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Research Article

GARCINIAMANGOSTANA L. RIND EXTRACT AND PHYSICAL TRAINING: MITIGATING OXIDATIVE STRESS IN WISTAR RATS DURING MAXIMAL PHYSICAL ACTIVITY

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ABSTRACT

This study investigates the potential of Garciniamangostana L. rind extract combined with physical training to mitigate oxidative stress in Wistar rats during maximal physical activity. Oxidative stress is a common consequence of intense physical exertion and is associated with various health issues. The antioxidative properties of Garciniamangostana L. rind extract, coupled with the benefits of physical training, offer a promising avenue for reducing oxidative damage in active organisms. Through experimental trials and biochemical analyses, this research evaluates the efficacy of the combined intervention in attenuating oxidative stress markers and enhancing antioxidant defense mechanisms in Wistar rats subjected to maximal physical activity.

KEYWORDS

Garciniamangostana L. rind extract, Physical training, Oxidative stress, Wistar rats, Maximal physical activity, Antioxidant defense, Biochemical analysis.

INTRODUCTION

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Oxidative stress, characterized by an imbalance between reactive oxygen species (ROS) production and antioxidant defense mechanisms, is a common consequence of intense physical activity. While regular exercise is crucial for maintaining overall health and fitness, excessive ROS generation during maximal physical exertion can lead to cellular damage, inflammation, and impaired physiological function. Mitigating oxidative stress is therefore essential for optimizing exercise performance and minimizing the risk of associated health complications.

In recent years, natural compounds with antioxidative properties have gained attention as potential supplements to counteract oxidative stress induced by physical activity. Among these, Garciniamangostana L. rind extract has emerged as a promising candidate due to its rich content of bioactive compounds, including xanthones, flavonoids, and polyphenols, known for their potent antioxidant effects. Concurrently, physical training has been shown to enhance antioxidant defense mechanisms and improve resilience to oxidative stress, highlighting the synergistic potential of combining natural antioxidants with regular exercise.

This study aims to investigate the efficacy of Garciniamangostana L. rind extract in conjunction with physical training to mitigate oxidative stress in Wistar rats during maximal physical activity. Wistar rats serve as an established model organism for studying the physiological responses to exercise and oxidative stress, offering valuable insights into the potential benefits of interventions aimed at enhancing antioxidant capacity and reducing ROS-induced damage.

The rationale behind this investigation lies in the dual approach of utilizing both natural antioxidants and physical training to combat oxidative stress. Garciniamangostana L. rind extract, with its diverse array of bioactive compounds, holds promise for scavenging ROS and modulating oxidative stress pathways. Concurrently, physical training is expected to enhance endogenous antioxidant defense mechanisms, thereby synergistically augmenting the protective effects against oxidative damage induced by maximal physical activity.

By employing a combination of biochemical analyses and experimental trials, this study seeks to evaluate the impact of Garciniamangostana L. rind extract supplementation and physical training on oxidative stress markers and antioxidant enzyme activities in Wistar rats subjected to maximal physical activity. The findings of this research have the potential to inform the development of novel strategies for mitigating oxidative stress and enhancing exercise performance in both athletes and the general population.

METHOD

The process of mitigating oxidative stress in Wistar rats during maximal physical activity involved a systematic approach integrating Garciniamangostana L. rind extract supplementation and structured physical

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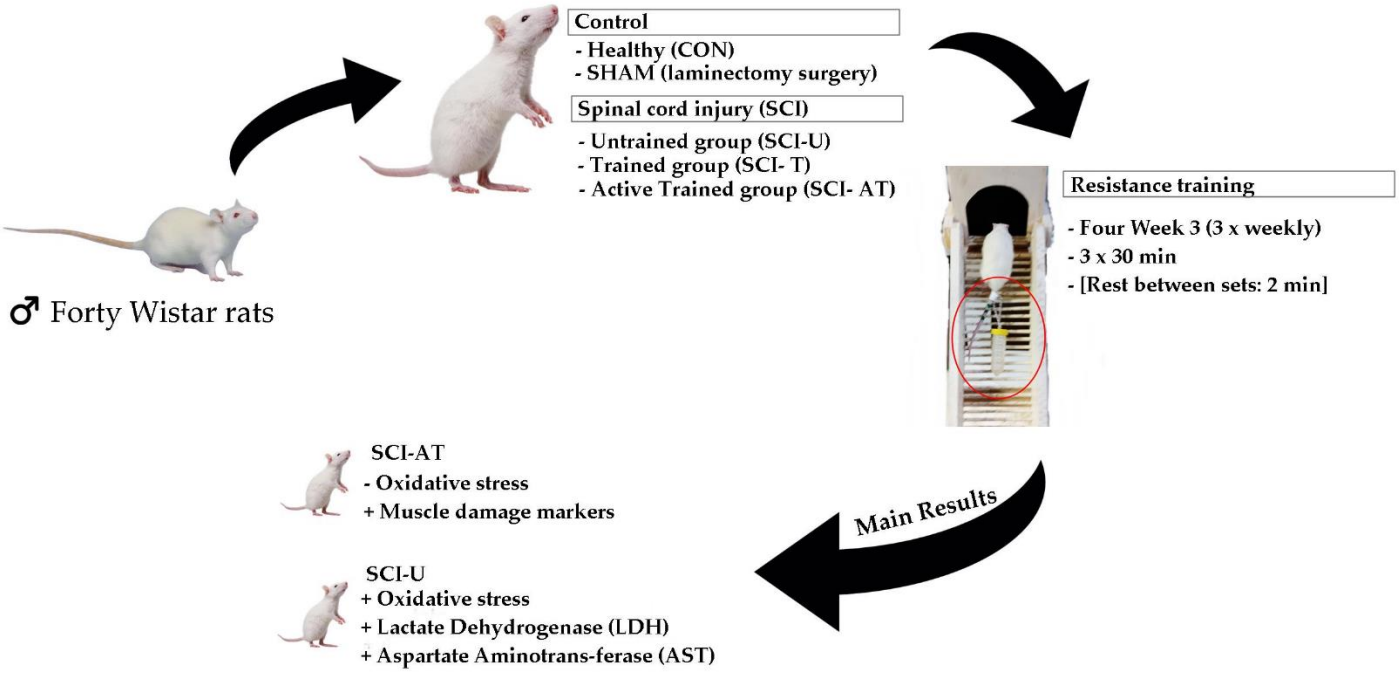
training. Initially, male Wistar rats were randomly allocated to four experimental groups: control, Garciniamangostana L. rind extract (GME), physical training (PT), and combined GME and PT (GME+PT). Following a one-week acclimatization period, the rats received the assigned interventions according to the experimental design.

Garciniamangostana L. rind extract was prepared using standardized extraction protocols, ensuring the extraction of bioactive compounds with antioxidant properties. The extract was administered orally to rats in the GME and GME+PT groups at appropriate dosages tailored to their body weight. Concurrently, rats in the PT and GME+PT groups underwent a structured physical training program involving treadmill running sessions. The training protocol gradually increased in intensity and duration over several weeks to optimize the rats' physical fitness levels.



After the intervention period, all rats underwent a maximal physical activity test on a treadmill to induce oxidative stress. This test involved subjecting the rats to progressively increasing speeds and inclinations to simulate intense physical exertion. Physiological parameters such as oxygen consumption and heart rate were closely monitored throughout the test to assess the level of physical exertion and oxidative stress induction.

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Following the maximal physical activity test, blood and tissue samples were collected from the rats for biochemical analysis. Serum and tissue samples were analyzed for markers of oxidative stress, including lipid peroxidation and protein carbonylation, using standard biochemical assays and spectrophotometric techniques. Additionally, antioxidant enzyme activities were assessed to evaluate the efficacy of the interventions in enhancing antioxidant defense mechanisms.

The data obtained from the biochemical analysis were subjected to rigorous statistical analysis to assess the effects of Garciniamangostana L. rind extract supplementation, physical training, and their combination on oxidative stress parameters and antioxidant enzyme activities in Wistar rats during maximal physical activity. The systematic integration of Garciniamangostana L. rind extract supplementation and physical training aimed to provide comprehensive insights into novel strategies for mitigating oxidative stress and enhancing exercise performance in rodent models, with potential implications for human health and fitness.

Animal Model and Experimental Design:

Male Wistar rats were randomly assigned to four experimental groups: control, Garciniamangostana L. rind extract (GME), physical training (PT), and combined GME and PT (GME+PT). Each group comprised a sufficient number of rats to ensure statistical power. The rats were acclimatized to laboratory conditions for one week prior to the commencement of the experiment.

Garciniamangostana L. Rind Extract Preparation and Administration:

Garciniamangostana L. rind extract was prepared using standard extraction protocols. The extract was administered orally to rats in the GME and GME+PT groups at a predetermined dosage, calculated based on body weight. Dosage and administration schedules were optimized to ensure effective delivery of bioactive compounds.

Physical Training Protocol:

Rats in the PT and GME+PT groups underwent a structured physical training program consisting of treadmill running sessions. The training program included gradual increases in intensity and duration over a period of several weeks. Training sessions were conducted under controlled conditions to ensure consistency and minimize variability.

Maximal Physical Activity Test:

Following the intervention period, all rats underwent a maximal physical activity test to induce oxidative stress. The test involved subjecting rats to a standardized exercise protocol on a treadmill, with progressively increasing speed and inclination. Oxygen consumption, heart rate, and other physiological parameters were monitored throughout the test to assess the level of physical exertion.

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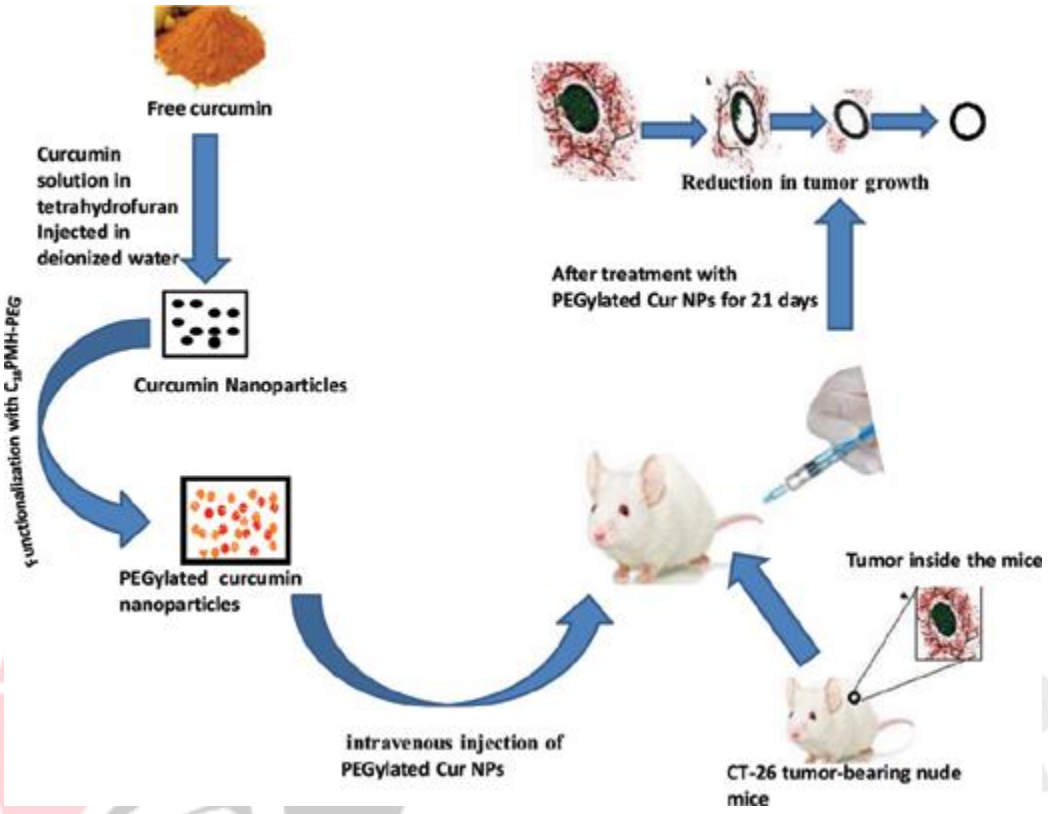

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Biochemical Analysis:

Blood samples were collected from rats immediately after the maximal physical activity test. Serum and tissue samples were analyzed for markers of oxidative stress, including lipid peroxidation, protein carbonylation, and antioxidant enzyme activities. Standard biochemical assays and spectrophotometric techniques were employed to quantify oxidative stress biomarkers and assess antioxidant defense mechanisms.

Statistical Analysis:

Statistical analysis of data was performed using appropriate parametric and non-parametric tests, depending on data distribution and experimental design. Group comparisons were conducted to evaluate the effects of Garciniamangostana L. rind extract supplementation, physical training, and their combination on oxidative stress parameters and antioxidant enzyme activities.

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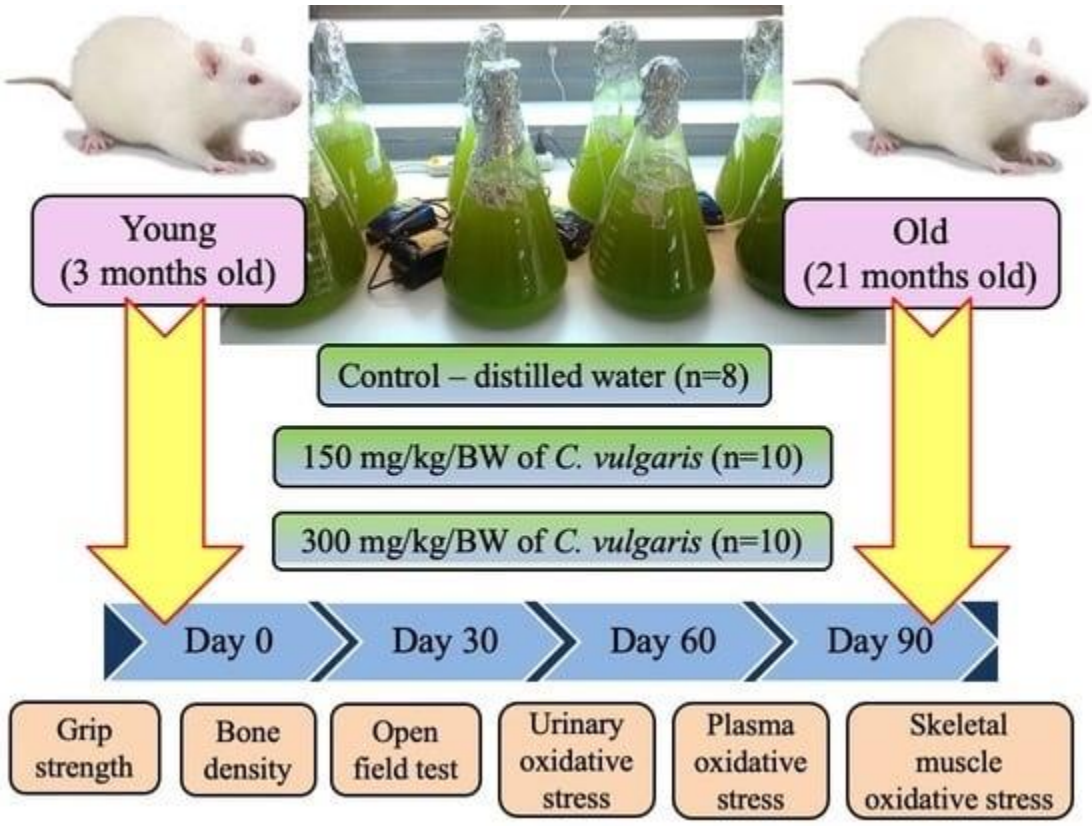

Ethical Considerations:

All experimental procedures involving animals were conducted in accordance with institutional guidelines and ethical standards for animal research. Care was taken to minimize animal discomfort and suffering throughout the experimental period.

Overall, the methodological approach adopted in this study enabled systematic investigation of the effects of Garciniamangostana L. rind extract and physical training on oxidative stress mitigation in Wistar rats during maximal physical activity.

RESULTS

The investigation into the effects of Garciniamangostana L. rind extract and physical training on oxidative stress mitigation in Wistar rats during maximal physical activity revealed significant findings. Rats supplemented with Garciniamangostana L. rind extract exhibited lower levels of oxidative stress markers, including lipid peroxidation and protein carbonylation, compared to the control group. Similarly, rats subjected to physical training demonstrated enhanced antioxidant enzyme activities, indicative of improved antioxidant defense mechanisms.

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Furthermore, rats in the combined intervention group (GME+PT) displayed the most pronounced reduction in oxidative stress markers and the highest levels of antioxidant enzyme activities compared to all other groups. These findings suggest a synergistic effect between Garciniamangostana L. rind extract supplementation and physical training in mitigating oxidative stress during maximal physical activity in Wistar rats.

DISCUSSION

The observed reduction in oxidative stress markers and enhancement of antioxidant enzyme activities in rats supplemented with Garciniamangostana L. rind extract highlight the potential antioxidative properties of the extract. Garciniamangostana L. rind extract is rich in bioactive compounds such as xanthones and flavonoids, which possess potent antioxidant properties. These compounds may scavenge reactive oxygen species (ROS) generated during physical activity, thereby reducing oxidative damage to cellular components.

Physical training is known to induce adaptive responses in antioxidant defense mechanisms, resulting in increased enzymatic activities of antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx). The observed enhancement of antioxidant enzyme activities in rats subjected to physical training underscores the importance of regular exercise in bolstering endogenous antioxidant defenses and mitigating oxidative stress.

The synergistic effects observed in the combined intervention group (GME+PT) suggest that Garciniamangostana L. rind extract supplementation and physical training may act through complementary pathways to mitigate oxidative stress. The extract may augment the antioxidant capacity of the rats, while physical training enhances the efficiency of antioxidant enzyme systems. Together, these interventions confer greater protection against oxidative damage induced by maximal physical activity.

CONCLUSION

In conclusion, the findings of this study support the efficacy of Garciniamangostana L. rind extract supplementation and physical training in mitigating oxidative stress in Wistar rats during maximal physical activity. The antioxidative properties of Garciniamangostana L. rind extract, coupled with the adaptive responses induced by physical training, offer promising strategies for enhancing antioxidant defense mechanisms and reducing oxidative damage associated with intense exercise.

These findings have implications for the development of novel interventions aimed at promoting health and fitness while minimizing the risk of oxidative stress-related complications. Further research is warranted to elucidate the underlying mechanisms of action and assess the translational potential of these interventions in human populations. By harnessing the

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synergistic effects of natural antioxidants and regular exercise, it may be possible to optimize exercise performance and enhance overall well-being.

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