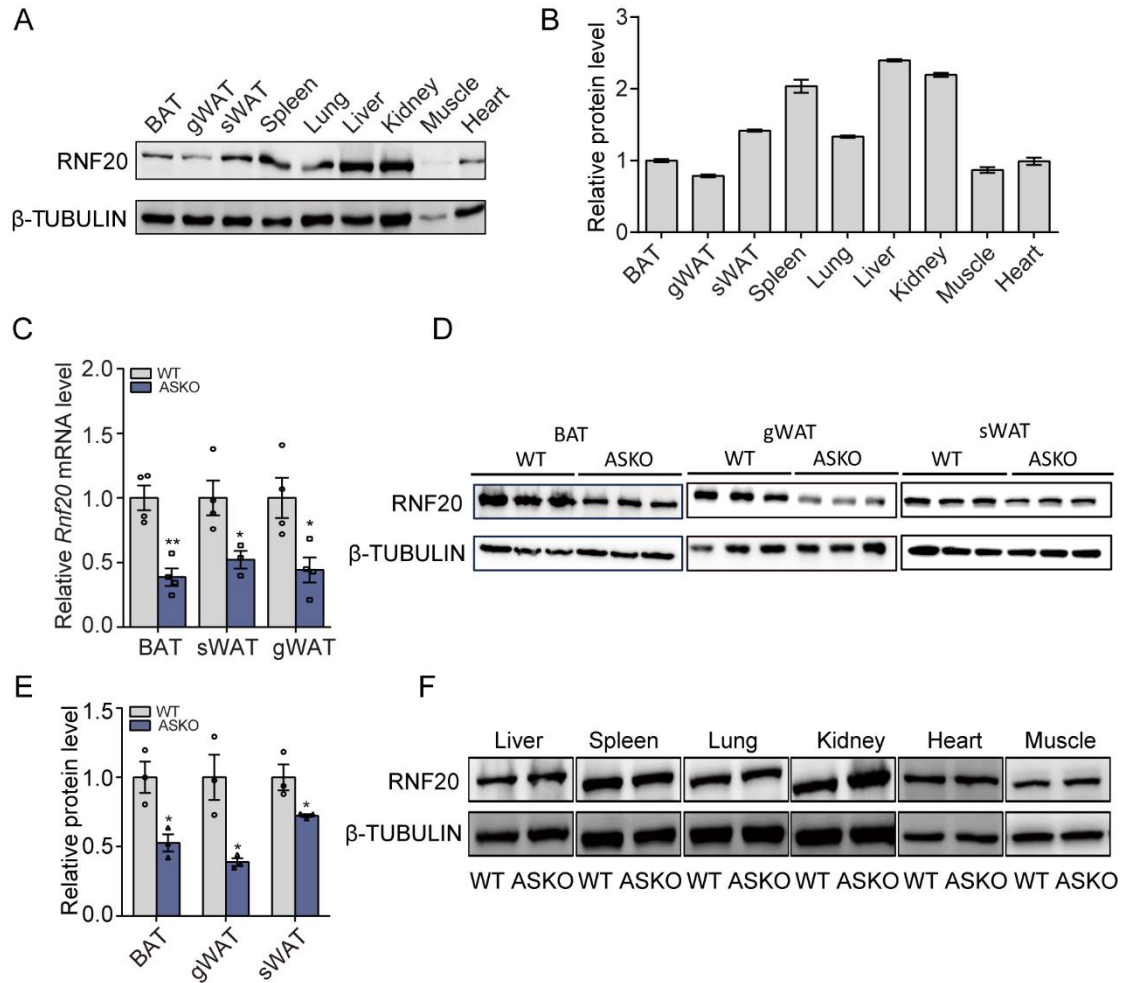
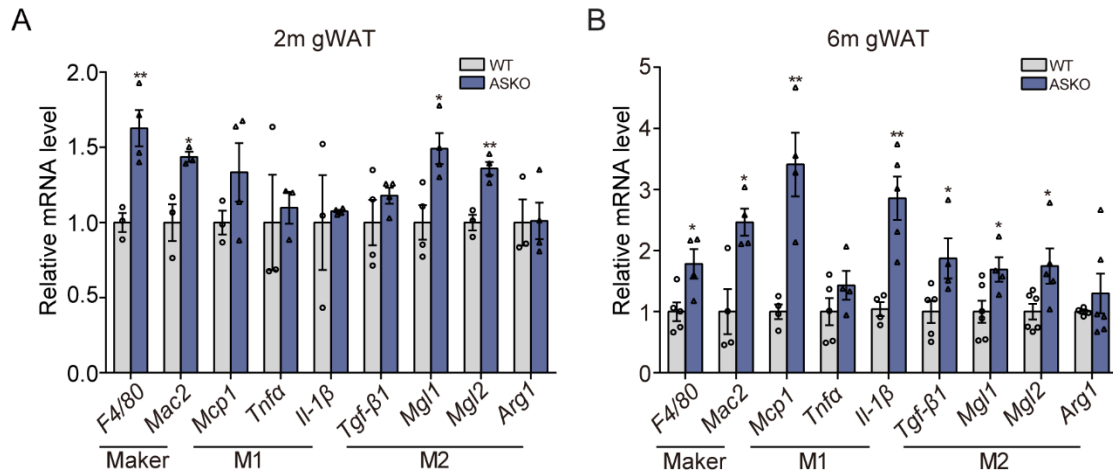


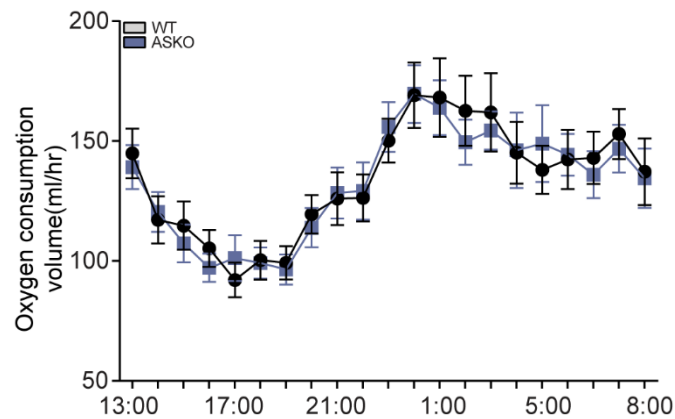
Supplementary materials



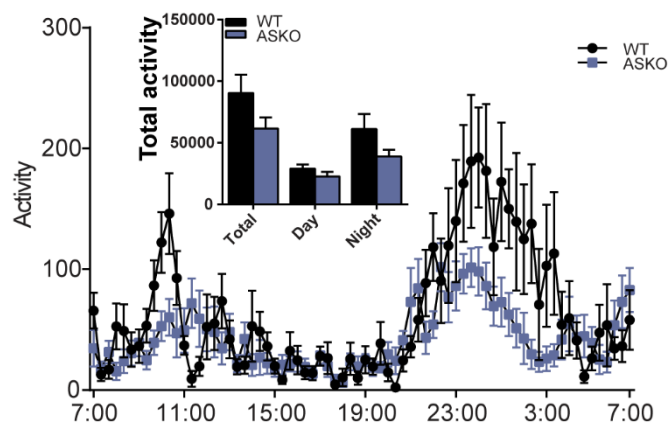
Supplementary Figure 1. Expression profile of RNF20 and the validation of adipocyte-specific *Rnf20* knockout mice. (A and B) Tissue distribution of RNF20 in 2-month-old male C57BL/6 mice (A) and the quantitative data (B). (C) *Rnf20* expression in the BAT, gWAT and sWAT from 2-month-old WT and ASKO mice (n = 4). (D and E) Protein expression of RNF20 in adipose tissues of 2-month-old WT and ASKO mice, as determined by immunoblot analysis (D) and the quantitative analysis. (F) RNF20 expression in various tissues, including liver, spleen, lung, kidney, heart and muscle in the 2-month-old WT and ASKO mice. Note that the levels of RNF20 expression were not changed in these tissues. Data are presented as the mean \pm s.e.m. * $p < 0.05$, ** $p < 0.01$.



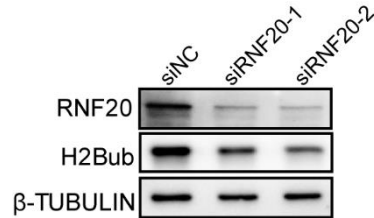
Supplementary Figure 2. Relative mRNA levels of macrophage markers and inflammatory cytokines in gWAT from 2-(A), and 6-month-old (B) WT and ASKO mice ($n = 4 - 6$). Data are presented as the mean \pm s.e.m. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ for differences between WT and ASKO mice.



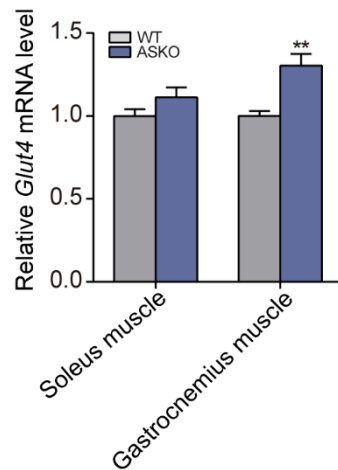
Supplementary Figure 3. The whole-body oxygen consumption rate (VO_2) of 6-month-old WT and ASKO mice ($n = 6$). Data are presented as the mean \pm s.e.m.



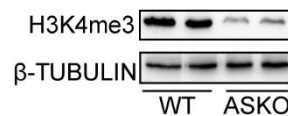
Supplementary Figure 4. Physical activity were measured with the 6-month-old WT and ASKO mice throughout the day and night (n = 8). Data are presented as the mean \pm s.e.m.



Supplementary Figure 5. The siRNAs efficiency test in 3T3-L1 cells.



Supplementary Figure 6. Relative *Glut4* mRNA level in soleus muscle and gastrocnemius muscle from 9-month-old mice. Data are presented as the mean \pm s.e.m. ** $p < 0.01$ for differences between WT and ASKO mice.



Supplementary Figure 7. Representative Western blot of H3K4me3 in BAT of the 6-month-old WT and ASKO mice.

Supplementary table 1. Primers used in this study

Name	Sequence 5'-3'
<i>Rnf20</i> -genotyping-F	GCTGTAAGAGTTCTTAATGTATG
<i>Rnf20</i> -genotyping-R	GGCTTGTCACACAAGCATGAGCATC
<i>Cre</i> -F	GCCTGCATTACCGGTCGATGC
<i>Cre</i> -R	CAGGGTGTATAAGCAATCCC
<i>18s</i> -F	GTAACCCGTTGAACCCCAT
<i>18s</i> -R	CCATCCAATCGGTAGTAGCG
<i>Rnf20</i> -qPCR-F	GTGAACCGGTAAGGAGCCAG
<i>Rnf20</i> -qPCR-R	GAAAGCTGGCTCTTGCCCATC
<i>Cebpa</i> -qPCR-F	CCCTTGCTTTTTGCACCTCC
<i>Cebpa</i> -qPCR-R	GCTTTCTGGTCTGACTGGGG
<i>Pparγ</i> -qPCR-F	CGGAAGCCCTTTGGTACTT
<i>Pparγ</i> -qPCR-R	CCTCGATGGGCTTCACGTTT
<i>Srebp1c</i> -qPCR-F	GGAGCCATGGATTGCACATT
<i>Srebp1c</i> -qPCR-R	GCTTCCAGAGAGGAGGCCAG
<i>Acc</i> -qPCR-F	GAGAGGGGTCAAGTCCCTCC
<i>Acc</i> -qPCR-R	ACATCCACTTCCACACACGA
<i>Dgat1</i> -qPCR-F	ATCTGAGGTGCCATCGTC
<i>Dgat1</i> -qPCR-R	ATGCCATACTTGATAAGGTTCT
<i>Dgat2</i> -qPCR-F	TCAACCGAGACACCATAGAC
<i>Dgat2</i> -qPCR-R	CCTCAAAGATCACCTGCTT
<i>Fas</i> -qPCR-F	GGGTCTATGCCACGATTC
<i>Fas</i> -qPCR-R	GTGTCCCATGTTGGATTG
<i>Scd1</i> -qPCR-F	CTGACCTGAAAGCCGAGAAG
<i>Scd1</i> -qPCR-R	GCGTTGAGCACCAGAGTGTA
<i>Fabp4</i> -qPCR-F	TCACCTGGAAGACAGCTCCT
<i>Fabp4</i> -qPCR-R	AATCCCCATTTACGCTGATG
<i>Adiponectin</i> -qPCR-F	CTCCTGCTTTGGTCCCTC
<i>Adiponectin</i> -qPCR-R	GCCAGTGCTGCCGTCATA
<i>Resistin</i> -qPCR-F	TCCTTGTCCTGAACTGC
<i>Resistin</i> -qPCR-R	ACGAATGTCCCACGAGCC
<i>Leptin</i> -qPCR-F	CACAGTCTGGAGCGAAGG
<i>Leptin</i> -qPCR-R	CACAATCTGGGAACAAGC
<i>Ucp1</i> -qPCR-F	GTGAAGGTCAGAATGCAAGC
<i>Ucp1</i> -qPCR-R	AGGGCCCCCTTCATGAGGTC
<i>Mcp1</i> -qPCR-F	GTAAACGCCCCACTCACCTG
<i>Mcp1</i> -qPCR-R	CCTTCTTGGGGTCAGCACAG
<i>Tnfa</i> -qPCR-F	AATGGCCTCCCTCTCATCAG
<i>Tnfa</i> -qPCR-R	CCCTTGAAGAGAACCTGGGA
<i>Hsl</i> -qPCR-F	GACTCACCGCTGACTTCC
<i>Hsl</i> -qPCR-R	TGTCTCGTTGCGTTTGTAG
<i>Atgl</i> -qPCR-F	CGTCACCTGTGCCTTACTC
<i>Atgl</i> -qPCR-R	GGGCTCAAACCTCCCAAAC

<i>Cpt1a</i> -qPCR-F	CCAGGCTACAGTGGGACATT
<i>Cpt1a</i> -qPCR-R	GAACTTGCCCATGTCCTTGT
<i>Cpt2</i> -qPCR-F	TATGATGGCTGAGTGCTCCA
<i>Cpt2</i> -qPCR-R	ATAGAGCTCAGGCAGGGTGA
<i>Srebp2</i> -qPCR-F	CCCTTGACTTCCTTGCTGCA
<i>Srebp2</i> -qPCR-R	GCGTGAGTGTGGGCGAATC
<i>Lxra</i> -qPCR-F	ATGTCCACGAGTGACTGTT
<i>Lxra</i> -qPCR-R	TTGACTCTCCCTTAATGCTAC
<i>Lxrβ</i> -qPCR-F	TATGCCTTGCTTATCGCCATC
<i>Lxrβ</i> -qPCR-R	CTTGTCCTGGAGTCGCAATG
<i>Cox4</i> -qPCR-F	CGGCGTGACTACCCCTTG
<i>Cox4</i> -qPCR-R	TGAGGGATGGGGCCATACA
<i>Cycs</i> -qPCR-F	CCAAATCTCCACGGTCTGTTC
<i>Cycs</i> -qPCR-R	ATCAGGGTATCCTCTCCCAG
<i>Acadl</i> -qPCR-F	TTGGTGGGGACTTGCTCTCA
<i>Acadl</i> -qPCR-R	CTGTTCTTTTGTGCCGTAAT
<i>Acadm</i> -qPCR-F	GGATGACGGAGCAGCCAATG
<i>Acadm</i> -qPCR-R	ATACTCGTCACCCTTCTTCT
<i>Crp</i> -qPCR-F	ATGGAGAAGCTACTCTGGTGC
<i>Crp</i> -qPCR-R	ACACACAGTAAAGGTGTTCAAGTG
<i>Elovl6</i> -qPCR-F	AAGCAGTTCAACGAGAACGAA
<i>Elovl6</i> -qPCR-R	CGTACAGCGCAGAAAACAGG
<i>Prdm16</i> -qPCR-F	TGAGCCCCAAGGAGTCTATG
<i>Prdm16</i> -qPCR-R	GTCGGCTCCAAAGCTAACAG
<i>Adrb3</i> -qPCR-F	TTTGATGGCTATGAAGGTGCG
<i>Adrb3</i> -qPCR-R	CGTTGCTTGCTTTCTGGAGG
<i>Cox6a1</i> -qPCR-F	TGCTCAACGTGTTCTCAAG
<i>Cox6a1</i> -qPCR-R	TAAGGGTCCAAAACCAAGTGC
<i>Slc27a2</i> -qPCR-F	ATGCCGTGTCCGTCTTTTAC
<i>Slc27a2</i> -qPCR-R	CGATGATGATTGATGGTTGC
<i>Cox8b</i> -qPCR-F	GAACCATGAAGCCAACGACT
<i>Cox8b</i> -qPCR-R	GCGAAGTTCACAGTGGTTCC
<i>Oplah</i> -qPCR-F	CTTCACGCACGTCTCCTTGT
<i>Oplah</i> -qPCR-R	GCATCTGCACAGGCCGTAT
<i>Cox17</i> -qPCR-F	ATAGTTGCTTTCGCCTGGAA
<i>Cox17</i> -qPCR-R	ACAAAGTAGGCCACCACGTC
<i>Apoe</i> -qPCR-F	GGTTCGAGCCAATAGTGGAA
<i>Apoe</i> -qPCR-R	TATTAAGCAAGGGCCACCAG
<i>Fads1</i> -qPCR-F	AAGGCCAACCACCTCTTCTT
<i>Fads1</i> -qPCR-R	ACTGACAGGTGCCCAAAGTC
<i>Pdk3</i> -qPCR-F	TTTGAGAGGCTGCCAGTTTT
<i>Pdk3</i> -qPCR-R	CGTCTCTGGTTGACTTGCAG
<i>Egfr</i> -qPCR-F	ACACTGCTGGTGTGCTGAC
<i>Egfr</i> -qPCR-R	CCCAAGGACCACTTCACAGT

<i>Bmp4</i> -qPCR-F	GCTGGAATGATTGGATTGTGG
<i>Bmp4</i> -qPCR-R	ATGGCATGGTTGGTTGAGTTG
<i>Acox1</i> -qPCR-F	CAGGAAGAGCAAGGAAGTGG
<i>Acox1</i> -qPCR-F	CCTTTCTGGCTGATCCCATA
<i>Klhl13</i> -qPCR-F	AGAATTGGTTGCTGCAATACTCC
<i>Klhl13</i> -qPCR-R	AAGGCACAGTTTCAAGTGCTG
<i>Cd137</i> -qPCR-F	CGTGCAGAACTCCTGTGATAAC
<i>Cd137</i> -qPCR-R	GTCCACCTATGCTGGAGAAGG
<i>Cd40</i> -qPCR-F	TTGTTGACAGCGGTCCATCTA
<i>Cd40</i> -qPCR-R	CCATCGTGGAGGTACTGTTTG
<i>Ear2</i> -qPCR-F	CCTGTAACCCAGAACTCCA
<i>Ear2</i> -qPCR-R	CAGATGAGCAAAGGTGCAAA
<i>Sp100</i> -qPCR-F	TGATGGAGGGAACCCAAACTC
<i>Sp100</i> -qPCR-R	CTTCCTTGAGAATAGCTGGCAC
<i>Tbx1</i> -qPCR-F	GGCAGGCAGACGAATGTTC
<i>Tbx1</i> -qPCR-R	TTGTCATCTACGGGCACAAAG
<i>Tmem26</i> -qPCR-F	ACCCTGTCATCCCACAGAG
<i>Tmem26</i> -qPCR-R	TGTTTGGTGGAGTCCTAAGGTC
<i>F4/80</i> -qPCR-F	TTTCCTCGCCTGCTTCTTC
<i>F4/80</i> -qPCR-R	CCCCGTCTCTGTATTCAACC
<i>Mac2</i> -qPCR-F	CGGGTGGAGCACTAATCAGG
<i>Mac2</i> -qPCR-R	GTAGGCCCCAGGATAAGCAG
<i>Il-1β</i> -qPCR-F	TGCCACCTTTTGACAGTGATG
<i>Il-1β</i> -qPCR-R	AAGGTCCACGGGAAAGACAC
<i>Tgf-β1</i> -qPCR-F	GGCGGTGCTCGCTTTGTA
<i>Tgf-β1</i> -qPCR-R	TCCCGAATGTCTGACGTATTGA
<i>Mgl2</i> -qPCR-F	GGATGGGACCGACTTTGA
<i>Mgl2</i> -qPCR-R	GTGGGCTGAGCTGGCTTT
<i>Mgl1</i> -qPCR-F	TGAGAAAGGCTTTAAGAAGTGGG
<i>Mgl1</i> -qPCR-R	GACCACCTGTAGTGATGTGGG
<i>Arg1</i> -qPCR-F	AAGACAGCAGAGGAGGTG
<i>Arg1</i> -qPCR-R	AGTCAGTCCCTGGCTTAT

Supplementary table 2 List of siRNA used in this study

Gene	sense (5'-3')	antisense (5'-3')
siRNF20-1	GAGAUUCUGUUAAGGAUAATT	UUAUCCUUAACAGAAUCUCTT
siRNF20-2	GCGAAUCAAGUCUAAUCAGTT	CUGAUUAGACUUGAUUCGCTT
siNC	UUCUCCGAACGUGUCACGUTT	ACGUGACACGUUCGGAGAATT
