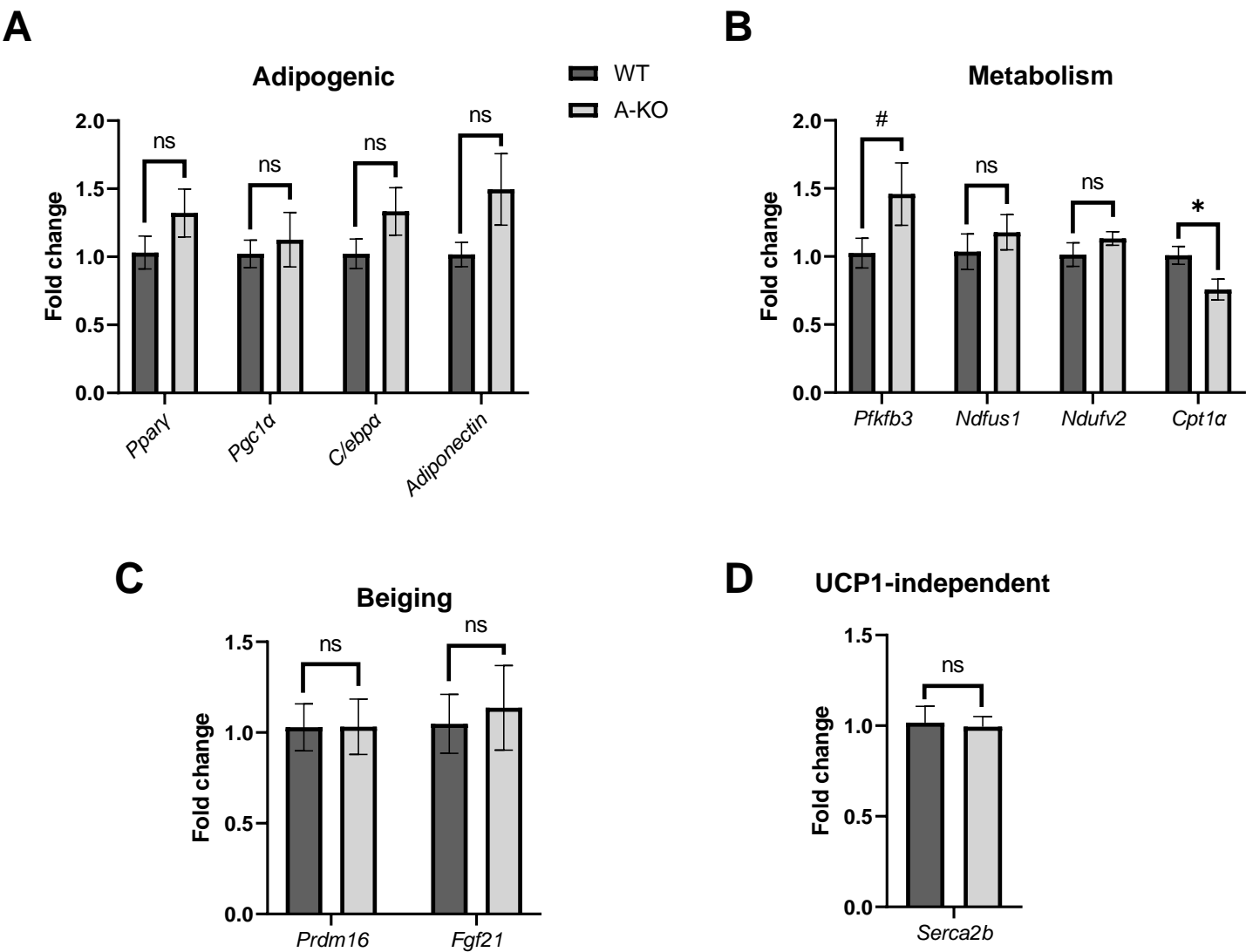
**Figure S2.** A-KO does not improve metabolic health in CD-fed female mice. **(A)** *HDAC9* mRNA expression level in SQ from CD-fed female mice (n=8-9). **(B)** Growth curves of CD-fed female WT and A-KO mice (n=8-9). **(C)** Fat mass and lean mass measured by whole body composition nuclear magnetic resonance (n=8-9). Representative H&E images of SQ **(D)** and VF **(E)** from CD-fed female WT and A-KO mice. Glucose tolerance **(F)** and insulin tolerance test **(G)** quantified by area under the curve (n=4). Data represent mean ± SEM. \*p<0.05. SQ, subcutaneous adipose tissue; VF, visceral adipose tissue.

# Supplemental Figure S3



**Figure S3.** A-KO does not improve metabolic health in CD-fed male mice. **(A)** Expression of *HDAC9* mRNA in SQ CD-fed male mice determined by qPCR (n=3-4). **(B)** Growth curves of CD-fed male WT and A-KO mice (n=10-15). **(C)** Fat mass and lean mass measured by whole body composition nuclear magnetic resonance (n=7-10). Glucose tolerance **(D)** and insulin tolerance test **(E)** quantified by area under the curve (n=4). Data represent mean  $\pm$  SEM.

# Supplemental Figure S4



**Figure S4.** Adipocyte-specific *HDAC9* gene deletion does not significantly alter gene expression in VF from HFD-fed female mice. mRNA expression of **(A)** adipogenic, **(B)** metabolic genes **(C)** classic beiging and **(D)** UCP1-independent beiging genes in SQ from HFD-fed female mice (n=5-6). Data represent mean ± SEM. #p<0.1; \*p<0.05. VF, visceral adipose tissue; PPARγ, peroxisome proliferator-activated receptor gamma; Pgc1α, PPARγ coactivator 1-alpha; C/ebpa, CCAAT/enhancer-binding protein alpha; Pfkfb3, 6-phosphofructo-2-kinase/fructose-2,6-bisphosphatase 3; Ndfus1, NADH-ubiquinone oxidoreductase; Ndufv2, NADH-ubiquinone oxidoreductase flavoprotein 2; Cpt1a, carnitine palmitoyltransferase 1a; Prdm16, PR/SET domain 16; Fgf21, fibroblast growth factor 21; Serca2b, sarco/endoplasmic reticulum Ca<sup>2+</sup> ATPase 2b.

# Supplemental Table S1

**Table S1:** Demographic data of human subjects.

BMI (kg/m2)	Age (years)	Gender	Diabetes Mellitus
21.4	55	M	Yes
23.3	50	M	No
24.0	68	M	No
24.0	43	M	Yes
24.5	64	M	No
25.0	62	M	No
27.1	65	M	No
27.8	60	M	No
28.7	82	M	No
34.9	53	F	No
35.3	44	M	No
42.2	64	F	Yes

# Supplemental Table S2

**Table S2:** Primer Sequences.

Gene Name	Species	Forward	Reverse
<i>Adiponectin</i>	mouse	GCACTGGCAAGTTCTACTGCAACA	AGAGAACGGCCTTGTCTTGTTGA
<i>Arbp</i>	mouse	AGCTGAAGCAAAGGAAGAGTCGGA	ACTTGGTTGCTTTGGCGGGATTAG
<i>Aromatase</i>	mouse	GCTGAACCCCATGCAGTATAA	AGCCAAAAGGCTGAAAGTACC
<i>Atp5a1</i>	mouse	TCTCCATGCCTCTAACACTCG	CCAGGTCAACAGACGTGTCAG
<i>C/ebpa</i>	mouse	AGAAGTCGGTGGACAAGAACAGCA	GCGTTGTTTGGCTTTATCTCGGCT
<i>Cpt1α</i>	mouse	CATGATTGCAAAGATCAATCGG	CTTGACATGCGGCCAGTG
<i>Fabp4</i>	mouse	ATGAAATCACCGCAGACGACAGGA	TGTGGTCGACTTTCCATCCCCTT
<i>Fgf21</i>	mouse	CTCCACATGAGAGCTAGAACAC	CTGATATCCAGGGCGAAGTAAG
<i>Gatm</i>	mouse	CAGACACAAATTGGCCGCTC	CCCAGGTAGTTTGTAACCTGGC
<i>Hdac9</i>	mouse	AGGATGATGATGCCTGTGGTGGAT	GAGTTGTGCTTGATGCTGCCTTGT
<i>Ldha</i>	mouse	ACATTGTCAAGTACAGTCCACAC	TTCCAATTACTCGGTTTTTGGGA
<i>Leptin</i>	mouse	CAAGCAGTGCCTATCCAGA	AAGCCCAGGAATGAAGTCCA
<i>Ndfus1</i>	mouse	AACCACTGTTCTGCAGGCTT	AGCGACAACCTTTGGAGCTT
<i>Ndfuv2</i>	mouse	GCAAGGAATTTGCATAAGACAGC	TAGCCATCCATTCTGCCTTTG
<i>Pfkfb3</i>	mouse	TACGAAGCTCACACGCTATCT	GCCTCTCGTCGATACTGACCTA
<i>Pgc1α</i>	mouse	CCCTGCCATTGTTAAGACC	TGCTGCTGTTCTGTTTTT
<i>Pparγ</i>	mouse	ACATAAAGTCCTTCCCGCTGACCA	AAATTCGGATGGCCACCTCTTTGC
<i>Prdm16</i>	mouse	AGATGAACCAGGCATCCACTCGAA	ACTTCCCGGCTAAGCTGTCATCAT
<i>Ryr2</i>	mouse	ATGGCTTTAAGGCACAGCG	ATGGCTTTAAGGCACAGCG
<i>Serca2b</i>	mouse	ACCTTTGCCGCTCATTTTCCAG	AGGCTGCACACACTCTTTACC
<i>Tst</i>	mouse	CCTGCTGTAGGTTACCTTTTAGG	GGAGGCACCAAGAGCAATTCTAAA
<i>Ucp1</i>	mouse	AAGCTGTGCGATGTCCATGT	AAGCCACAAACCCTTTGAAAA
<i>Gapdh</i>	human	CGACTTCAACAGCAACTCCCACTCTTCC	TGGGTGGTCCAGGGTTTCTTACTCCTT
<i>Hdac9</i>	human	TACTCAGGCGGAAGGATGGA	CCAGTTGGCCCATTGTTTGG