

## Testosterone and physical exercise positively modulate synaptic ultrastructure in old mice

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Androgenic steroids affect numerous aspects of central nervous system function inclusive of cognition [1]. The hippocampus is an anatomical model to investigate the neuronal structural dynamics because of its prominent plasticity. Androgens modulate the structure and function of the hippocampus by affecting patterns of dendritic arborisation, dendritic spine and spine synapse density. Synaptic contacts, synaptic strength, and plasticity are reduced in the ageing hippocampus as well as neurogenesis. However, evidence of a structural effect of testosterone on the aged hippocampus of normal rodents is lacking. Physical exercise is beneficial to the ageing hippocampus. Recently, we showed that aerobic physical exercise positively modulates synaptic ultrastructural dynamics in the old mice hippocampus [2]. In this work, old (27mo) mice were randomly assigned to one of four groups including 5 mice each: control (C), testosterone administration (10 mg/kg once a week, TA), treadmill training (30 min a day, five days a week at belt speed 8m/min, TT), and treadmill training plus testosterone administration (TTTA). The experimental period was one month. One-way ANOVA of morphometric ultrastructural results obtained in the inner molecular layer of the hippocampal dentate gyrus showed that the numeric and surface density of synapses were significantly different within the four groups ( $p < 0.05$ ) whereas the average size of synaptic contacts was not. Post-hoc analysis (Bonferroni's) showed that both testosterone and physical exercise tended to increase synaptic density, the combination of the two treatments yielding no further increase. It is concluded that testosterone and physical exercise are both able to positively modulate synaptic density in the inner molecular layer of the hippocampal dentate gyrus without affecting synaptic size.

### References

- [1] Patchev et al. (2004) Neurotropic action of androgens: principles, mechanisms and novel targets. *Exp Gerontol.* 39:1651-60.
- [2] Fattoretti et al. (2018) Modulatory Effect of Aerobic Physical Activity on Synaptic Ultrastructure in the Old Mouse Hippocampus. *Front Aging Neurosci.* May 16;10:141.

### Key words

Testosterone, physical exercise, synapse, morphometry.