I'm looking for articles on differences between the mitochondria of men and women

Articles on Sex Differences in Mitochondria

Here are strong starting papers on **differences between male and female mitochondria**, with the main takeaway that sex differences exist but are **tissue-specific** rather than universal (Junker et al., 2021).

Differences Between Men and Women

Evidence Strength	Claim
Strong	Across 50 human studies and 2,258 participants, there was **no overall binary sex difference** for most mitochondrial measures; the clearest aggregate differences were **higher ROS production in men's skeletal muscle** and **higher mitochondrial content in women's adipose tissue and leukocyte subtypes** (Junker et al., 2021)
Moderate	In human blood cells, women showed **higher PBMC respiration, ATP, and mitochondrial content** than men in a young adult pilot study, and **higher blood-cell respiration** also appeared in older adults (Silaidos et al., 2018; Mahapatra et al., 2024)
Moderate	Several animal and tissue-specific studies report **lower oxidative stress** or **greater antioxidant capacity** in females, but the direction can reverse by tissue, substrate, species, or age (Khalifa et al., 2017; Cikic et al., 2020; Guerrero et al., 2024)

FIGURE 1 Strength of evidence for male-female mitochondrial differences

Key Human Studies

Study	Main finding	Why it matters
Silaidos et al., 2018	Women had **higher PBMC complex I, I+II, IV respiration**, about **10% higher ATP**, and higher citrate synthase activity	Direct human cellular evidence for higher mitochondrial activity in females (Silaidos et al., 2018)
Mahapatra et al., 2024	Older women had **higher respiration rates** than older men in PBMCs and platelets	Suggests blood-cell bioenergetic differences persist in aging (Mahapatra et al., 2024)
Miotto et al., 2018	Skeletal muscle showed **similar maximal respiration**, but women had **lower ADP sensitivity** and lower respiration at physiological ADP	Shows sex differences can affect regulation, not just capacity (Miotto et al., 2018)
Junker et al., 2021	Meta-analysis found **few consistent binary sex differences overall** and strong tissue dependence	Best broad overview if you want the field-level picture (Junker et al., 2021)

Study	Main finding	Why it matters
Bellissimo et al., 2022	Mitochondrial metabolism was **similar between sexes overall**, but links with fat and lean mass differed by sex	Useful if you care about metabolism and body composition context (Bellissimo et al., 2022)

FIGURE 2 Representative human studies on mitochondrial sex differences

Tissue Patterns

Female-associated advantages often involve **lower ROS** and stronger antioxidant buffering, including reports of roughly half as much hydrogen peroxide generation in females and higher antioxidant defenses (Silaidos et al., 2018). But these effects appear to weaken with age and after loss of ovarian hormones, supporting a role for sex hormones rather than a fixed difference in all contexts (Silaidos et al., 2018; Iboleon-Jimenez et al., 2025).

The direction also changes by tissue. Female brain, heart, adipose, and microvascular studies often show higher respiration, mitochondrial content, or antioxidant proteins (Khalifa et al., 2017; Cikic et al., 2020). In contrast, primate brain tissue showed higher male complex I and II activity, and kidney cortex studies reported higher male oxygen consumption under some substrates (Guerrero et al., 2024; Dave et al., 2024).

Good Review Articles

- **Mauvais-Jarvis 2023** reviews sex differences in energy metabolism and argues female mitochondria have **higher functional capacity** and **greater resistance to oxidative damage** (Mauvais-Jarvis, 2023).
- **Ventura-Clapier et al. 2017** is a broad review covering mitochondrial **oxidative capacity, calcium handling, and oxidative stress** across tissues and diseases (Ventura-Clapier et al., 2017).
- **Demarest and McCarthy 2015** focuses on brain and neuroprotection, emphasizing sex differences in **mitochondrial metabolism and cell-death signaling** (Demarest & McCarthy, 2015).
- **Sultanova et al. 2020** specifically reviews **renal mitochondrial sex differences**, including biogenesis, ROS, and oxidative stress (Sultanova et al., 2020).

Evidence Coverage Across Mitochondrial Sex Differences

	Human Data	Mechanism	Tissue Breadth	Aging	Long-Term Outcomes
Blood cells	4	3	4	2	1
Skeletal muscle	3	2	3	2	1
Brain	2	3	4	2	1
Kidney	1	2	2	1	GAP

	Human Data	Mechanism	Tissue Breadth	Aging	Long-Term Outcomes
Cross-tissue synthesis	2	2	4	2	1

FIGURE 3 Evidence coverage across mitochondrial sex-difference subtopics

The biggest gap is **integrated human evidence across tissues and aging**. The best meta-analysis concluded that findings vary strongly by tissue and that older adults remain underrepresented, which limits firm claims about lifespan effects (Junker et al., 2021). Kidney and liver are especially thin in humans, with much of the evidence still coming from reviews, rodents, or conference abstracts rather than large peer-reviewed clinical studies (Sultanova et al., 2020; Dave et al., 2024; Dave et al., 2025).

If the question is which articles to read on differences between men's and women's mitochondria, the most useful set is the **2021 meta-analysis** for the overview, then the **human PBMC**, **skeletal muscle**, **renal**, and **broad review** papers for tissue-specific detail (Junker et al., 2021; Silaidos et al., 2018; Miotto et al., 2018; Sultanova et al., 2020).

These search results were found and analyzed using Consensus, an AI-powered search engine for research. Try it at https://consensus.app. © 2026 Consensus NLP, Inc. Personal, non-commercial use only; redistribution requires copyright holders' consent.

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