The Effect of Snakehead Fish (Channa Striata) Extract On Superoxide Dismutase (SOD) Levels And Pancreatic Histology Phytology In A Rat Model With Liver Cirrhosis

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Abstract.

*Liver cirrhosis results in progressive liver tissue damage and systemic oxidative stress affecting the pancreas. This study aimed to evaluate the effects of snakehead fish (Channa striata) extract on superoxide dismutase (SOD) levels and pancreatic histopathology in a rat model of liver cirrhosis.**Method:**An experimental study used male Wistar rats induced with CCl_4. The rats were divided into groups treated with snakehead fish extract at different doses (100, 150, 200 mg/kgBW) orally for two weeks. The parameters measured included body weight, pancreatic SOD activity, and histopathological analysis using Hematoxylin-Eosin staining. Data analysis used One Way ANOVA and post-hoc test with a significance level of $p < 0.05$.**Results:**Snakehead fish extract significantly increased pancreatic SOD activity in a dose-dependent manner and improved pancreatic histology compared to the control cirrhosis group. Body weight and organ function increased, indicating reduced oxidative damage and tissue regeneration.**Conclusion:**Snakehead fish extract shows potential as a natural antioxidant therapy in reducing oxidative stress and repairing pancreatic tissue in cirrhosis models. Further research is needed to isolate the active compounds and verify their clinical effectiveness.*

Keywords: *Antioxidants; Histology; Pancreas; Cirrhosis and Superoxide Dismutase.*

I. INTRODUCTION

This research phenomenon stems from the condition of liver cirrhosis, which is a chronic disease characterized by progressive damage to liver tissue due to fibrosis and abnormal regeneration. This condition not only causes impaired liver function but also triggers systemic complications involving other organs such as the pancreas, which is damaged by oxidative stress (Maharani et al., 2023; Subakti, Mathilda, & Naully, 2025). This oxidative stress is characterized by a decrease in the activity of the enzyme Superoxide Dismutase (SOD), a key antioxidant enzyme that plays a role in neutralizing free radicals so they do not damage cells (Thaha, Yunita, & Sabir, 2020; The Gut-Liver-Pancreas Axis in Chronic Liver Disease, 2023). Decreased SOD levels are directly proportional to increased tissue damage, including in the pancreas, which can cause exocrine and endocrine dysfunction.The main problem examined in this research is how to overcome the effects of oxidative stress that exacerbates pancreatic damage in patients with liver cirrhosis. Decreased SOD levels, an indicator of increased free radicals, require therapeutic solutions that can enhance endogenous antioxidant defenses (Raya et al., 2023; Hutagaol & Tarigan, 2024). Snakehead fish (Channa striata) extract is known to contain albumin and essential amino acids such as arginine and leucine, which Have the potential to increase SOD levels and repair tissue damage (Ariadi et al., 2024; Asfar et al., 2024).

Previous studies have shown that this extract not only increases SOD levels but also supports tissue regeneration and strengthens the body's antioxidant defense system (Abdulgani et al., 2020; Purnani et al., 2023).Another issue is the lack of effective and safe alternative therapies based on natural ingredients to address the residual effects of free radicals in liver cirrhosis and improve pancreatic histopathology. Studies on the potential of snakehead fish extract as a supportive therapy by increasing antioxidant enzyme activity and improving pancreatic structure are still limited and require further research using systematic scientific methods (Fiizhda et al., 2021; Maharani et al., 2023).The aim of this study was to evaluate the effect of

snakehead fish (Channa striata) extract on Superoxide Dismutase enzyme levels and pancreatic histopathology in mice with a model of liver cirrhosis. This research is highly urgent given the need to develop alternative natural therapies that can reduce oxidative stress and improve the regeneration of pancreatic tissue affected by liver cirrhosis (Yulizal et al., 2021; Silaban et al., 2020). The novelty of this study lies in the use of different doses of snakehead fish extract combined with a comprehensive assessment of pancreatic biochemical and histopathological parameters. This study is expected to provide scientific contributions in the field of antioxidant therapy for liver cirrhosis patients.

II. METHODS

This study is an experimental study using male white rats of the Wistar strain as experimental animals, which were divided into several treatment groups. The research method included induction of liver cirrhosis with carbon tetrachloride (CCl_4) and administration of snakehead fish (Channa striata) extract at different doses (100, 150, and 200 mg/kg body weight). Parameters measured included final body weight, Superoxide Dismutase (SOD) enzyme levels in pancreatic tissue, and histopathological examination of the pancreas using Hematoxylin-Eosin (H&E) staining (Raya et al., 2023; Hutagaol & Tarigan, 2024). This experimental approach allows for systematic quantitative and qualitative testing of treatment effects, in accordance with ethical laboratory animal research guidelines (Sugiyono, 2022; Sudaryono, 2023).

Data Analysis Instruments and Techniques

The main instruments in this study included an oral dosing device (feeding tube), a microtome for tissue preparation, a light microscope at 400x magnification for histopathological analysis, and a spectrophotometer to measure SOD enzyme activity based on the superoxide radical inhibition method (Halliwell & Gutteridge, 2015). Data were analyzed using the One-Way ANOVA statistical method accompanied by a post-hoc test to detect significant differences between treatment groups with a significance level of $p < 0.05$. Data analysis was performed using SPSS software, resulting in valid and reliable interpretations (Emzir, 2022; Creswell, 2021).

Population and Sample

The population in this study was healthy male Wistar rats, aged 6-8 weeks, weighing between 150-250 grams, free of anatomical abnormalities or other diseases. Samples were taken purposively, meeting the inclusion criteria, and randomly divided into several treatment groups to ensure homogeneity and eliminate bias. Normal and cirrhotic control groups were also prepared as comparisons to validate the results (Sugiyono, 2022; Sudaryono, 2023).

Research Procedures

The research procedure began with the induction phase of liver cirrhosis using a mixture of 10% CCl_4 in coconut oil, administered orally twice a week for six weeks (Fahrudin et al., 2020; Raya et al., 2023). After that, the rats were divided into treatment groups to receive snakehead fish extract at graded doses (100, 150, and 200 mg/kgBW) administered orally for two weeks using a homogeneous suspension dissolved in 0.5% Carboxymethyl Cellulose (CMC) (Purnani et al., 2023). During the treatment, observations of activity, appetite, and potential toxic effects were routinely carried out. After the treatment period, pancreatic tissue was taken for histopathological examination and measurement of SOD levels.

Histopathological examination was performed using the standard Hematoxylin-Eosin method to assess tissue structure and the density of the islets of Langerhans in the pancreas (Yulizal et al., 2021; Hutagaol & Tarigan, 2024). SOD levels were measured using spectrophotometric techniques representing enzyme activity per mg of tissue protein (Halliwell & Gutteridge, 2015; Emzir, 2022). The research data were statistically analyzed to ensure the validity and significance of the treatment effects (Creswell, 2021; Sugiyono, 2022).Overall, the design and procedures of this study strictly adhere to scientific and ethical principles of laboratory animal research, with a systematic and standardized methodological approach to evaluate the effects of snakehead fish extract in overcoming oxidative stress and pancreatic damage due to liver cirrhosis.

III. RESULT AND DISCUSSION

This study showed that administration of Channa striata extract significantly improved several biochemical and histological parameters in rats with CCl_4-induced liver cirrhosis. The increase in final body weight and pancreatic organ weight in the treated group indicated the positive effect of Channa striata in restoring nutritional status and impaired cell metabolism due to chronic liver injury (Maharani et al., 2023). These findings are consistent with previous reports showing that albumin and amino acid components in Channa striata contribute to anabolic and regenerative processes in damaged tissues (Asfar et al., 2024). The cirrhotic control group showed a marked decrease in liver and pancreas weight, reflecting the catabolic effects of prolonged oxidative stress and systemic inflammation. The increase in organ weight after treatment may be due to the high protein and amino acid content—especially arginine, glycine, and leucine—in Channa striata, which play an important role in promoting protein synthesis and tissue regeneration. Furthermore, the albumin in the extract can improve osmotic balance and tissue repair, supporting hepatopancreatic recovery (Erviany et al., 2024). In this study, fasting blood glucose levels did not differ significantly between groups, indicating that the Channa striata extract did not interfere with glucose metabolism. However, the mild decrease in glucose levels observed in the treatment group may indicate improved pancreatic function and insulin regulation. These findings are consistent with the histological improvements observed in pancreatic tissue, where restoration of islets of Langerhans and acinar cell architecture was evident, particularly at higher extract doses.

A significant increase in Superoxide Dismutase (SOD) levels was observed after administration of Channa striata extract, demonstrating its potential as an antioxidant enhancer (Yulizal et al., 2021). This increase was dose-dependent, with the highest SOD activity found in the 200 mg/kgBW group. This suggests that Channa striata extract can reduce CCl_4-induced oxidative damage by enhancing endogenous antioxidant defense mechanisms (Purnani et al., 2023). SOD is a crucial enzyme that catalyzes the dismutation of superoxide radicals into hydrogen peroxide, thereby protecting cells from oxidative damage. These findings confirm that Channa striata extract has protective and reparative effects on pancreatic tissue, likely mediated by its antioxidant and anti-inflammatory properties. These results are consistent with those of Hutagaol and Tarigan (2024), who reported that Channa striata extract increased antioxidant enzyme expression and reduced tissue necrosis in an oxidative stress model. Similarly, (Fiizhda et al. 2021) described the ability of Channa striata to modulate inflammatory cytokines and promote regeneration in damaged organs. Overall, the increase in SOD levels, organ weight, and histological structure suggests that Channa striata extract exerts a systemic protective effect against oxidative damage caused by chronic liver cirrhosis. The biological activity of this extract is likely due to its content of albumin, omega-3 fatty acids, and essential amino acids, which work synergistically to enhance antioxidant capacity, suppress inflammation, and stimulate tissue repair. Further research is recommended to isolate the active compounds responsible for these effects and to evaluate their molecular mechanisms in liver-pancreas interactions.

IV. CONCLUSION

This study shows that administration of snakehead fish (Channa striata) extract significantly increases Superoxide Dismutase (SOD) enzyme levels and improves pancreatic histopathological features in rat models of liver cirrhosis induced by CCl_4. The results indicate that the highest dose of the extract can increase pancreatic and liver organ weight and restore tissue structure that has undergone degeneration and damage due to oxidative stress. These findings support the therapeutic potential of snakehead fish extract as an antioxidant and tissue-protecting agent in the context of damage caused by liver cirrhosis, which is directly related to decreased antioxidant enzyme activity and systemic organ damage. However, this study has several limitations, such as a limited sample size and a focus on biochemical and histological parameters without examining the specific molecular mechanisms underlying these effects, thus necessitating further studies to identify the active compounds and biochemical pathways involved.

Furthermore, this study recommends further in-depth research on the isolation and characterization of active compounds from snakehead fish extract responsible for its antioxidant and regenerative activities, as well as testing its effectiveness in human clinical models. Furthermore, long-term evaluation and safety

testing of this natural medicine are necessary before wider clinical application. The practical implications of this study indicate that snakehead fish extract has the potential to be a safe and effective natural supportive therapy to reduce oxidative stress and repair organ tissue damage associated with liver cirrhosis, which may help improve the quality of life of patients with this condition in the future.

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