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Catechin in Gambir Extract (Uncaria Gambir. Roxb) with a Protective Effect Against Inflammation and Hematological Alterations in Wistar Rats

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Abstract

This study is to investigate the effects of catechins from Uncaria gambir extract, which has anti-inflammatory and antioxidant activities in Wistar male rats with peroral administration. Two weeks before the intervention, 24 mice were exposed to cigarette smoke for 3 hours/day, and then the mice were randomly divided into 4 groups, namely the control group (given aquadest), the dose group 45 mg/kg, 90 mg/kg and the group 180 mg/kg. Gambir extract is given the extract daily for 14 days, then blood samples are taken before and after the period of drug administration. The result was a significant increase in hemoglobin, hematocrit, MCV, and MCHC in the dose group of 180 mg/kg and increased leukocytes seen in all intervention groups. Decreased CRP values and elevated levels of superoxide dismutase (SOD) in the blood also saw significant differences before and after the intervention. This indicates a high anti-inflammatory and antioxidant activity of gambir, which will indirectly help prevent and inhibit inflammation in the body.

Keywords: Catechin, Uncaria Gambir, Inflammatory, Antioxidant, Superoxide Dismutase

INTRODUCTION

The study on the anti-inflammatory and antioxidant effects of Uncaria gambir extract is rooted in the need to explore the medicinal potential of this plant (Granger, & Senchenkova, 2010). Uncaria gambir, commonly referred to as gambir, has been traditionally used in various cultures for its perceived health benefits, and recent scientific interest has focused on understanding its bioactive properties, particularly its anti-inflammatory and antioxidant effects. Chronic inflammation and oxidative stress are known contributors to a variety of diseases, including cardiovascular conditions, neurodegenerative disorders, and cancers. Thus, identifying natural compounds capable of counteracting these effects holds significant potential for therapeutic applications.

The main active component of Uncaria gambir extract is catechin, a type of polyphenol with well-documented health benefits (Gunaydin, & Bilge, 2018). Catechins are recognized for their strong antioxidant properties, which enable them to neutralize free radicals, thus reducing oxidative stress and preventing cellular damage. Moreover, catechins possess anti-inflammatory capabilities by modulating inflammatory pathways, decreasing the production of pro-inflammatory cytokines, and regulating immune responses. These properties make catechins, particularly those derived from Uncaria gambir, a promising candidate for the management of conditions linked to inflammation and oxidative stress.

There is a growing body of evidence suggesting the potential health benefits of catechins derived from Uncaria gambir. However, most studies have focused on the general effects of catechins in various models without specific attention to the route of administration and dosage on particular subjects. Given this context, the current research aims to fill this gap by exploring the effects of orally administered Uncaria gambir extract on a controlled animal model. Specifically, the study

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uses male Wistar rats, which are a common choice for preclinical research due to their physiological similarities to humans and well-understood biological responses.

The choice of administering the extract orally reflects a realistic route for potential therapeutic applications in humans and allows for the study of its bioavailability and systemic effects (Ide, & Yamada, 2016). The model also involves exposing the rats to cigarette smoke, which is known to induce oxidative stress and inflammation, thereby creating a physiological state that mimics chronic inflammatory conditions in humans. This model provides a relevant context for understanding how the active compounds in Uncaria gambir can mitigate inflammation and oxidative stress.

The primary aim of this research is to investigate the effects of Uncaria gambir extract on reducing inflammation and oxidative stress markers in the experimental subjects. The study tests varying dosages of the extract to determine the optimal concentration that provides the greatest therapeutic effect. This approach not only seeks to establish the efficacy of the extract in improving the health status of rats exposed to cigarette smoke but also aims to identify dose-dependent responses, which are crucial for the potential translation of findings to human health.

Ultimately, the findings from this research are expected to contribute to the growing body of knowledge on the medicinal properties of Uncaria gambir. By providing evidence of its anti-inflammatory and antioxidant effects, particularly in response to the stressors induced by cigarette smoke exposure, the study aims to highlight the potential of Uncaria gambir extract as a natural therapeutic agent. This could pave the way for further investigations into its applications in preventing or treating inflammation-related diseases.

METHODS

The research design employed in this study is experimental, using an animal model to explore the effects of Uncaria gambir extract (Muller, 2013). A total of 24 male Wistar rats were chosen as the sample subjects for the study. Prior to the intervention, all rats were exposed to cigarette smoke for 3 hours per day over a period of two weeks to induce oxidative stress and inflammation, simulating chronic exposure to harmful environmental factors. This pre-intervention exposure served to establish a baseline level of inflammation and oxidative stress, allowing for an assessment of the impact of the gambir extract on these physiological conditions.

The intervention groups were established by randomly dividing the 24 rats into four distinct groups. One group served as the control and was given distilled water (aquadest), while the remaining three groups received different doses of Uncaria gambir extract: 45 mg/kg, 90 mg/kg, and 180 mg/kg body weight, respectively. The extract was administered orally to all rats daily for a period of 14 days. Blood samples were collected from the rats both before and after the treatment period to measure the effects of the intervention. Key hematological and biochemical parameters were assessed, including hemoglobin levels, hematocrit, Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin Concentration (MCHC), leukocyte count, C-Reactive Protein (CRP) levels, and the activity of superoxide dismutase (SOD) enzyme. These measurements provided a comprehensive profile of the inflammatory and oxidative status of the rats and allowed for the evaluation of the therapeutic potential of Uncaria gambir extract at different dosage levels.

RESULTS

The results of the study indicated a significant increase in hemoglobin, hematocrit, Mean Corpuscular Volume (MCV), and Mean Corpuscular Hemoglobin Concentration (MCHC) in the

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group that was administered a dose of 180 mg/kg of Uncaria gambir extract. This suggests that the extract, particularly at this higher dose, has a pronounced effect on these hematological parameters, potentially improving the oxygen-carrying capacity of the blood and enhancing overall red blood cell function.

Additionally, the leukocyte count showed an increase across all intervention groups that received the Uncaria gambir extract. This rise in leukocytes may be indicative of an immune response or modulation influenced by the extract. The elevation in leukocyte numbers across various dosage groups implies that the extract may stimulate an adaptive immune response, which can play a role in the body's defense mechanism and healing processes.

Furthermore, there was a significant decrease in C-Reactive Protein (CRP) values and an increase in superoxide dismutase (SOD) levels before and after the intervention across all dosage groups. CRP is a marker of inflammation, and its reduction points to an anti-inflammatory effect of the extract. The enhancement in SOD, an important antioxidant enzyme, suggests that the Uncaria gambir extract aids in reducing oxidative stress. These findings collectively highlight the anti-inflammatory and antioxidant effects of the extract, which become more prominent at higher doses, indicating that Uncaria gambir can play a role in mitigating inflammation and oxidative damage in biological systems.

DISCUSSION

The discussion focuses on the role of catechins in Uncaria gambir extract, contributing to the observed increases in hemoglobin, hematocrit, Mean Corpuscular Volume (MCV), and Mean Corpuscular Hemoglobin Concentration (MCHC). Catechins are polyphenolic compounds known for their biological activities, including enhancing red blood cell parameters. This suggests that catechins in the gambir extract may positively affect erythropoiesis, improving oxygen transport and blood health. Their presence may facilitate the enhancement of these hematological indices, particularly when administered in higher doses, as seen in the study's findings with a dose of 180 mg/kg.

The anti-inflammatory and antioxidant effects of the gambir extract were also evident in the study, as shown by the decrease in C-Reactive Protein (CRP) and an increase in superoxide dismutase (SOD) levels. CRP is a commonly used biomarker for inflammation, and its reduction reflects the anti-inflammatory properties of catechins. The rise in SOD activity is significant, as this enzyme plays a critical role in neutralizing reactive oxygen species, suggesting that the gambir extract enhances antioxidant defense mechanisms. These changes point to the dual functionality of the extract in addressing both inflammation and oxidative stress.

When comparing these results to previous studies on the anti-inflammatory and antioxidant effects of catechins or similar plants, it is evident that the outcomes are consistent with the established benefits of catechin-rich compounds. Prior research has indicated that catechins from green tea and other polyphenol-rich sources can mitigate inflammation, enhance antioxidant activity, and support hematological health. The current study adds to this body of evidence, emphasizing the potential efficacy of Uncaria gambir as a comparable source of beneficial catechins with similar health-promoting effects.

The implications of these findings are significant for the potential use of Uncaria gambir extract as a therapeutic agent. Its capacity to modulate inflammatory responses and reduce oxidative stress could make it an effective natural remedy for conditions associated with chronic inflammation and oxidative damage, such as cardiovascular diseases, metabolic disorders, and inflammatory

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conditions. By enhancing both anti-inflammatory and antioxidant defenses, the extract shows promise in promoting overall health and disease prevention.

However, this study has certain limitations that should be addressed in future research. The use of a single animal model (Wistar rats) limits the generalizability of the findings to other species, including humans. Additionally, while the study explores different dosages, it does not evaluate long-term effects or potential toxicity over extended periods of use. Further research is needed to confirm the safety and efficacy of Uncaria gambir extract in different models and at varying doses and durations, as well as to explore its mechanisms of action at the molecular level.

In conclusion, while the current study provides valuable insights into the therapeutic potential of Uncaria gambir extract, additional studies are warranted to further explore its clinical applications. Such research should focus on human trials, optimal dosing regimens, and an in-depth exploration of the mechanisms by which catechins exert their anti-inflammatory and antioxidant effects. This will pave the way for the development of effective therapeutic interventions for inflammation and oxidative stress-related diseases using natural compounds like Uncaria gambir.

CONCLUSION

The extract of Uncaria gambir, which contains catechins, demonstrates significant anti-inflammatory and antioxidant effects in male Wistar rats, particularly at a dosage of 180 mg/kg. This observation is evidenced by the reduction in markers of inflammation and the enhancement of antioxidant enzyme activity, indicating that catechins play a crucial role in modulating these biological processes. The study highlights the potential of the extract in enhancing hematological parameters, reducing oxidative stress, and lowering inflammatory markers, making it a promising natural agent for maintaining cellular health and preventing inflammation-induced damage.

The findings of this research support the use of Uncaria gambir extract as a potential agent for the prevention and management of inflammatory conditions. Its strong anti-inflammatory and antioxidant properties suggest that the extract could help regulate immune responses and oxidative stress, thereby providing therapeutic benefits. The study's outcomes point towards the feasibility of using this plant-derived compound as a complementary treatment for diseases associated with chronic inflammation and oxidative stress, adding to the growing evidence of the health benefits offered by catechins. Further research into optimal dosing and long-term effects will help clarify its role in clinical applications for managing inflammation and promoting health.

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