e-ISSN: 0974-4614 p-ISSN: 0972-0448
https://doi.org/10.47059/ijmtlm/V27I5/029

Antioxidant Effects of Cinnamon Extract on Liver Health in Rats

Al darraji Raad Kareem Alwan1 , Dr. Mohd Yusmaidie Bin Aziz2
DR. MOHAMED ASHRAF MOHAMED DAUD3 , DR. NOZLENA BINTI ABDUL SAMAD4 and Prof. Dr. Hayder Saadoon Qasim Alhilfi5
University of Al-Manara, Collage of pharmacy, Advanced Medical and Dental Institute, University Sains Malaysia, Kepala Batas, Pulau, Penang, Malaysia
Advanced Medical and Dental Institute, University Sains Malaysia, Kepala Batas, Pulau, Penang, Malaysia

Received: 18.09.2024 Revised: 17.10.2024 Accepted: 07.11.2024

ABSTRACT
Cinnamon is medical palnt a spice derived from the Cinnamomum genus and it is renowned for its unique flavor, aroma and potential health-profits, mainly its antioxidant properties. This study aim to evaluating the protective effects of cinnamon-extract on liver damage induced by Thioacetamide (TAA) in rats. Thirty adult male Wistar-rats were distributed into three groups: a Negative Control (NG) group, Positive Control (PG) group that treated with TAA to induce liver injury, and Treated Group (TG) that received both TAA and cinnamon extract (50-100 mg/kg body weight daily) for one month. Liver functions were assessed by measuring Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and alkaline phosphatase (ALP) enzyme levels. The results shown a significant increasing in ALT and AST levels in the PG group compared to the NG group, indicating liver damage. The treated group of rats showed a reduction in ALT and AST levels compared to the positive control group although the decrease was not statistically significant where as Alkaline phosphatase in positive control group exhibited a significant elevation while the treated group showed a nonsignificant decrease. These results showed that cinnamon extract might offer fractional protection against liver damage induced by TAA due to its antioxidant role that reduce oxidative stress in the liver.

Keywords: Cinnamon; Thioacetamide; Antioxidant; Hepatotoxicity.

INTRODUCTION

Cinnamon plant is a widely known spice gotten from the inner-bark of trees belonging to the Cinnamomumgenus and mostly found in tropical countries[1]. It is celebrated for its unique aroma and flavor and has been used for centuries in both cooking and medicine field. There are two primary types of cinnamon plant first one named as Ceylon cinnamon (Cinnamomumverum) also known as "true cinnamon" and the second is known Cassia cinnamon (Cinnamomum cassia)[2]. Ceylon cinnamon is milder and contains lower levels of coumarin, a compound that can be harmful in large amounts, whereas Cassia cinnamon has a stronger taste and is extra widely presented due to its affordability[3,4].

Cinnamon herbs contained active compounds like cinnamaldehyde, which contributes to its distinct flavor and many of its health profits as well as eugenol and polyphenols which known for their anti-oxidant and antiinflammatory properties[5]. Cinnamon spice is highly regarded for its potential-health benefits including improving insulin-sensitivity, controlling blood- glucose levels, decreasing inflammation effect and its role as antimicrobial properties. Historically, cinnamon has been used in traditional remedies to treat various healthconditions[6].

The Cinnamon herbs is familiar for its role as significant antioxidant characterization which show a vital role in protecting cells from oxidative-damage specially hepatocyte[7]. Oxidative-stress caused by reactive-oxygenspecies (ROS) and the body's capability to neutralize themis a key factor in the development of numerous diseases, including liver damage, cancer, and cardiovascular disease. Cinnamon antioxidants help combat this oxidative-damage by scavenging free radicals and supporting the body's natural defense mechanisms[8,9]. This study aim to evaluate role of Cinnamon extraction as antioxidant agent in liver rats treated with Thioacetamide as oxidant factors of rat liver.

MATERIALS AND METHODS

Plant extraction

Cinnamon plant extract was prepared by adding (250 g) of cinnamon to a flask containing (250 mL) of water. The mixture was heated to 70°C for 24 hours, with continuous stirring to ensure proper extraction of activecompounds. Then the mixture was allowed to cool, and the supernatant was carefully separated. The resulting liquid extract was stored in a dark container and kept in the freezer for later use preserving its stability and potency.

Animal

A thrity healthy adult male rats (Wistar rats) that weighting about (300-450 gm) were use in thestudy.. All Rats were acclimatized in the standard appropriate conditions 12h/light and 12h/dark in 25 ±4 ºC for 1 weeks beforeexperiments was starting[10].

Groups and treatment

This study included 30 rats, which were divided into three groups:

Frist Group (Healthy/Negative Control) (NC): These rats served as the control group and were not treated with any substances. Second Group (PC Group): Rats in this group were treated with Thioacetamide (TAA) at doses ranging from 100 mg/kg, administered orally twice a week for 1 month. This was designed to induce acute liver damage in rats. Third groups (TG): Rats in this group received the same TAA treatment (100 mg/kg orally twice a week for 1 month) but in addition they were also treated with cinnamon extract daily, at doses of 50-100 mg/kg body weight per day for 1 month. This group aimed to evaluate the potential hepato-protective effects of cinnamon against liver damage induced by TAA. Liver function was assessed by measuring ALT, AST and ALP levels, which served as biomarkers indicators for liver damage.

Statistical analysis

All Figures and Tables were created using Microsoft-Excel and GraphPad Prism (Version 8). The results were analyzed using the independent t-test and ANOVA methods to assess statistical significance with P value ≤0.05.

RESULTS AND DISCUSSION

Cinnamon contains many bioactive compounds that contribute to its distinctive flavor, aroma, and health benefits and role as antioxidant factor[11]. ALT levels are usually used as biomarkers indicator to evaluate liver function and damage in liver cells. When there damaged in the liver ALT is released into the bloodstream causing an raise in serum ALT levels. Therefore, measuring ALT is vital in studies evaluating hepatotoxicity or liver protection[12,13].

Table 1: Statistical Result of the three groups. P value ≤ 0.05

Groups	N	Mean ± SEM U/L	Range	P value (0.05)	95% confidence interval
ALT					
Negative control (NG)	10	37.60 ± 6.925	15- 89	-	43.43 to 159.8
Positive control (PG)	10	139.2 ± 26.81	22- 310	S** (0.0018)[a]	-132.0 to -0.4428
Treated Group (TG)	10	73.00 ± 16.15	33- 201	NS (0.0592)[a] S* (0.0486)[b]	-1.524 to 72.32
AST					
Negative control (NG)	10	37.80 ± 9.136	4- 104	-	-17.10 to 86.70
Positive control (PG)	10	151.8 ± 21.92	34- 290	S*** (0.0001)[a]	64.12 to 163.9
Treated Group (TG)	10	72.60 ± 22.95	22- 270	NS (0.1760)[a] S* (0.0225)[b]	-145.9 to -12.53
ALP					
Negative control (NG)	10	111.7 ± 32.33	22 - 330	-	11.33 to 290.1
Positive control (PG)	10	262.4 ± 57.92	130-640	S* (0.0356)	-240.5 to 44.48
Treated Group (TG)	10	164.4 ± 35.27	30-410	NS (0.2852)	-47.83 to 153.2

NS: Non-significant, S: Significant

The results show in Table 1 showing an increase in ALT levels in the Positive Control (PG) group, with a mean value of 139.2 ± 26.81 U/L, compared to the Negative Control (NG) group, which had a mean value of 37.60 ± 6.925 U/L. This difference was statistically significant, with a p-value of 0.0018.
In the Treated Group (TG), the ALT level showed a mean value of 73.00 ± 16.15 U/L. Although this value was not significantly different from that of the Positive Control (PG) group, it was lower. The difference between the Treated Group (TG) and the Negative Control (NG) group was statistically significant, with a p-value of 0.0486 as in Figure 1.

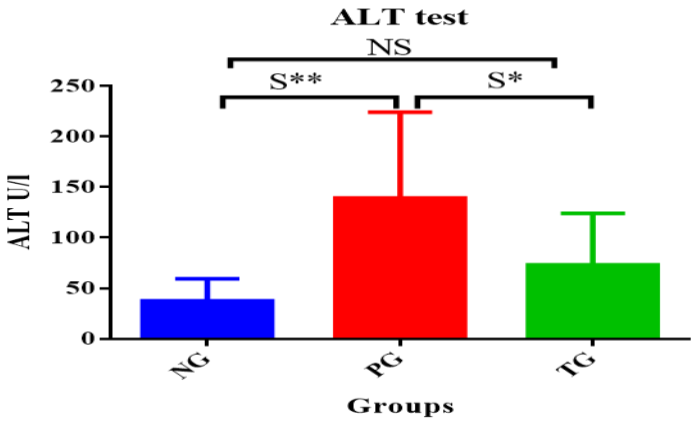

Figure 1: ALT level in-group where NG: Negative control, PG: Positive control and TG: Treated group. S: Significant, NS: NON-significant, P value ≤ 0.05

This elevated ALT value is a clear indicator of liver damage, as ALT is released into the bloodstream when liver cells are compromised. The difference between the PG and Negative Control (NG) group was statistically significant (p-value of 0.0018), suggesting that the treatment successfully induced liver injury[14], as evidenced by the rise in ALT. The results in Figure 1 showed that the cinnamon extract does not fully protect the liver from the hepatotoxic agent (as indicated by the non-significant difference with the PG group) but it may offer some degree of liver protection as antioxidant agent and reducing ALT levels compared to the untreated Positive Control group. These results suggest a potential therapeutic role for cinnamon in liver health, although further studies are needed to determine the full extent of its protective effects and to explore the underlying mechanisms[15].
AST level as show in Table 1 indicated to high increasing of AST level in Positive Control group 151.8 ± 21.92 U/L compared to Negative control 37.80 ± 9.136 with high significant difference between them with p value 0.0001where as treated group show decreasing in AST level 72.60 ± 22.95 U/L with Non-significant compared to Postive control, as in Figure 2.

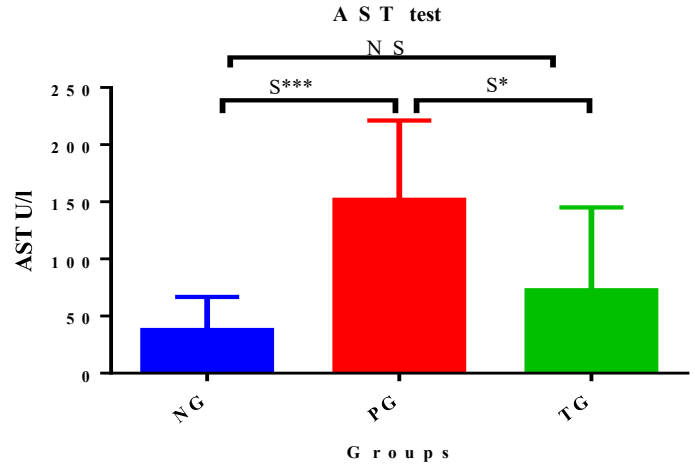

Figure 2: AST level in-group where NG: Negative control, PG: Positive control and TG: Treated group. S: Significant, NS: NON-significant, P value ≤ 0.05

AST is released from damaged liver cells into the bloodstream. The difference between the PG group and the Negative Control (NG) group was highly significant (p-value = 0.0001), confirming that the hepatotoxic treatment effectively caused liver injury, as reflected by the substantial rise in AST levels. AST levels in the Treated group were significantly lesser than those in the Positive-Control, but did not reach statistical significance indicating a fractional protective effect. These results propose that while cinnamon may not fully reverse liver damage it could potentially mitigate the extent of cellular injury and damage caused by the hepatotoxic factor[16].
Akaline-phosphatase enzymes (ALP) across the different groups providing insights into the liver biliary functions and potential-liver-injury[17]. ALP is an enzyme found in several tissues, including the liver, bone, and bile ducts, and elevated levels can indicate liver dysfunction, especially in cases of cholestasis or bile duct obstruction. As show in Table 1 there are significant increase in ALP level in Positive Control 262.4 ± 57.92 U/L compared to Negative group 111.7 ± 32.33 with P value 0.0356 whereas treated group show nonsignificant decreasing in ALP to 164.4 ± 35.27 as in Figure 3.

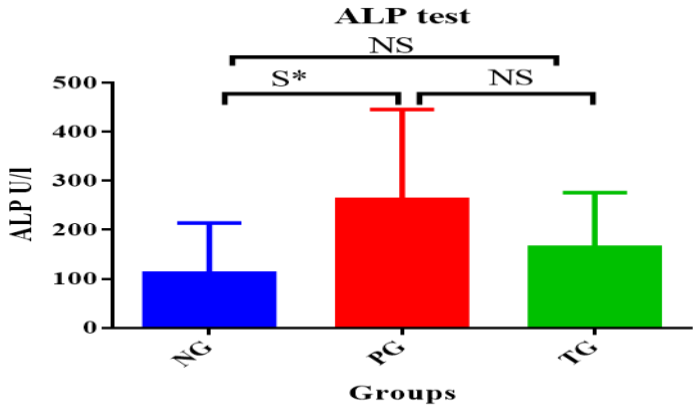

Figure 3: ALP Level in-group where NG: Negative control, PG: Positive control and TG: Treated group. S: Significant, NS: NON-significant, P value ≤ 0.05

As show in result, it is important to note whether this decreasing was statistically significant. If the reduction was not significant, as in some cases with ALT and AST, this might indicate that while cinnamon may mitigate liver injury it did not fully restore the liver normal function or prevent the effects of the hepatotoxic agent entirely. If the ALP reduction was significant, it would indicate that the cinnamon extract has a more profound hepatoprotective effect particularly on the liver s biliary function[18].

CONCLUSION

Cinnamon plant extract can provide fractional protection against liver damage induced by Thioacetamide which is oxidant to liver, likely due to Cinnamon antioxidant properties. While it reduced ALT and AST and ALP levels in the treated group.

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