Flaxseed oil as a neuroprotective agent during trimethyltin-induced neurodegeneration in female rats

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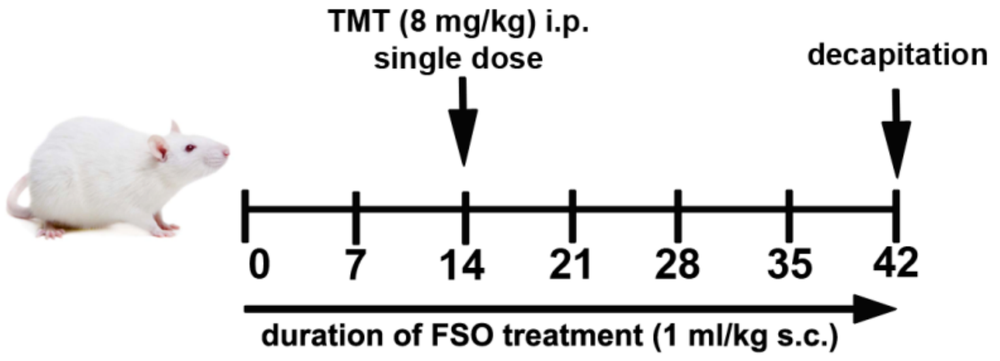
INTRODUCTION

Flaxseed oil (or linseed oil, FSO) derived from the seeds of the flax (Linum usitatissimum L.) gained worldwide awareness as a functional food, with potent neuroprotective properties.

Following nervous system injury, cells massively release adenosine-5'-triphosphate (ATP) into the extracellular space, (a "danger signal") which levels are tightly controlled by NTPDases/ecto-5'-nucleotidase (eN) enzyme chain, which act together as an immune checkpoint since they degrade pro-inflammatory ATP and generate anti-inflammatory adenosine.

Therefore the **AIM** of the present study was determine whether supplementation with FSO may prevent trimethyltin (TMT)-induced neurodegeneration and gliosis in female Wistar rats.

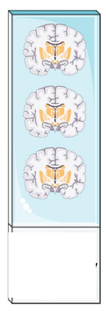
METHODS



4 experimental groups

Ctrl- animals without any treatment; FSO- received FSO for 5 weeks; TMT- received a single dose of TMT, and FSO+TMT- animals pretreated with FSO for two weeks and then received a single dose of TMT and application of FSO continued for twenty one days.

After brain isolation, hippocampal coronal sections were mounted on gelatin-coated slides



1. Thionine staining;
2. Immunohistochemistry with markers of reactive astrocytes (GFAP) and microglia (Iba1);
3. ATP/ADP hydrolysis assay

Results

Data have convincingly showed that FSO continuous treatment ameliorated TMT-induced neuronal loss in CA3* hippocampal region (Figure 1), ameliorated reactivation of astrocytes (Figure 2) and microglia (Figure 3) and inhibited increase in ATP/ADP hydrolysis rates (Figure 4).

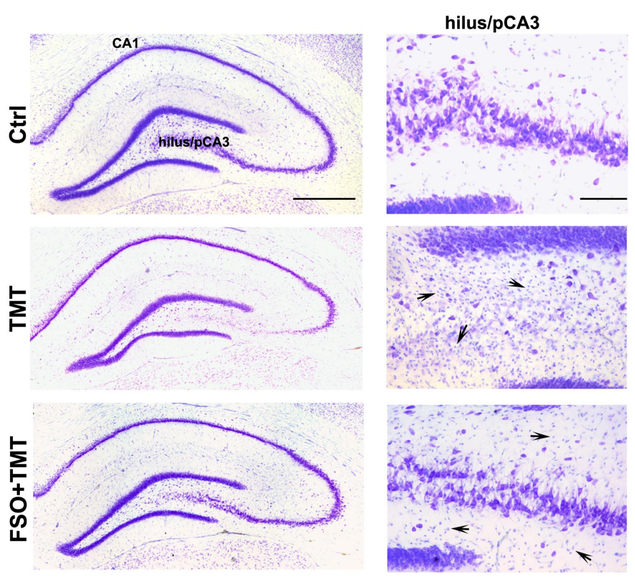


Figure 1. FSO treatment prevented TMT-induced neuronal loss. Representative thionin-stained hippocampal sections showing hilaus/pCA3 subfield of DG of Ctrl animals, TMT animals, and animals treated with FSO+TMT. Scale bar applicable to lower (5x) magnifications – 500 μm and 20μm aplicable to higher (20x) magnifications.

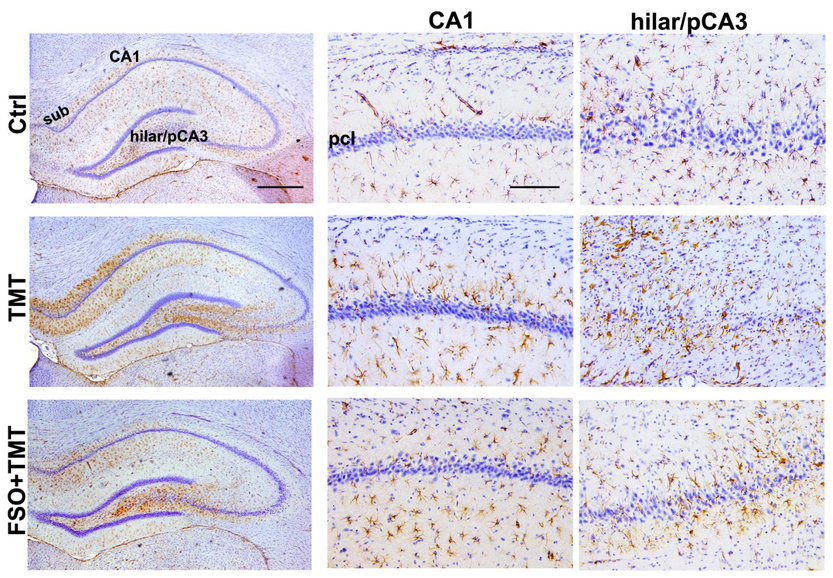


Figure 2. FSO treatment prevented TMT-induced astrogliosis. Representative images of immunolabeling directed to astrocyte marker GFAP in CA1 and hilar/pCA3 subfield of DG in Ctrl, TMT, and FSO+TMT experimental groups. The high magnification images represent GFAP occurence in CA1, and hilar/pCA3 of DG. Scale bar applicable to lower (5x) magnifications – 500 μm and 20μm aplicable to higher (20x) magnifications.

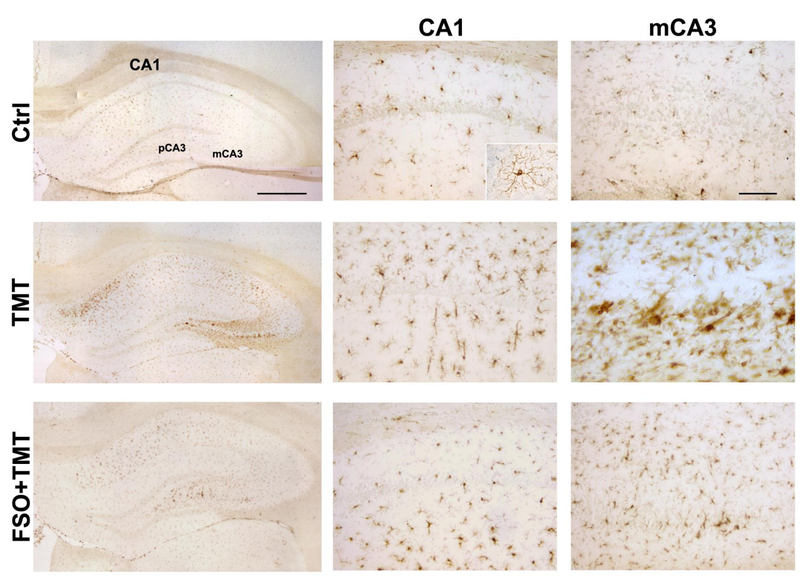


Figure 3. FSO treatment prevented TMT-induced microgliosis. Representative images of immunolabeling directed to microglial marker Iba1 in CA1 and hilar/pCA3 subfield of DG in Ctrl, TMT, and FSO+TMT experimental groups. The high magnification images representIba1occurence in CA1, and hilar/pCA3 of DG. Scale bar applicable to lower (5x) magnifications – 500 μm and 20μm aplicable to higher (20x) magnifications.

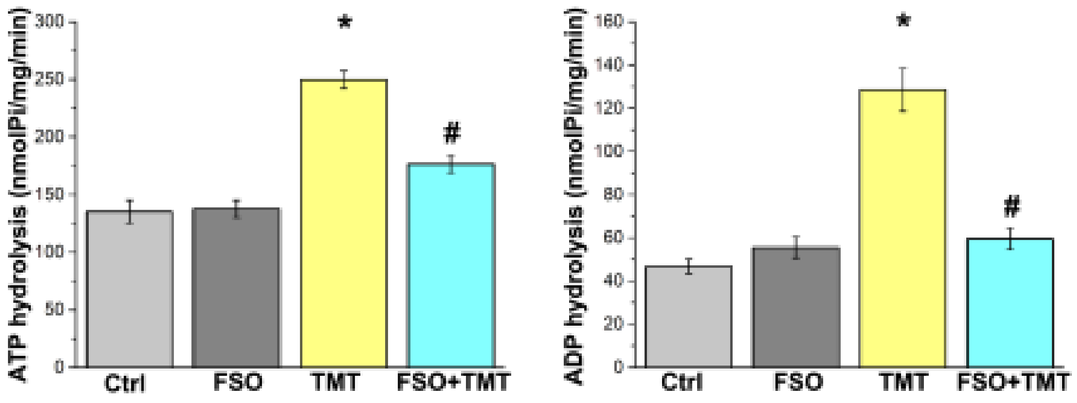


Figure 4. Specific NTPDase activity in the presence of ATP/ADP. FSO prevented TMT-induced increase in ATP/ADP hydrolysis rates. Significance level: *p < 0.001 in respect to Ctrl; # p < 0.001 in respect to TMT.

Conclusion

Pretreatment with FSO prevented TMT-induced increase in ATP/ADP hydrolysis rates probably by preventing neuronal injury, gliosis and consequent massive release of ATP. These findings support beneficial neuroprotective properties of FSO against TMT-induced neurotoxicity and hint at a promising preventive use of FSO in hippocampal degeneration and dysfunction.

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