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Original Research Article

Investigation of the Role of Nephroprotective Effects of Aqueous Ginger Extract (AGE) on the CCl4-induced of Renal Dysfunctions in Male Rats as a Model

Elham F. Hamzah[1], Ahmed Neema AL-Mussawy[2], Rabab Adnan Hamzah[3], H.H.K. Al-Shukri[4*]
[1]Department of Clinical Biochemistry, Hammurabi College of Medicine, University of Babylon, 51002 Hillah, Babylon, Iraq
[2]College of Science, Al-Qasim Green University, 51013, Babylon, Iraq
[3]Technical Institute of Babylon, AL-Furat Al-Awsat Technical University (ATU), Iraq
[4]Veterinary Medicine College, Al-Qasim Green University, Babylon, Iraq

***Corresponding Author**
H.H.K. Al-Shukri
Veterinary Medicine College, Al-Qasim Green University, Babylon, Iraq

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Abstract: ***Background and Aim*:** Kidney disease represents a growing global challenge that disproportionately impacts impoverished, vulnerable, and marginalized communities, leading to significant individual, healthcare, and societal expenses. The current investigation focused on assessment of the role of *zingiber officinale* aqueous ginger extract (AGE) on induced kidney dysfunctions in male rats as a model. ***Methods*:** This study was performed on 40 male rats divided into 4 groups each group included 10 white Albino rats. CCl4 was intraperitoneal (i.p.) injected for 3 days and following administration of aqueous ginger extract (AKE) (250 and 500 mg/kg/b.w. for 15 days as period of this experiment). At the end of this study, biochemical markers related to kidney dysfuntions such as, serum creatinine (CR), uric acid (UA), total antioxidant capacity (TAO-C), and the malondialdehyde (MDA) as antioxidant and oxidative stress markers were assessed by spectrophotometric methods. ***Results*:** The results of this study were showing CR (mg/dl) and UA (mg/dl) levels were significantly elevated in the T2 group as negative control group in comparison with the T1 as control group ($p<0.05$). UA (mg/dl) levels were found significant decrease in T4 and T3 groups in compare with T2 and T1. The results shown significant increase in TAO-C in T4 and T3 compare to T2, also TAO-C (U/ml) levels were found significant decrease in T2 group in compare with T1. ***Conclusion*:** This study suggested that a significant protective action of AGE on CCl4-induced kidney damage in the male rats model.

Keywords: Renal dysfunctions, Aqueous Extract, Ginger, Rats, Antioxidant.

INTRODUCTION

The World Health Organization (WHO) has identified five primary non-communicable diseases that contribute significantly to premature mortality and disability: chronic lung disease and heart disease, stroke, cancer, and diabetes [1]. Notably, kidney disease, including both acute kidney injury (AKI) and chronic kidney disease (CKD). It is important to highlight that AKI elevates the likelihood of developing CKD and vice versa [2]. Furthermore, renal disease frequently coexists with and exacerbates the risk of major non-communicable diseases such as ischemic heart disease, stroke, peripheral vascular disease, diabetes, and cancer [3].

Kidney disease represents a growing global challenge that disproportionately impacts impoverished, vulnerable, and marginalized communities, leading to significant individual, healthcare, and societal expenses [4, 5]. Since ancient times, medicinal herbs have been employed to treat a variety of infections. The World Health Organization reports that 80 percent of the global population relies on different plant components and their active compounds as traditional healing methods [6]. Numerous studies have identified the active constituents in various herbs as antioxidants, exhibiting both low toxicity and significant effectiveness. Ginger (Zingiber officinale) is one such herb [7]. Furthermore, the rhizomes of the ginger plant represent the most therapeutically important component of the plant [8]. They exhibit a range of beneficial properties, including such as antiarthritic, antiplatelet, antitumor, antioxidant, antiinflammatory, antiviral, and antihepatotoxic effects [9]. Research has shown that ginger can offer protection against various toxic substances, including cisplatin [10] and bromobenzene [11], which is linked to its capacity to enhance the activity of antioxidant enzymes [12]. This study aimed to assessment of the role of aqueous ginger (*zingiber officinale*) extract (AGE) on induced renal dysfunctions in male rats as a model.

MATERIALS AND METHODS

This study was performed on forty white Albino rats divided into four groups (each group included ten rats). Male rats (10 weeks of age and 200-250 gm of weight) were obtained from animal house in Babylon university. The preparation of CCl4 injected solution was performed by dissolving of 3 ml in olive oil to produce 30% concentration of stock solution and gives i.v. After rats were acclimated with rats were divided into four groups of ten rats each as the following [13]:

Group 1(T1): Administrated normal drinking water as control group for `15 days.

Group 2(T2): Intraperitoneal (i.p.) injection of CCl4 for 3 days to induced renal damage. Then administrated with normal drinking water for 15 days as negative control group.

Group 3(T3): Intraperitoneal (i.p.) injection of CCl4 for 3 days to induced renal damage. Then administrated with 250 mg/kg/body weight of AGE for 15 days.

Group 4(T4): Intraperitoneal (i.p.) injection of CCl4 for 3 days to induced renal damage. Then administrated with 500 mg/kg/body weight of AGE for 15 days.

After end of the experiment, blood were withdraw from all rats in all groups and the serum was isolated to investigation of the biochemical markers related to kidney dysfunctions such as, serum creatinine (CR), uric acid (UA), total antioxidant capacity (TAO-C and MDA), as oxidative stress marker. All biochemical parameters were investigated depending on the protocols provided by the clinical companies with spectrophotometric method analysis.

RESULTS

The results indicated that serum levels of CR (mg/dl) and UA (mg/dl) were significantly elevated in the T2 group as negative control group in compare with the T1 ($p<0.05$). UA (mg/dl) levels were found significant decrease in T4 and T3 groups in compare with T2 and T1, as shown in table 1.

Table 1: CR (mg/dl) and UA (mg/dl) levels in study groups

GROUPS	CR(mg/dl) N=10	UA (mg/dl) N=10
T1	0.54±0.03 d	2.28±0.23 d
T2	1.08±0.07a*	4.09±0.43a*
T3	0.99±0.06b*s	3.34±0.76bs
T4	0.78±0.32c*s	2.66±0.32cs
p-value	0.001	0.001

- * $p < 0.001$ in respect to the T1 group, s=significant in compare to T2 group
- different letters a-d represented significant in all groups

The results indicated that serum levels of MDA (µg/dl) was significantly elevated in the T2 group as negative control group in comparison with the T1 as positive control group ($p<0.05$), and represented in the figure 1.

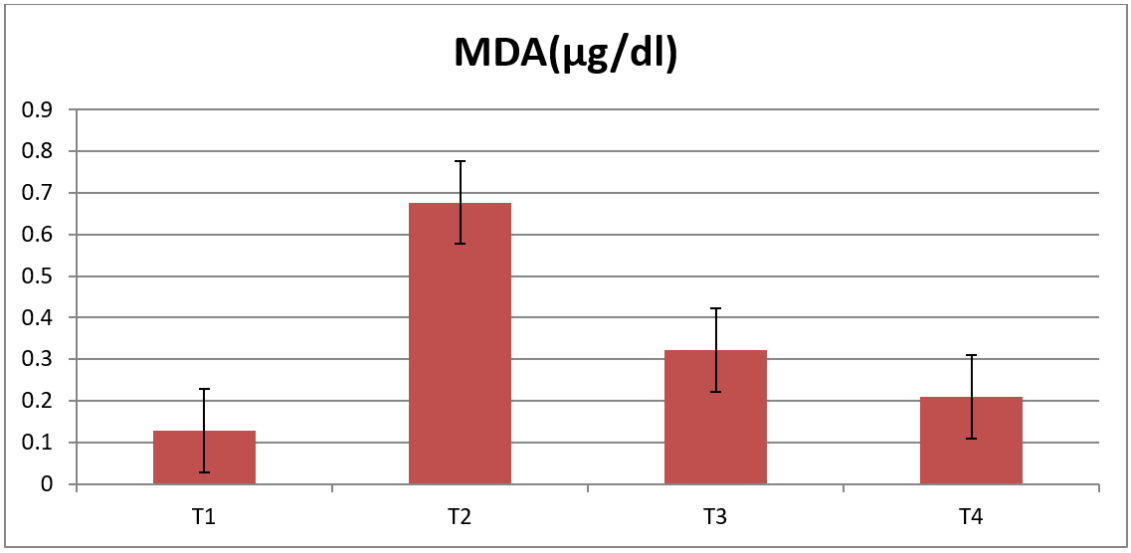

Figure 1: MDA (µg/dl) levels in study groups

The results shown significant increase in TAO-C in T4 and T3 compare to T2, also TAO-C (U/ml) levels were found significant decrease in T2 group in compare with T1 as shown in figure 2.

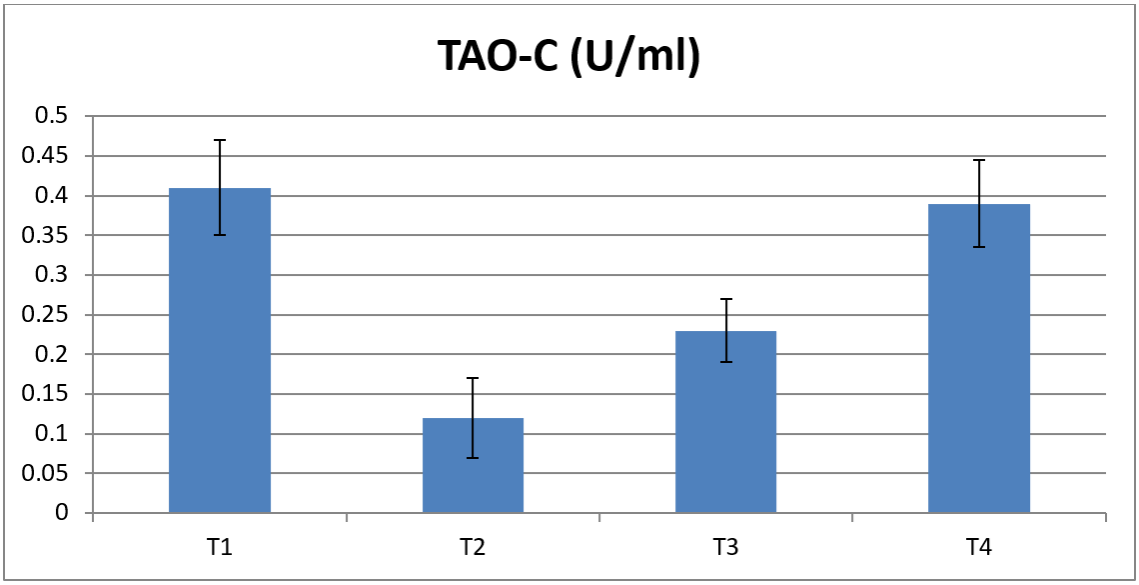

Figure 2: TAO-C (U/ml) levels in study groups

DISCUSSION

The current investigation focused on the protective effect of aqueous ginger extract (AGE) against CCl4-induced renal dysfunctions was evaluated in this study in forty albino white rats (weighing 200-250 g) classified into four groups (ten rats per each group T, T2, T3, and T4). Numerous studies have demonstrated that carbon tetrachloride (CCl4) induces renal damage in rats [14, 15] alongside hepatic toxicity [16] via the free radicals generation. In the present study, kidney functions were investigated through estimation of blood urea acid (UA) and serum creatinine (CR). The results indicated that serum levels of CR (mg/dl) and UA (mg/dl) were significantly elevated in the T2 group as negative control group in comparison with the T1 as control group ($p<0.05$). UA (mg/dl) levels were found significant decrease in T4 and T3 groups in compare with T2 and T1. In the present study, antioxidant status investigated through estimation of blood total antioxidant capacity (TAO-C) and serum malondialdehyde (MDA). The results indicated that serum levels of MDA (µg/dl) was significantly elevated in the T2 group as negative control group in comparison with the T1 as control group ($p<0.05$). TAO-C (U/ml) levels were found significant decrease in T2 group in compare with T1, as shown in figure 1. The results shown significant increase in TAO-C in T4 and T3 compare to T2. Ahmed and Sajida were reported that AGE in combination with cisplatin result to protects the hepatic and heart tissues serve

as against the toxicity caused by this cytotoxic medication [17]. It has been proposed that our plant extract provides a protective effect by inhibiting lipid peroxidation induced by CCl4, which is reflected in the reduced generation of free radical derivatives, as indicated by the increase MDA (µg/dl) levels and lowered levels of TAO-C (U/ml). The group treated with CCl4 demonstrated a heightened susceptibility to lipid peroxidation, while the group that received the same treatment in conjunction with the AGE showed marked protection and increase levels of TAO-C (U/ml) and decrease the MDA (µg/dl) levels. Ansari *et al.,* 2006 [18] were reported that the degree of cardio-protection provided by ginger correlates with a notable reduction in serum levels of LDH, CK, AST, and ALT. in conclusion, this study marked that AGE is very useful for renal protective against medication damage.

CONCLUSION

This study was suggested that protective effects of AGE on renal-nephrotoxicity induced by CCl4.

REFERENCES

1. World Health Organization. SDG target 3.4 non-communicable diseases and mental health. https://www.who.int/data/gho/data/themes/topics/sdg-target-3_4-noncommunicable-diseases-and-mental-health (2024).
2. Hsu, C. Y., Ordonez, J. D., Chertow, G. M., Fan, D., McCulloch, C. E., & Go, A. S. (2008). The risk of acute renal failure in patients with chronic kidney disease. *Kidney international*, *74*(1), 101-107.
3. Coca, S. G., Singanamala, S., & Parikh, C. R. (2012). Chronic kidney disease after acute kidney injury: a systematic review and meta-analysis. *Kidney Int., 81*, 442–448.
4. James, M. T., Hemmelgarn, B. R., Wiebe, N., Pannu, N., Manns, B. J., Klarenbach, S. W., & Tonelli, M. (2010). Glomerular filtration rate, proteinuria, and the incidence and consequences of acute kidney injury: a cohort study. *The Lancet*, *376*(9758), 2096-2103.
5. Bikbov, B. (2023). Core global metrics of chronic kidney disease (CKD) mortality in the GBD 2019 study. Zenodo https://doi.org/10.5281/zenodo.8312881.
6. Ogbera A., Dada O., Adeleye F., & Jewo P. (2010). Complementary and alternative medicine use in diabetes mellitus. *West African Journal of Medicine, 29*(3), 158–162.
7. Alqahtani A. S., Ullah R., & Shahat A. A. (2022). Bioactive constituents and toxicological evaluation of selected antidiabetic medicinal plants of Saudi Arabia. *Evidence-based Complementary and Alternative Medicine, 2022*, 23.
8. Ullah R., Alqahtani A. S., Noman O. M., Alqahtani A. M., Ibenmoussa S., & Bourhia M. (2020). A review on ethno-medicinal plants used in traditional medicine in the Kingdom of Saudi Arabia. *Saudi Journal of Biological Sciences,* 27(10), 2706–2718.
9. Mascolo, N., Jain, R., Jain, S. C., & Capasso, F. (1989). Ethnopharmacologic investigation of ginger (*Zingiber officinale*) *Journal of Ethnopharmacology, 27*(1-2), 129–140.
10. Kamtchouing, P., Mbongue Fandio, G. Y., Dimo, T., & Jatsa, H. B. (2002). Evaluation of androgenic activity of Zingiber officinale and Pentadiplandra brazzeana in male rats. *Asian Journal of Andrology,* 4(4), 299–301.
11. El-Sharaky, A. S., Newairy, A. A., Kamel, M. A., & Eweda, S. M. (2009). Protective effect of ginger extract against bromobenzene-induced hepatotoxicity in male rats. *Food and Chemical Toxicology: An International Journal Published for the British Industrial Biological Research Association, 47*(7), 1584–1590.
12. Afshari, A. T., Shirpoor, A., Farshid, A., Saadatian, R., Rasmi, Y., Saboory, E., ... & Allameh, A. (2007). The effect of ginger on diabetic nephropathy, plasma antioxidant capacity and lipid peroxidation in rats. *Food chemistry*, *101*(1), 148-153. doi: 10.1016/j.foodchem.2006.01.013.
13. Suzuki, K., Nakagawa, K., Yamamoto, T., Miyazawa, T., Kimura, F., Kamei, M., & Miyazawa, T. (2015). Carbon tetrachloride-induced hepatic and renal damages in rat: inhibitory effects of cacao polyphenol. *Bioscience, biotechnology, and biochemistry*, *79*(10), 1669-1675.
14. Khan, M. R., Rizvi, W., Khan, G. N., Khan, R. A., & Shaheen, S. (2009). Carbon tetrachloride induced nephrotoxicity in rat: protective role of Digera muricata. *Journal of Ethnopharmacology, 122*, 91–99.
15. Khan, R. A., Khan, M. R., & Sahreen, S. (2010). Evaluation of Launaea procumbens use in renal disorders: a rat model. *Journal of Ethnopharmacology, 128*, 452–461.
16. Lin, H. M., Tseng, H. C., Wang, C. J., Lin, J. J., Lo, C. W., & Chou, F. P. (2008). Hepatoprotective effects of Solanum nigrum Linn. extract against CCl4-induced oxidative damage in rats. *Chemico-Biological Interactions, 171*, 283–293.
17. Attyah, A. M., & Ismail, S. H. (2012). Protective Effect of Ginger Extract Against Cisplatin-Induced Hepatotoxicity and Cardiotoxicity in Rats. *Iraqi Journal of Pharmaceutical Sciences (P-ISSN 1683-3597 E-ISSN 2521-3512)*, *21*(1), 27-33.
18. Ansari, M. N., Bhandari, U., & Pillai, K. K. (2006). Ethanolic Zingiber officinale R. extract pretreatment alleviates isoproterenol-induced oxidative myocardial necrosis in rats. *Indian J. Exp. Biol., 44*, 892–897.