Summary of: Evidence for increased thermogenesis in female C57BL/6J mice housed aboard the international space station

Key findings and quantitative results:

- **BAT (Brown Adipose Tissue)**: - **Ucp1 (Uncoupling Protein 1)**: Increased Ucp1 expression in BAT, providing direct evidence for elevated non-shivering thermogenesis. - **Adipoq (Adiponectin)**: Increased Adipoq expression, associated with increased glucose uptake and metabolism. - **Ppargc1a (Protein Phosphatase 1 Regulatory Subunit A)**: Increased Ppargc1a expression, associated with adipogenesis. - **Cfd (Cyclin-Dependent Kinase Inhibitor)**: Increased Cfd expression, associated with thermogenesis.

- **WAT (White Adipose Tissue)**: - **Adig (Adipose-Associated Gene)**: Increased Adig expression, associated with thermogenesis. - **Lipe (Leptin)**: Increased Lipe expression, associated with thermogenesis. - **Lmna (Laminin)**: Increased Lmna expression, associated with thermogenesis. - **Lpl (Leptin-Regulated Protein)**: Increased Lpl expression, associated with thermogenesis.

- **Gene Expression**: - **Ucp1**: Significantly higher Ucp1 expression in flight animals compared to ground controls. - **Adipoq**: Significantly higher Adipoq expression in flight animals compared to ground controls. - **Ppargc1a**: Significantly higher Ppargc1a expression in flight animals compared to ground controls. - **Cfd**: Significantly higher Cfd expression in flight animals compared to ground controls.

- **Weight Gain**: - Weight gain did not differ between flight and ground control animals.

- **Activity Levels**: - Activity levels were higher in flight animals compared to ground control animals.

- **Data Collection**: - RNA was isolated from BAT and WAT samples. - Gene expression was measured using RT-qPCR. - Gene expression was normalized using GusB and ActB housekeeping genes.

- **Temperature**: - Spaceflight temperatures ranged from 21.3 to 28.0°C. - Average housing temperatures were 26.0°C and 26.4°C for flight and ground control animals, respectively.

- **Housing**: - Flight animals were housed at room temperature (22°C). - Ground control animals were housed at thermoneutral temperature (29-31°C).

- **Mechanisms**: - Increased Ucp1-mediated thermogenesis in BAT. - Increased expression of genes associated with adipogenesis and thermogenesis. - Increased sympathetic signaling, a key factor in adaptive thermogenesis.

- **Implications**: - Increased thermogenesis may exaggerate bone loss or alter responses to ionizing radiation. - Increased thermogenesis may impact the translatability of animal studies to astronauts.