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Original Article

Analysis of Serum Glutamate Pyruvate Transaminase (SGPT) and Serum Glutamate Oxaloacetate Transaminase (SGOT) Levels in the Blood of Rat Offspring (*Rattus norvegicus*) Treated with Soybean (*Glycine max* L.) Extract and Zinc

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ABSTRACT

Background: The liver is the largest metabolic organ and plays an important role in the body. Nutritional fulfilment is one factor in maintaining liver health. Liver function can be evaluated by measuring the levels of SGPT and SGOT enzymes in the blood. Soybean juice and zinc can support liver health by keeping SGPT and SGOT enzyme levels normal.

Methods: This study was conducted between October and December 2024 at the Zoology Laboratory of the University of Lampung. This study used a Completely Randomized Design (CRD) included four treatment groups. Each treatment included five mice: control (K), treatment 1 (P1)- induced Soybean juice 0,6 mL/kg body weight (P2) induced Soybean 0,3 mL/kg body weight and Zinc 0,3 mL/kg body weight, and (P3) induced Soybean 0,6 mL/kg body weight and Zinc 0,6 mL/kg body weight for 14 days. Normal and homogeneous data were analyzed using analysis of variance (ANOVA) to determine whether the treatment's effect was significant. Differences were considered statistically significant at $p < 0.05$. Duncan's multiple interval post hoc test (=5%) was used to identify the most effective treatment.

Result: Based on the results of the one-way ANOVA test with a 95% confidence interval, the average SGPT and SGOT levels in the K, P1, P2, and P3 treatments differ significantly. The average SGPT levels above show that the P2 and P3 groups experienced a significant decrease compared to the K and P1 treatments.

Conclusion: Analysis of variance (ANOVA) showed that administering soya juice and zinc at an optimum dose of 1.2 mL/kg body weight can affect and maintain normal SGPT and SGOT levels.

INTRODUCTION

The liver is the body's primary metabolic hub, responsible for chemical synthesis, detoxification, and immune support. However, the global prevalence of metabolic dysfunction-associated steatotic liver disease (MASLD) has reached alarming levels, now affecting approximately 38.77% of the general population [1]. When hepatocytes are compromised by oxidative stress or toxins, intracellular enzymes like Serum Glutamic Pyruvate Transaminase (SGPT) and Serum Glutamic Oxaloacetate Transaminase (SGOT) leak into the bloodstream, serving as gold-standard clinical indicators of hepatic necrosis [2]. Because conventional pharmacological treatments often carry significant side effects, there is a critical and urgent need for accessible, natural hepatoprotective interventions [3].

Liver function can be checked by testing the levels of certain enzymes called transaminases, such as serum glutamic pyruvate transaminase (SGPT) and serum glutamic oxalacetate transaminase (SGOT). Both enzymes help find out if liver cells are damaged, and when their levels are higher than normal in the blood, it shows that the liver is not working properly [4]. Things that can lead to this kind of problem include alcohol, viruses, harmful chemicals, medicines, and not getting enough nutrients. One way to get the nutrients you need is by using foods made from plants, like soya juice. Soybeans can be turned into soya milk, which has a lot of good things like isoflavones, amino acids, vitamins, and other nutrients that are good for your health [5]. Soya beans, which are scientifically known as Glycine max L, have valuable nutrients like vitamins A, E, K, and different kinds of B vitamins, as well as minerals such as potassium, iron, zinc, and phosphorus. Soybean fat has 15% saturated fatty acids and around 60% unsaturated fats, like linoleic and linolenic acids [6].

Recent research emphasizes that a diet rich in plant-based antioxidants, such as polyphenols and phenolic acids, offers a viable strategy for preventing systemic civilization diseases [7]. Soybeans (*Glycine max* L.**)** are a particularly potent candidate due to their high concentration of isoflavones, which act as exogenous antioxidants to neutralize reactive oxygen species (ROS) and stabilize hepatocyte membranes [8]. Studies have demonstrated that fermented soy derivatives can significantly lower serum transaminase levels in animal models subjected to toxic stress [9]. However, plant extracts alone may not provide a complete defense without the support of essential mineral cofactors [10].

The combination of soya bean juice and zinc is interesting to study due to its synergistic potential in affecting liver function. Isoflavones in soybean juice can act as antioxidants, while zinc plays a role in the endogenous antioxidant defence system through superoxide dismutase (SOD) enzyme activity [11]. The interaction between these two components is expected to provide a more optimal effect on liver health. Despite the many benefits of soya juice and zinc, research on their role in liver function is limited. Therefore, this study aims to provide an understanding of the effects of the combination of soya juice and zinc on liver function, particularly through the measurement of SGPT and SGOT levels [12].

Based on this background, there is a need to explore the effects of the combination of soya juice and zinc on liver function. The purpose of this study is to determine the levels of SGPT and SGOT enzymes in the blood of white rats induced with soybean juice and zinc, and to determine the optimum dose of soybean and zinc that is appropriate for the levels of SGPT and SGOT enzymes in white rats.

METHOD

This study was conducted between October and December 2024 at the Zoology Laboratory of the University of Lampung. This study used a Completely Randomized Design (CRD) including four treatment groups. Each treatment included five rats: The rats were divided into four groups: control (K), treatment group 1 (P1), treatment group 2 (P2), and treatment group 3 (P3). The control group received no treatment. Group P1 received soybean juice at a dose of 0.6 mL/kg body weight. Group P2 received soybean juice at a dose of 0.3 mL/kg body weight combined with zinc at a dose of 0.3 mL/kg body weight. Group P3 received soybean juice at a dose of 0.6 mL/kg body weight combined with zinc at a dose of 0.6 mL/kg body weight. All treatments were administered for 14 days.

To collect blood samples, rats were first removed from their cages and allowed to rest briefly to minimize stress. Blood (2–3 mL) was collected via cardiac puncture using a sterile syringe and transferred into tubes containing EDTA as an anticoagulant. The samples were then centrifuged at 3000 rpm for 5 minutes to obtain the serum layer. The serum was carefully pipetted into labeled tubes and stored in a refrigerator until analysis. SGPT and SGOT levels were determined using a spectrophotometric method. Serum samples (100 µL) were mixed with 1000 µL of SGPT or SGOT buffer reagent, vortexed, and incubated for 5 minutes at room temperature. The absorbance of the mixture was measured for 3 minutes using a UV/Vis spectrophotometer at a wavelength of 340 nm, and the recorded absorbance values were used to calculate SGPT and SGOT enzyme levels.

Normal and homogeneous data were analyzed using analysis of variance (ANOVA) to determine whether the treatment's effect was significant. Differences were considered statistically significant at $p < 0.05$. Duncan's multiple interval post hoc test (=5%) was used to identify the most effective treatment. Ethical approval for this study was obtained from the Animal Ethics Committee of Universitas Lampung with ethical clearance number No. 860/UN26.18/PP.05.02.00/2025.

RESULT AND DISCUSSION

The results of observations of the number of SGPT and SGOT blood levels of rats both between controls and treatments with soybean juice and zinc induction showed different results, the results are presented in Table 1.

Table 1. Mean SGPT and SGOT levels in each experimental group

Experience Group	Mean Enzyme Levels (U/L)	
	SGPT	SGOT
K	80.00 ±2.91^{a}	166.00 ±39. 83^{bc}
P1	75.20 ±5.89^{a}	201.20 ±67.96^{c}
P2	44.40 ±9.78^{b}	114.60 ±25.68^{ab}
P3	48.60 ±9.52^{b}	91.80 ±17.02^{a}

Based on the results of the one-way ANOVA test with a 95% confidence interval in tabel 2, it is known that there are significant differences in the average results of SGPT and SGOT levels in the K; P1; P2; and P3 treatments. the average results of SGPT levels above show that the P2 and P3 groups have decreased significantly compared to the K and P1 groups. This indicates that groups P2 and P3 have a good ability to keep SGPT levels in rats at the normal threshold compared to groups K and P1. This finding is consistent with the study conducted by Taswin et al. (2022), which reported a significant difference in SGPT levels between the tempeh-treated group and the control group ($p = 0.007$). The administration of tempeh at a dose of 640 mg/kg body weight/day was found to be more effective in providing hepatoprotective effects compared to doses of 160 and 320 mg/kg body weight/day.

Table 2. ANOVA Test Results of SGPT and SGOT Enzyme Levels

Enzyme	Sum of Squares	df	Mean Square	F	Sign.
SGPT	4937.750	3	1654.917	28.650	.000
SGOT	45132.950	3	15044.317	11.551	.000

While the average results of SGOT levels show that administering soya juice and zinc can reduce SGOT levels [13]. This suggests that the addition of zinc may enhance the hepatoprotective effect of soybean juice. The decrease in SGOT levels observed in the treatment groups also indicates a potential protective effect on liver function. Among the treatments, the P2 group showed a greater reduction in enzyme levels, suggesting that this dosage combination may represent a more optimal treatment compared to the other groups [14].

The reduction in SGPT and SGOT levels observed in the treatment groups related to the biological activity of soybean juice and zinc in protecting liver cells. Soybeans contain isoflavones, which are natural antioxidants capable of neutralizing reactive oxygen species (ROS) and reducing oxidative stress in hepatocytes. Excessive ROS can damage liver cells and increase liver enzyme levels in the blood [15]. By inhibiting lipid peroxidation and stabilizing cell membranes, isoflavones help prevent the leakage of liver enzymes such as SGPT and SGOT into the bloodstream. Isoflavones are a subgroup of flavonoids, consisting of more than 200 known compounds, characterized by an isomeric structure in which the benzene ring is attached to the third carbon of a heterocyclic structure. In vitro studies have shown that isoflavonoids can inhibit the growth of prostate cancer cells. Additionally, flavonoids are known to neutralize excessive reactive oxygen species (ROS), act as antioxidants against free radicals, and enhance liver glutathione levels, thereby helping to reduce the harmful effects of oxidative stress [15]. Therefore, the combined administration of soybean juice and zinc may provide a protective effect on liver function, which is reflected in the decreased SGPT and SGOT levels in the treatment groups.

Free radicals can contribute to increased SGPT and SGOT levels. Elevated SGPT levels are associated with conditions such as liver injury, diabetes, hepatitis, bile duct disorders, congestive heart failure, myopathy, and mononucleosis. Increased SGOT levels may indicate medical conditions including myocardial infarction, acute pancreatitis, acute hemolytic anemia, acute kidney disease, severe burns, and musculoskeletal disorders [16]. In cases of liver dysfunction, liver enzymes leak into the bloodstream, leading to higher enzyme concentrations in the blood and signaling impaired liver function [17].

Isoflavones act as antioxidants by inhibiting oxidation reactions through their role as reducing agents. They prevent the oxidation of unsaturated fatty acids in cell membranes, thereby reducing lipid peroxidation [18]. In addition, isoflavones neutralize free radicals by interrupting chain reactions and protecting cells from DNA activation, which helps minimize cellular damage. Isoflavones present in soybeans exhibit antioxidant activity ranging from 7.5 to 12.18 μmol/g, comparable to the synthetic antioxidant BHT (*butylated hydroxytoluene*) [19]. Furthermore, Suarsana et al. (2006) reported that soybeans can protect liver function in rats under stress, as evidenced by decreased SGOT and SGPT enzyme levels in stressed rats treated with tempeh extract. Yoghurt produced from tempeh has also been shown to help prevent liver damage [20].

Zinc contributes to the reduction of oxidative stress in the liver by enhancing the activity of antioxidant enzymes, thereby protecting hepatocytes from damage that may result in increased SGPT and SGOT levels. As an essential trace element, zinc is crucial for numerous biochemical processes in the body [21]. It plays an important role in DNA synthesis, RNA transcription, and cell division, and serves as a structural or functional component of many enzymes and proteins, including transcription factors that regulate gene expression [22].

Zinc has been shown to positively influence liver enzyme levels, including SGPT and SGOT. Supplementation with zinc can reduce the concentrations of these enzymes in individuals with liver disease, particularly those experiencing alcohol-related liver damage [23]. This effect is attributed to zinc's ability to enhance the activity of antioxidant enzymes, thereby protecting liver cells from oxidative injury [24]. In addition, zinc plays a role in regulating apoptosis, as studies indicate that zinc supplementation can reduce excessive hepatocyte cell death commonly associated with liver damage. Consequently, zinc supports the maintenance of a healthy and functional population of liver cells [25].

A limitation of this study is that liver function assessment was based solely on biochemical markers (SGPT and SGOT levels) in the serum. While these enzymes are reliable indicators of hepatocyte integrity, this research did not include a histopathological examination to directly observe cellular structural changes in the liver tissue [26]. Therefore, the protective effects at the cellular level are inferred from the significant reduction of enzyme leakage into the bloodstream.

CONCLUSION

Administration of soybean juice (*Glycine max* (L.) Merr.) combined with zinc at an optimum dose of 1.2 mL/kg BW significantly reduces SGPT and SGOT levels, demonstrating synergistic hepatoprotective potential. While these results suggest a viable nutritional strategy for liver health, future studies should include histopathological analysis and oxidative markers (MDA/glutathione) to confirm cellular mechanisms. Further research using diverse stress models is recommended to validate these findings for broader clinical application.

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REFERENCES

1. *Qiu, Y., Laguna, J. C., Alegret, M., & Vilà, L. (2026). A Global Perspective on Metabolic Dysfunction-Associated Steatotic Liver Disease: From Molecular Mechanisms to Therapeutic Strategy Innovation. Nutrients, 18(4), 679. https://doi.org/10.3390/nu1804067*
2. *Mooli, R. G. R., Mukhi, D., & Ramakrishnan, S. K. (2022). Oxidative Stress and Redox Signaling in the Pathophysiology of Liver Diseases. Comprehensive Physiology, 12(2), 3167–3192. https://doi.org/10.1002/cphy.c200021*
3. *Zhou, Y., Wang, J., Zhang, D., Liu, J., Wu, Q., Chen, J., Tan, P., Xing, B., Han, Y., Zhang, P., Xiao, X., & Pei, J. (2021). Mechanism of drug-induced liver injury and hepatoprotective effects of natural drugs. Chinese medicine, 16(1), 135. https://doi.org/10.1186/s13020-021-00543-x*
4. *Lala V, Zubair M, Minter DA. Liver Function Tests. [Updated 2023 Jul 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482489/*
5. *Jing, J., Guo, S., Li, Y., & Li, W. (2020). The alleviating effect of exogenous polyamines on heat stress susceptibility of different heat resistant wheat (Triticum aestivum L.) varieties. Scientific reports, 10(1), 7467. https://doi.org/10.1038/s41598-020-64468-5*
6. *Khairani, N. R., Kurniawan, M. R., and Dewi, A. P. 2022. Differences of SGOT SGPT Levels in Serum and EDTA Plasma in Hepatitis B Patients. Jurnal Ilmu dan Teknologi Kesehatan. 9(2): 253-260. https://doi.org/10.32668/jitek.v9i2.759*
7. *Alharbi, A. A. D., Ebine, N., Nakae, S., Hojo, T., & Fukuoka, Y. (2021). Application of Molecular Hydrogen as an Antioxidant in Responses to Ventilatory and Ergogenic Adjustments during Incremental Exercise in Humans. Nutrients, 13(2), 459. https://doi.org/10.3390/nu13020459*
8. *Fan Y, Wang M, Li Z, Jiang H, Shi J, Shi X, Liu S, Zhao J, Kong L, Zhang W and Ma L (2022) Intake of Soy, Soy Isoflavones and Soy Protein and Risk of Cancer Incidence and Mortality. Front. Nutr. 9:847421. doi: 10.3389/fnut.2022.847421*

9. *Yu, L., Xu, Z., Cheng, M., Lin, W., Qiu, W., & Xiao, X. (2023). MSEDDI: Multi-Scale Embedding for Predicting Drug—Drug Interaction Events. International Journal of Molecular Sciences, 24(5), 4500.* https://doi.org/10.3390/ijms24054500
10. *Kristiadi, O. H. I, dan Lunggani, A. T., 2022, Tempe Kacang Kedelai Sebagai Pangan Fermentasi Unggulan Khas Indonesia: Literature Review .vol., no. 2, pp. 48–56. Available at* https://jurnal.unimed.ac.id/2012/index.php/jgpkm/article/view/40334/pdf.
11. *Ramos, H., Bogdanov, P., Sampedro, J., Huerta, J., Simó, R., & Hernández, C. (2020). Beneficial Effects of Glucagon-Like Peptide-1 (GLP-1) in Diabetes-Induced Retinal Abnormalities: Involvement of Oxidative Stress. Antioxidants, 9(9), 846.* https://doi.org/10.3390/antiox9090846
12. *Vergara, P., Kumar, D., Srinivasan, S., Koyanagi, I., Naoi, T., Singh, S., & Sakaguchi, M. (2021). Remapping of Adult-Born Neuron Activity during Fear Memory Consolidation in Mice. International Journal of Molecular Sciences, 22(6), 2874.* https://doi.org/10.3390/ijms22062874
13. *Rowland, N. E. (2023). Neurobehavioral Mechanisms of Sodium Appetite. Nutrients, 15(3), 620.* https://doi.org/10.3390/nu15030620
14. *Rezaei, S. M. A., Mohammadi, F., Eftekhari, M. H., Ejtehadi, F., Ghaem, H., & Mohammadipoor, N. (2023). The effects of zinc supplementation on the metabolic factors in patients with non-alcoholic fatty liver disease: a randomized, double-blinded, placebo-controlled clinical trial. BMC nutrition, 9(1), 138.* https://doi.org/10.1186/s40795-023-00776-z
15. *Latifah, A., Kurniasih, D., and Muslina, M. 2023. Overview of Serum Glutamic Pyruvic Transaminase (SGPT) Activity in Coal Workers in Talang Duku, Muaro Jambi Regency. Scientific Journal of Batanghari University Jambi. 23(3): 3042-3045. DOI: 10.33087/jiubj.v23i3.398*
16. *Moriles KE, Zubair M, Azer SA. Alanine Aminotransferase (ALT) Test. [Updated 2024 Feb 27]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from:* https://www.ncbi.nlm.nih.gov/books/NBK559278/
17. *Liss C, Litwak K, Tilford D, Reinhardt V. 2015. Rats. In: Animal Welfare Institute. Comfortable quarters for laboratory animals. ten editions. Washington DC: Animal Welfare Institute. Available*
18. *Yaoyao Qi, Leyi Xie, Zeyuan Deng, Bing Zhang, Hongyan Li, Stability and antioxidant activity of 10 isoflavones and anthocyanidins during in vitro digestion, Food Bioscience, Volume 56, 2023,103189, ISSN 2212-4292,* https://doi.org/10.1016/j.fbio.2023.103189.
19. *Wójciak, M., Drozdowski, P., Ziemlewska, A., Zagórska-Dziok, M., Nizioł-Łukaszewska, Z., Kubrak, T., & Sowa, I. (2024). ROS Scavenging Effect of Selected Isoflavones in Provoked Oxidative Stress Conditions in Human Skin Fibroblasts and Keratinocytes. Molecules (Basel, Switzerland), 29(5), 955.* https://doi.org/10.3390/molecules29050955
20. *McCommis K.S., Chen Z., Fu, X., McDonald, W.G., Colca, J.R., and Kletzien R.F. 2015. Loss of Mitochondrial Pyruvate Carrier 2 in The Liver Leads to Defects in Gluconeogenesis And Compensation Via Pyruvate-Alanine Cycling. Cell Metab. 22: 682-694. Available at:* https://pubmed.ncbi.nlm.nih.gov/26344101/
21. *Cui, J., Xu, T., Lv, H., & Guo, M. Y. (2023). Zinc deficiency causes oxidative stress, endoplasmic reticulum stress, apoptosis and inflammation in hepatocytes in grass carp. Fish & shellfish immunology, 139, 108905.* https://doi.org/10.1016/j.fsi.2023.108905
22. *Yao G, Wang Z, Xie R, Zhanghuang C and Yan B (2024) Trace element zinc metabolism and its relation to tumors. Front. Endocrinol. 15:1457943. doi: 10.3389/fendo.2024.1457943*
23. *Gong, Y., Yang, Z., Sun, G. et al. Zinc supplementation in liver cirrhosis: meta-analysis of its effect on biochemical and clinical outcomes. BMC Nutr* ***12****, 10 (2026).* https://doi.org/10.1186/s40795-025-01239-3
24. *Kelly, R. K., Pollard, Z., Young, H., Piernas, C., Lentjes, M., Mulligan, A., Huybrechts, I., Carter, J. L., Key, T. J., & Perez-Cornago, A. (2022). Evaluation of the New Individual Fatty Acid Dataset for UK Biobank: Analysis of Intakes and Sources in 207,997 Participants. Nutrients, 14(17), 3603.* https://doi.org/10.3390/nu14173603

25. *Widarti, W., and Nurqaidah, N. 2019. Analysis of Serum Glutamic Pyruvic Transaminase (SGPT) and Serum Glutamic Oxaloacetic Transaminase (SGOT) Levels in Farmers Using Pesticides. Journal of Health Analyst Media. 10(1): 35-43.* https://doi.org/10.32382/medkes.v17i2.2822
26. *Taswin, M., Astuti, R. D., Marlina, D., Ocktariyana, O., and Agustianingsih, A. 2022. Pengaruh Pemberian Ekstrak Isoflavon Tempe Terhadap Tingkat Stress Oksidatif Pada Tikus Putih Jantan Galur Wistar (Rattus novergicus) Setelah Diinduksi Dengan Dosis Toksik Parasetamol. Jpp (Jurnal Kesehatan Poltekkes Palembang). 17(2): 250-265.* https://doi.org/10.36086/jpp.v17i2.1513
27. *Di Cesare, M., Perel, P., Taylor, S., Kabudula, C., Bixby, H., Gaziano, T. A., McGhie, D. V., Mwangi, J., Pervan, B., Narula, J., Pineiro, D., & Pinto, F. J. (2024). The Heart of the World. Global heart, 19(1): 11.* https://doi.org/10.5334/gh.1288