

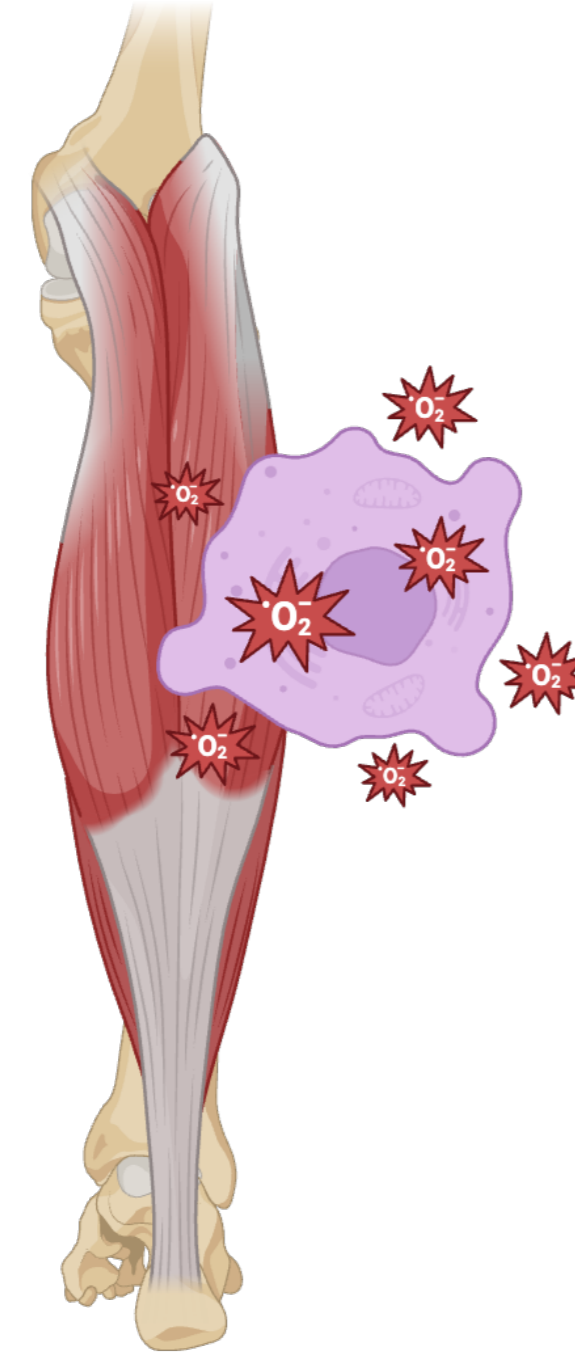


## Background

- Thermal properties of low intensity ultrasound therapy facilitates the generation of heat within the target tissue, enhancing vasodilation, oxygenation, and nutrient exchange, thereby promoting healing and reducing oxidative stress

- It has been previously shown that both antioxidant supplementation and ultrasound therapy reduce oxidative markers in experimental rats after muscle injury when implemented individually

- There has not yet been studies exploring the potentially synergistic effects of ultrasound therapy and antioxidant supplementation in treating muscle injury when used simultaneously



## Goal

- Literature Review: Explore the mechanisms through which this combined approach may optimize muscle injury treatment

- Conceptualize an experiment which can be performed to investigate this relationship

## Methods

Academic literature review studying scientific papers published between 2004-2023 discussing:

- ultrasound therapy in relation to muscle injury
- antioxidant action in relation to muscle injury
- Ultrasound therapy and antioxidant action in relation to one another

## Main Findings

### Antioxidants

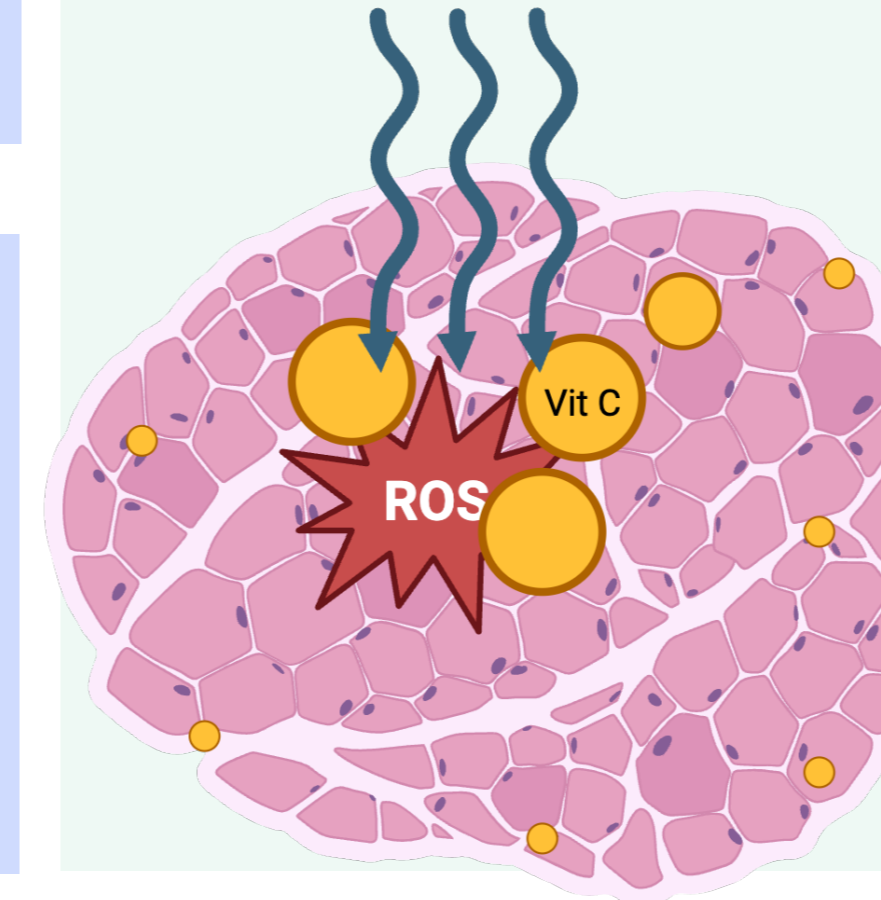
- Melatonin, Quercetin and Selenium have been shown to reduce oxidative stress post injury
- Vitamin C supplementation: there is conflicting evidence on its antioxidant effects on muscle recovery when provided post-injury

### Ultrasound Therapy

- Therapeutic pulsed ultrasound has been shown to reduce inflammatory and oxidative markers (TNF- $\alpha$ , IL-1 $\beta$ , nuclear factor-kappa B proteins, c-jun n-terminal kinases)

### Combined

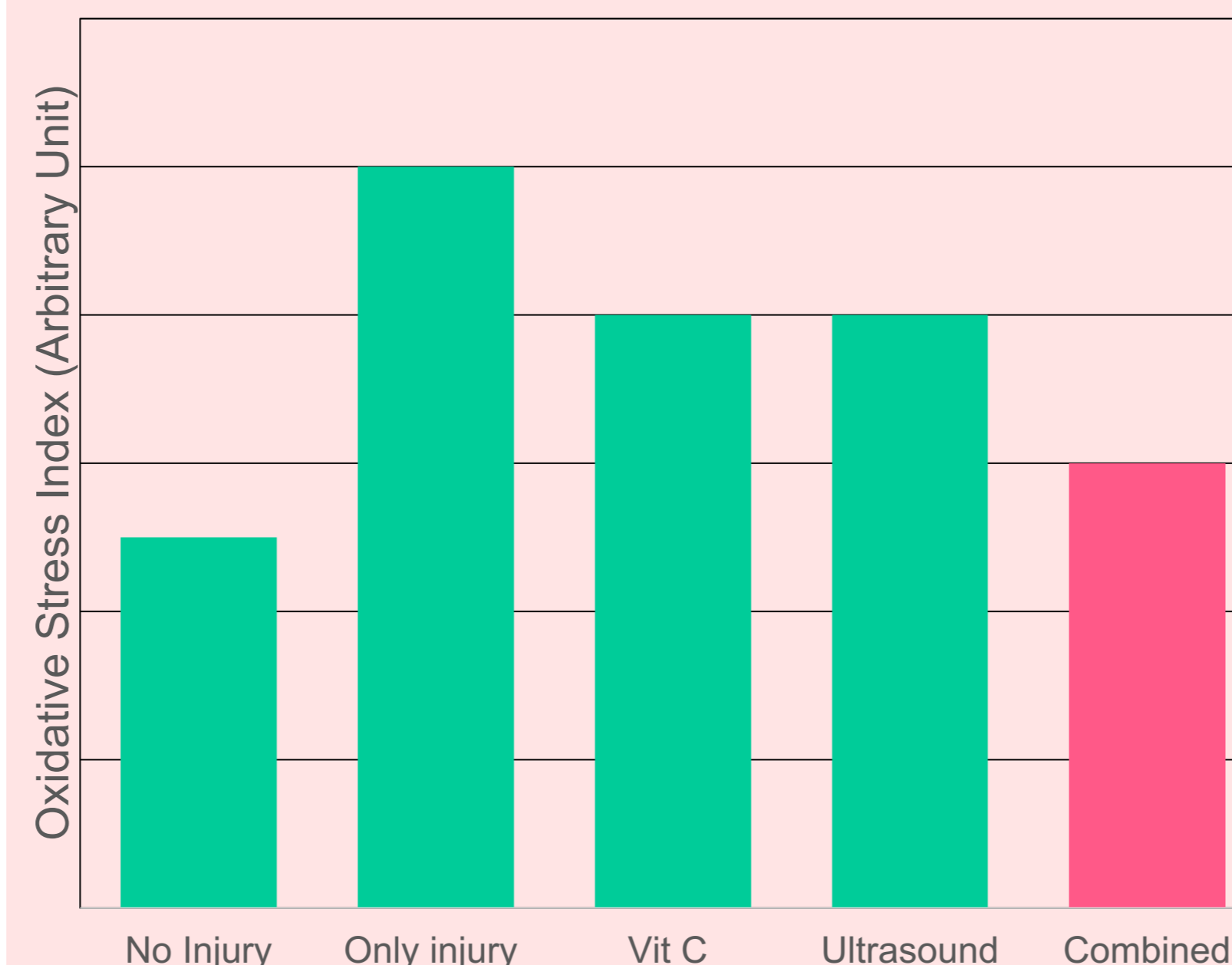
- Higher temperatures improve antioxidant action (45-65°C, 50-150 °C)
- Ultrasound therapy can be targeted at the location and depth of injury



-Increased heat and blood flow would promote the transport of radical-scavenging antioxidants

### Proposed Study

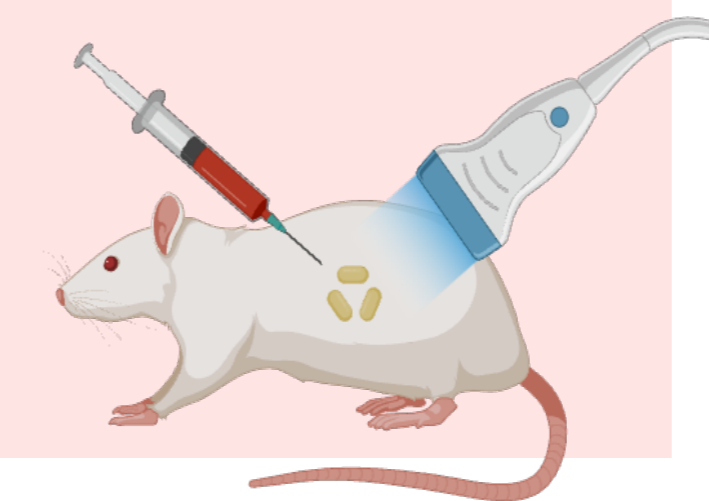
(Methods adapted from Tülüce et al. (2023))



Purpose: studying levels of oxidative markers in injured experimental rats treated with both ultrasound therapy and antioxidants as compared to controls, to establish the relationship between Vit C and Ultrasound therapy

OSI: Considers oxidative markers such as creatine kinase, measured from blood serum post treatment

Expected results: Combined therapy results in lower OSI



### Limitations

- Therapy should be targeted to spare the free radicals which are essential for cellular function
- There have not yet been studies specifically establishing the relationship between Vitamin C antioxidant action and different temperatures

## Conclusions

- The mechanism of action through which ultrasound therapy promotes healing for muscle injuries could also serve to improve the effectiveness of antioxidant supplements by reducing oxidative stress at the site of injury.

- This finding warrants further exploration, beginning with animal studies designed to establish their synergistic potential, and the confines of their relationship if any.

## Future Directions

- Verify the relationship using different kinds of antioxidants

- Exploring its effectiveness in different types of injuries, based on depth, location and severity

- Applications in different systems: ultrasound therapy and antioxidant supplementation in nerve regeneration

## References

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