

Dietary supplementation of gingerols- and shogaols-enriched ginger root extracts attenuate pain-associated behaviors in animals with spinal nerve ligation

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ABSTRACT

- Neuropathic pain (NP), arising from damage to the nervous system, could be a consequence of the imbalance between reactive oxygen species (ROS) and endogenous antioxidants, leading to neuroinflammation after nerve injury.
- This study was aimed to evaluate the effects of two ginger root extracts rich in gingerols and shogaols, respectively, on pain sensitivity and anxiety-like behaviors in the rodent spinal nerve ligation model of neuropathic pain.
- We also assessed the plasma circulating cell-free mitochondrial DNA (ccf-mtDNA) damage, a biomarker of excessive mitochondria-derived ROS linked to inflammation.

METHODS

- 16 male rats were randomly divided into 4 groups: **sham**, **SNL**(spinal nerve ligation pain model) as the control for the ginger groups, **SNL+GEG**(gingerols-enriched ginger extract), and **SNL+SEG**(shogaols-enriched ginger extract). Animals in **SNL+GEG** and **SNL+SEG** groups were fed with their respective diets on the day of SNL surgery for 30 days.
- At 1 day before and 10, 20, and 30 days post operation, behavioral testing was done:
 - (i) **von Frey Test**: paw withdrawal mechanical thresholds were measured using von Frey filaments for sensory pain assessment
 - (ii) **Open Field Test (OFT)**: center frequency and center duration in the open field test (OFT) were measured to assess anxiety-like behavior.
- At Day 30, plasma was obtained to determine **ccf-mtDNA** concentration by qRT-PCR.
- Data were analyzed by one-way ANOVA or one-way repeated measures ANOVA followed by post-hoc analysis.

CONCLUSION

- Both gingerols (**GEG**) and shogaols (**SEG**) supplementation decreased pain sensitivity and improved anxiety-like behavior mediated in part through the suppression of mitochondrial damage.

ACKNOWLEDGEMENT

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RESULTS

1. The **SNL** group had significant greater pain sensitivity to mechanical stimuli compared to the **Sham** group (Figure 1, *).
2. The **SNL+GEG** (Figure 1, *) and **SNL+SEG** (Figure 1, *) groups showed significantly (50%) reduced pain sensitivity (increased thresholds) compared to the **SNL** group.

Figure 1. von Frey Test.

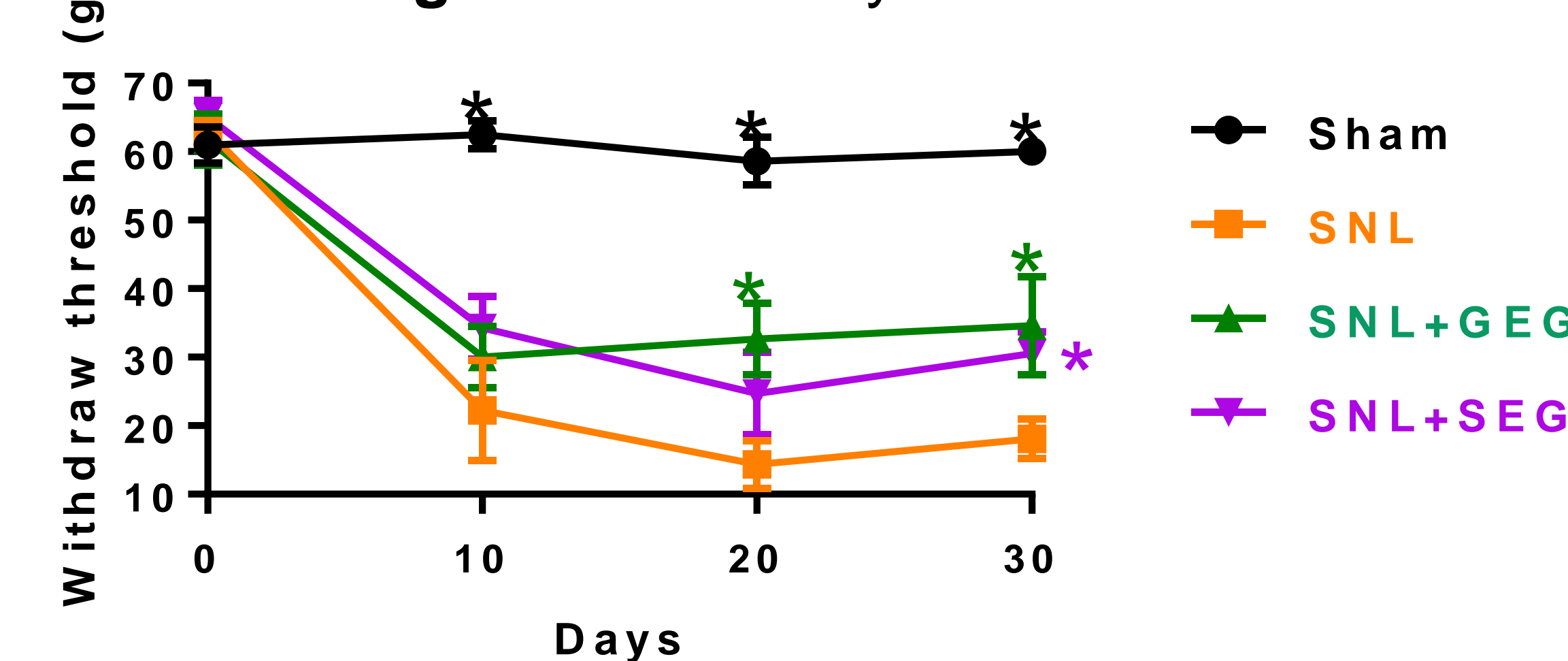


Figure 1. Pain sensitivity.

- * indicates significant difference between **Sham** and **SNL** groups, $p < 0.05$.
- * indicates significant difference between **SNL+GEG** and **SNL** groups, $p < 0.05$.
- * indicates significant difference between **SNL+SEG** and **SNL** groups, $p < 0.05$.

3. The **SNL+GEG** and **SNL+SEG** groups had less anxiety-like behavior, as indicated by prolonged center duration (Figure 2A) and increased center frequency (Figure 2B) in open field test (OFT), than the untreated **SNL** group.

Figure 2A. OFT Center Duration.

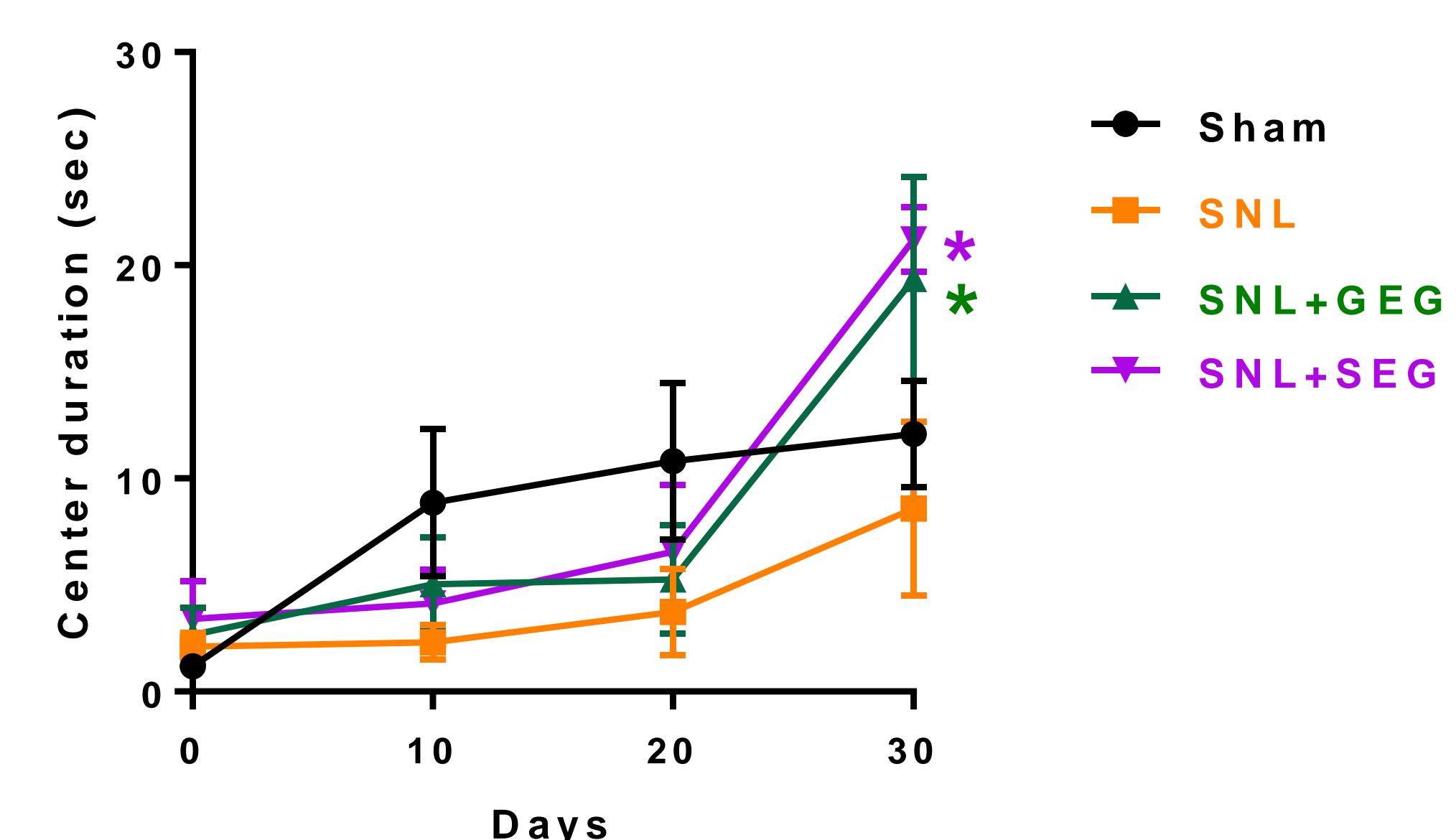
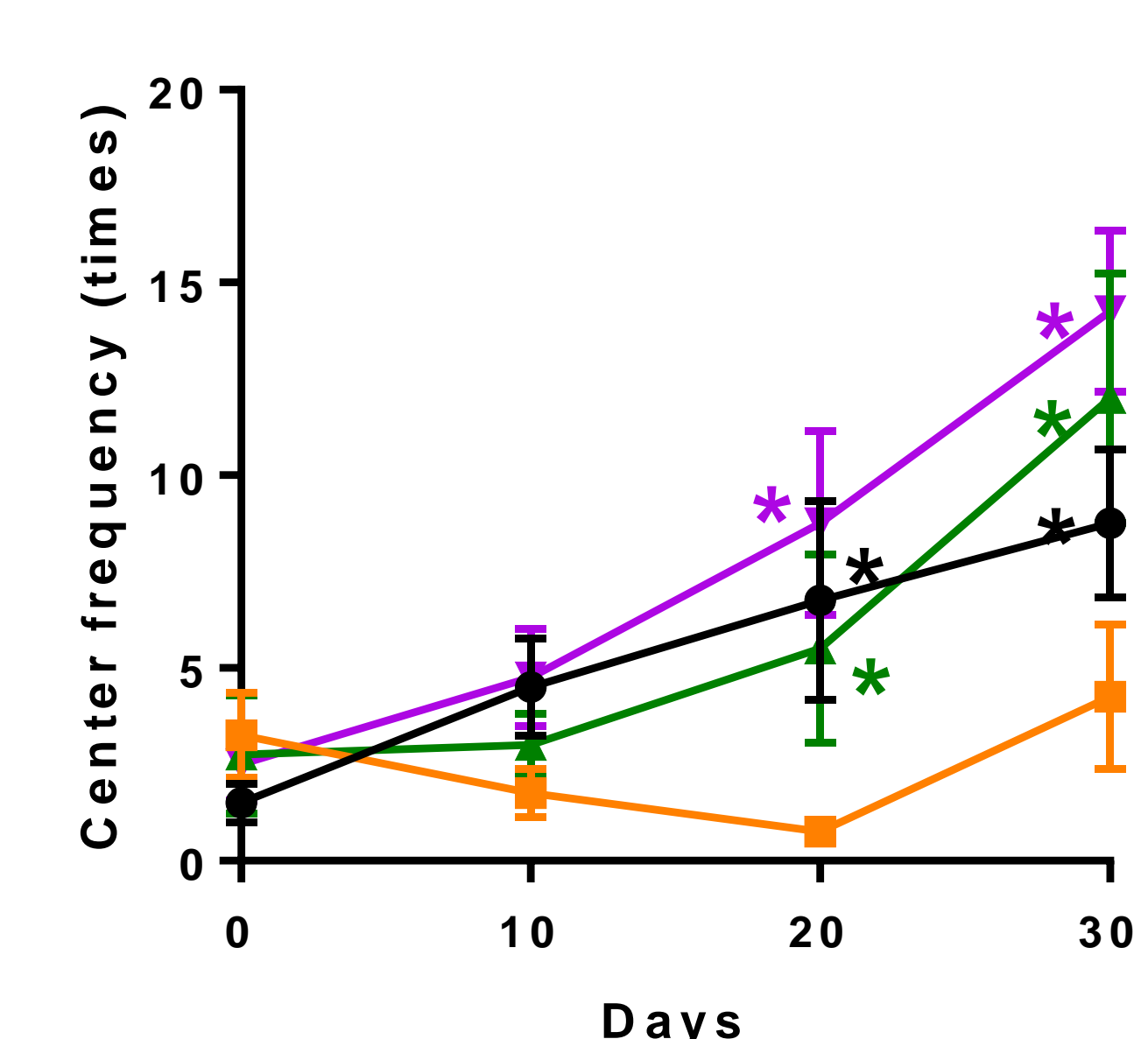


Figure 2B. OFT Center Frequency.



4. The **SNL** group had significantly higher plasma ccf-mtDNA levels than the **sham** group (Figure 3, *).
5. The **SNL+GEG** and **SNL+SEG** groups showed reduction in plasma ccf-mtDNA (Figure 3, * and *).

Figure 3. Plasma ccf-mtDNA levels.

