Patient-Centered Approaches to Medical Intervention

Proceedings of International Conference September 27 & 28, 2024 | Online | Worldwide

CRC Press
Taylor & Francis Group

MedForum: International Conference on Patient-Centered Approaches to Medical Intervention

About MedForum

This book is the collection of selected articles that appeared at the First MedForum: International Conference on Patient-Centered Approaches to Medical Intervention held in Hyderabad in virtual mode on September 27 & 28, 2024.

In this forum following issues were discussed: exploring the collaborative process where healthcare providers and patients work together to select treatments that best align with clinical evidence, patient values, and individual preferences, delving into cutting-edge approaches to tailoring medical interventions based on genetic profiles, lifestyle choices, and environmental factors for improved efficacy and minimized risks, discovering methods to empower patients through education, communication, and the integration of patient-reported outcomes into healthcare practices, examining strategies for reducing disparities and ensuring equitable healthcare access for all, particularly underserved populations, learning about the transformative role of telemedicine, wearable devices, and digital health platforms in modern healthcare, and how they connect patients and professionals with the latest medical advancements, gaining an understanding of the ethical challenges in patient-centered care, including privacy, autonomy, and the ethical use of emerging technologies.


Taylor & Francis
Taylor & Francis Group

MedForum: International Conference on Patient-Centered Approaches to Medical Intervention

Edited by
Dr. Tanima Bhattacharya
Dr. Eugenio Vocaturo

CRC Press
Taylor & Francis Group

First published 2024
by CRC Press
4 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by CRC Press
2385 NW Executive Center Drive, Suite 300, Boca Raton FL 33431

CRC Press is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record has been requested for this book

Typeset in Times LT Std by Aptara, Inc.

MedForum: International Conference on Patient-Centered Approaches to Medical Intervention 2024 – Dr. Tanima Bhattacharya et al. (eds)

Pharmacological correction of fatty liver disease by supramolecular complexes of gallic acid

Feruza Kh. Inoyatova[1], Mashkhura I. Abdullayeva[2], Alimjan Matchanov[3], Ulugbek Z. Zaribbayevich[4], Akmal A. Odilov[5] , Komila G. Mirakhmedova[6]
[1,2,3,4,5,6]Tashkent Medical Academy, Tashkent, Uzbekistan
Email: inoyatovaf49@mail.ru, mashhura.ikromjonovna@mail.ru, olim_0172@mail.ru, ulugbek@rambler.ru, kmirakhmedova@gmail.com

.

Abstract
Currently affecting a quarter of the global population, Non-alcoholic fatty liver disease (NAFLD) is the most common cause of liver cirrhosis and and is recognized as the hepatic phenomenon of metabolic syndrome. The possible effects of supramolecular complex gallic acid on experimental nonalcoholic fatty liver injury were examined in this article. Rats were fed a standard diet and a high-fat diet (HFD). Rats fed HFD were given 10% fructose and 10% glucose syrup instead of water for twenty weeks to induce the NAFLD model. Supramolecular complex (SC) was administered orally to rats in the last 4 weeks. Our results showed that treatment reduced hyperenzymemia, hyperbilirubinemia, hypercholesterolemia, and dysproteinemia and significantly ameliorated the histopathological lesions induced by HFD. These results show that the supramolecular complex of gallic acid possesses a marked role in the treatment of NAFLD.
Keywords: high fat diet, nonalcoholic fatty liver disease, gallic acid, glycyrrhizic acid, carsil, supramolecular complex, biochemical parameters

Introduction

Non-alcoholic fatty liver disease (NAFLD) is a prevalent liver disorder affecting nearly 25% of the global population and is projected to increase further, posing significant public health challenges [1]. It is associated with obesity, insulin resistance, and metabolic syndrome, leading to severe liver conditions, including cirrhosis and hepatocellular carcinoma [2]. Research shows that diet-induced models of NAFLD help elucidate its pathogenesis, and recent studies have explored the potential therapeutic effects of natural compounds like glycyrrhizic acid and gallic acid [3]. Glycyrrhizic acid has demonstrated hepatoprotective and anti-inflammatory properties, particularly in suppressing necrosis and collagen production [4], while gallic acid is recognized for its antioxidant, anti-inflammatory, and anti-cancer activities [5]. Despite promising results, there is a lack of consensus on the most effective therapeutic approaches for managing NAFLD, particularly in preventing the progression of liver damage [6]. In this study, we propose that the use of a supramolecular complex of gallic acid and glycyrrhizic acid could significantly ameliorate the biochemical and histopathological effects of NAFLD, offering a novel and effective strategy for combating this widespread condition. This approach could benefit the field of medical sciences by providing a more targeted treatment for liver disease management.

Materials and Methodology

The study was conducted on 50 male Wistar rats, aged six to eight weeks, with an average weight of 180–220 grams. The rats were housed under controlled 12-hour light/dark cycles, with access to food and water. NAFLD was induced by feeding the rats a high-fat diet (HFD) and replacing water with 10% fructose and glucose for 20 weeks. The treatment began in the 16th week and lasted for 4 weeks. Four groups were created: a control group, an HFD-only group, a comparison group treated with Carsil (100 mg/kg), and the main group treated with a supramolecular complex of glycyrrhizic acid and gallic acid (100 mg/kg). Blood samples were collected after fasting, and biochemical parameters such as total protein, albumin, cholesterol, and liver enzymes were analysed using a MINDRAYBA-88A analyser. Histological examination of liver tissues was performed after staining with hematoxylin-eosin. The results were statistically analysed using OriginPro 8.6 with a significance threshold set at $P<0.05$. The study included the use of a novel supramolecular complex but excluded any direct comparisons with other pharmaceutical interventions. Only male rats were used, limiting the generalisability of the findings across genders.

Results

The study evaluated the effects of a supramolecular complex (SC) of glycyrrhizic acid and gallic acid on non-alcoholic fatty liver disease (NAFLD) induced by a high-fat diet (HFD) in rats. The biochemical, histopathological, and enzymatic parameters of liver function were assessed in various experimental groups, including rats treated with the hepatoprotective agent Carsil as a comparison.

Biochemical Analysis

The results revealed a significant increase in liver enzymes and metabolic disruptions in rats exposed to HFD. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels were elevated by 83% and 732%, respectively, indicating liver damage. Rats treated with the SC demonstrated a substantial reduction in these enzymes. ALT levels decreased by 4474% in the SC group, compared to a 385% reduction in the Carsil group. AST levels in the SC-

treated rats were reduced by 3787%, while Carsil reduced AST by 378% (Figure 1A-B). This suggests that the SC has a more potent hepatoprotective effect compared to Carsil.

Table 1: Changes in Biochemical Markers After Treatments

Biochemical Parameter	Control	HFD Group	Carsil Group	SC Group
ALT (IU/L)	30	83	51	45
AST (IU/L)	40	312	165	144
Total Cholesterol (mmol/L)	1.5	3.3	2.2	2.0
Glucose (mmol/L)	6	13.5	10.9	9.4
Albumin (g/L)	40	20	30	32

Treatment with SC significantly improved cholesterol, glucose, and albumin levels. Cholesterol levels, which had increased by 1.65 times in the HFD group, were reduced by 2835% in the SC group compared to 232% in the Carsil group (Figure 1G). Glucose levels also dropped significantly, with SC reducing it by 2323%, compared to 1987% in the Carsil group (Figure 1D). The albumin concentration, which had decreased by 1584% in the HFD group, increased by 107% in the SC group and 123% in the Carsil group (Figure 1E).

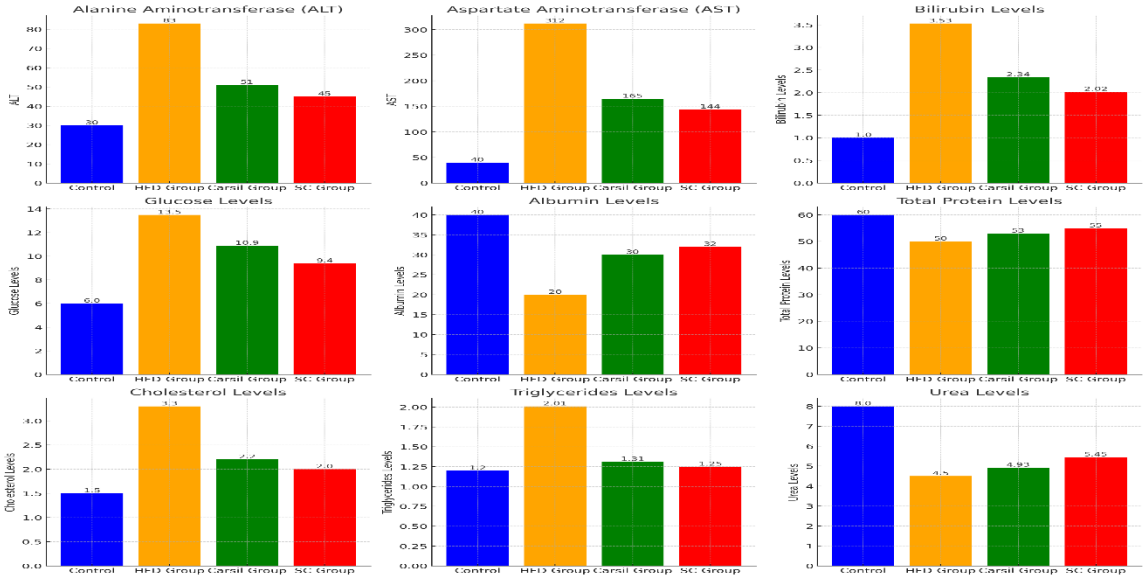

Figure 1: Biochemical Parameters in Different Treatment Groups: (A) Alanine aminotransferase (ALT), (B) Aspartate aminotransferase (AST), (C) Bilirubin, (D) Glucose, (E) Albumin, (F) Total Protein, (G) Cholesterol (H) Triglycerides (I) Urea

Histopathological Analysis

Histological examination of liver tissues showed severe damage in the HFD group, including hepatic steatosis, ballooning, and fibrosis (Figure 2B). The SC group demonstrated significant improvements in liver structure. The liver of SC-treated rats retained normal histoarchitecture, with improved periportal and centrolobular areas, and reduced ballooning and fibrosis (Figure 2D). In contrast, the Carsil group exhibited only partial improvements, with fatty degeneration still observable in the centrolobular area (Figure 2C).

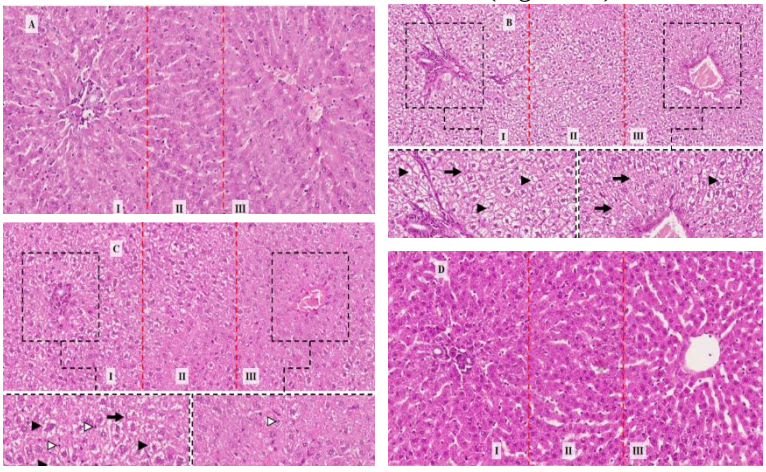

Figure 2: Hematoxylin-Eosin Stain of Liver Tissue: (A) Control group showing normal liver histoarchitecture, (B) HFD group displaying diffuse hepatic steatosis and fibrosis, (C) Carsil-treated group showing partial improvement in liver damage, (D) SC-treated group demonstrating significant improvement in liver morphology.

Discussion and Analysis

The study found that the supramolecular complex (SC) of glycyrrhizic acid and gallic acid significantly improved biochemical and histopathological outcomes in rats with non-alcoholic fatty liver disease (NAFLD) induced by a high-fat diet (HFD). Key findings included a substantial reduction in liver enzymes, with ALT levels decreasing by 4474% and AST by 3787% compared to the untreated HFD group. Glucose and cholesterol levels were also notably reduced, with glucose dropping by 2323% and cholesterol by 2835% in the SC-treated group. Histological analysis showed marked improvements, with reductions in hepatic steatosis, ballooning, and fibrosis. In comparison, the group treated with Carsil showed less pronounced improvements. These results suggest that the SC was more effective in reversing liver damage associated with NAFLD, making it a promising therapeutic candidate for further exploration in clinical trials.

Conclusion

In conclusion, this study demonstrated that the supramolecular complex (SC) of glycyrrhizic acid and gallic acid significantly alleviated the biochemical and histopathological effects of non-alcoholic fatty liver disease (NAFLD) induced by a high-fat diet in rats. The SC treatment resulted in substantial reductions in liver enzymes (ALT by 4474%, AST by 3787%), improved glucose and cholesterol levels, and mitigated hepatic steatosis and fibrosis. Compared to the hepatoprotective agent Carsil, the SC showed superior efficacy in restoring liver function and structure. These findings suggest that the SC offers a promising therapeutic option for managing NAFLD and other liver-related conditions. Future studies should focus on validating these results in human trials, exploring the long-term safety and efficacy of the complex, and investigating its potential for treating other metabolic disorders. Further research into different dosages and combinations with existing treatments could enhance its clinical utility.

References

1. Abdullayeva, M. I., Inoyatova, F. Kh., Narbutayeva, D. A., & Siddiqiv, D. (2020). Changes in biochemical indexes of rats' blood during chronic ethanol poisoning and treatment with herbal preparations. *International Journal of Scientific and Technology Research*, *9*(3), 701-709. ISSN: 2277-8616.
2. Basalai, A. A., Kuznetsova, T. E., Mityukova, T. A., Poluliakh, O. Y., Chudilovskaya, K. N., Kastsiuchenka, M. S., Shcherbakov, Y. V., Khrustaleva, T. A., & Hubkin, S. V. (2022). Morphofunctional state of the liver of male Wistar rats during diet-induced obesity and its correction. *Proceedings of the National Academy of Sciences of Belarus. Medical Series*, *19*(3), 308-320. https://doi.org/10.29235/1814-6023-2022-19-3-308-320
3. Berlanga, A., Guiu-Jurado, E., Porras, J. A., & Auguet, T. (2014). Molecular pathways in non-alcoholic fatty liver disease. *Clinical and Experimental Gastroenterology*, *7*, 221-239.
4. Cai, S., Bi, Z., Bai, Y., et al. (2020). Glycyrrhizic acid-induced differentiation repressed stemness in hepatocellular carcinoma by targeting c-Jun N-terminal kinase 1. *Frontiers in Oncology*, *9*, 1431. https://doi.org/10.3389/fonc.2019.01431
5. Dominica, M., Agniezska, L., Karolina, D., Karolina, S., Izabela, G., Marta, S., Daniel, S., Kamila, M., Anna, P., Joanna, P., Katarzycka, S., Wojciech, M., & Ewa, S. (2019). Diet-induced rat model of gradual development of non-alcoholic fatty liver disease (NAFLD) with lipopolysaccharides (LPS) secretion. *Diagnostics*, *9*, 205. https://doi.org/10.3390/diagnostics9040205
6. Kasimov, Sh., & Matchanov, A. (2022). Supramolecular complexes and some physico-chemical constants of gall acid. *NUUz Bulletin*, *3*(1), 361-365.

Note: All the figures and tables in this chapter were made by the author.