

Original Research Article

Nephroprotective Role of *Zingiber officinale* Aqueous Extract on the Renal Damage in Male Rats as Model

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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 dysfunctions 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 was 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

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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 and UA were found significantly elevated in 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
significant	S	S

- * $p < 0.001$ 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 ($\mu\text{g/dl}$) 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.

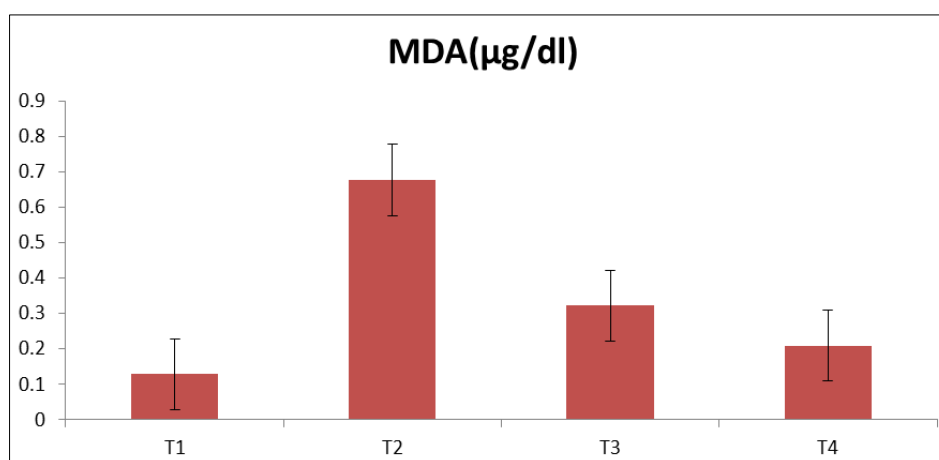


Figure 1: MDA ($\mu\text{g/dl}$) levels in study groups

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.

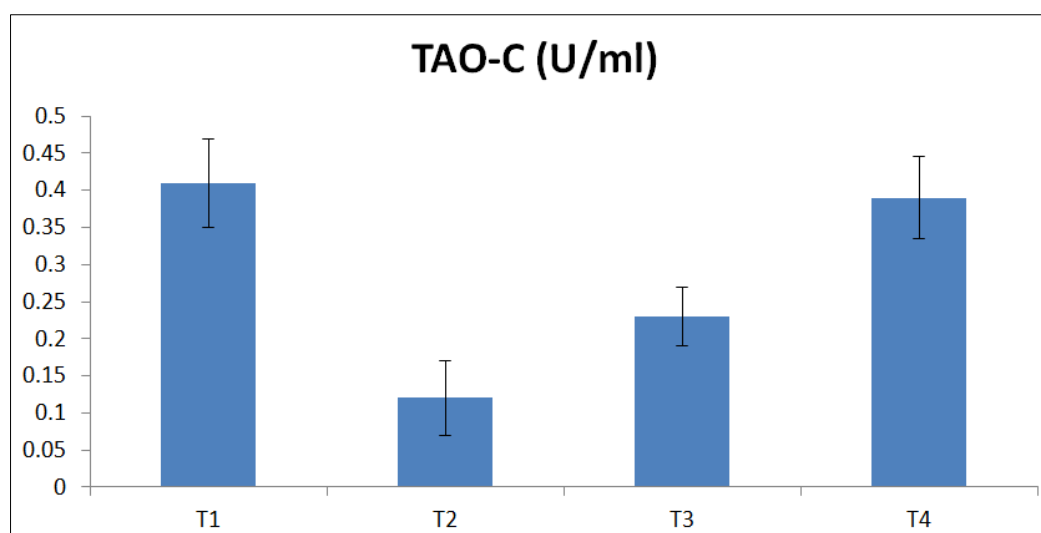


Figure 2: TAO-C (U/ml) levels in study groups

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 comparing to 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 ($\mu\text{g/dl}$) was significantly elevated in the T2 group as negative control group in comparing to 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 ($\mu\text{g/dl}$) 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 ($\mu\text{g/dl}$) levels. Ansari *et al.*, 2006 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.

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