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Editorial

Exercise to Promote Healthy Mitochondria and Improve Lifestyle of Aging Society

Naomi X.Y. Ling

Editorial Board of The Asian Journal of Kinesiology
St. Vincent's Institute of Medical Research, Victoria, Australia

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Mitochondria produce ATP that provides readily releasable energy to cells [1]. In order to maintain proper function, the mitochondrial network undergoes fission to separate damaged mitochondrial fragments from the healthy, and fusion to reduce mitochondrial dysfunction [2,3]. Dynamin-related proteins that are known to regulate mitochondrial fusion include Mitofusin 1 (Mfn1), Mitofusin 2 (Mfn2) and Optic atrophy gene 1 (Opa1), whereas the major effector of fission is Dynamin-related protein 1 (Drp1) which has been most frequently associated with pathological conditions [4].

During aging, mitochondrial performance declines as the balance between fusion and fission is often compromised [5,6]. This imbalance has been implicated in neurodegenerative diseases [6], sarcopenic muscles [2] and various other pathological conditions [2,4]. Exercise has been reported to increase mitochondrial biogenesis, remove damaged mitochondria, stimulate mitochondrial function [5,7] and delay aging associated decline in physical fitness [8-10] and cognitive function [11]. Exercise in the elderly has also been reported to improve mitochondrial efficiency as observed with the increase in Ser637 phosphorylation in Drp1 [12].

Therefore, promoting exercise is a promising strategy to improve lifestyle of the current aging society, requiring further research to better understand the mechanisms of mitochondrial dynamics.

References

1. Dunn J, Grider MH. Physiology, Adenosine Triphosphate. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2022; https://www.ncbi.nlm.nih.gov/books/NBK553175/ (Accessed Feb 17, 2022)
2. Romanello V. The interplay between mitochondrial morphology and myomitokines in aging sarcopenia. International Journal of Molecular Sciences. 2021; 22(1):91.
3. Zhao Y, Zhu Q, Song W, Gao B. Exercise training and dietary restriction affect PINK1/Parkin and Bnip3/Nix-mediated cardiac mitophagy in mice. General. Physiology and Biophysics. 2018; 37(6):657–66.

***Correspondence:** Naomi X.Y. Ling, St. Vincent's Institute of Medical Research, 9 Princes Street, Fitzroy Victoria, Australia 3065; E-mail: nling@svi.edu.au

4. Rosdah AA, Smiles WJ, Oakhill JS, et al. New perspectives on the role of Drp1 isoforms in regulating mitochondrial pathophysiology. Pharmacology & Therapeutics. 2020; 213:107594.
5. Pahlavani HA, Laher I, Knechtle B, Zouhal H. Exercise and mitochondrial mechanisms in patients with sarcopenia. Frontiers in Physiology. 2022; 13:1040381.
6. O'Reilly CL, Miller BF, Lewis Jr. TL Exercise and mitochondrial remodeling to prevent age-related neurodegeneration. Physical Activity, Mitochondria, and Disease. 2023; 134(1).
7. Chen PB, Yang JS, Park Y. Adaptations of skeletal muscle mitochondria to obesity, exercise, and polyunsaturated fatty acids. Lipids. 2018; 53(3):271–8.
8. Moore TM, Zhou Z, Cohn W, et al. The impact of exercise on mitochondrial dynamics and the role of Drp1 in exercise performance and training adaptations in skeletal muscle. Molecular Metabolism. 2019; 21:51-67.
9. Picca A, Calvani R. Molecular mechanism and pathogenesis of sarcopenia: An overview. International Journal of Molecular Sciences. 2021; 22(6):3032.
10. Campos JC, Bozi LHM, Krum B, et al. Exercise preserves physical fitness during aging through AMPK and mitochondrial dynamics. 2023; 120(2):e2204750120.
11. Bernardo TC, Marques-Aleixo, Beleza J, Oliveira PJ, Ascensão A, Magalhães J. Physical Exercise and Brain Mitochondrial Fitness: The Possible Role Against Alzheimer's Disease. Brain Pathology. 2016; 26(5):648-63.
12. Casuso RA, Huertas JR. The emerging role of skeletal muscle mitochondrial dynamics in exercise and ageing. Ageing Research Reviews. 2020; 58:101025.