



Lycopene Mitigates Cisplatin-Triggered Renal Injury in Sprague-Dawley Rat Model

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Abstract

Background : Cisplatin is a commonly used chemotherapy drug that works well for various solid cancers. Nevertheless, its therapeutic effectiveness is restricted by the risk of nephrotoxicity, which can significantly impact long-term patient outcomes. The problem addressed in this study is the nephrotoxicity associated with cisplatin treatment which can lead to kidney damage compromised renal performance. **Objective:** This study aimed to investigate the protective potential of lycopene (LP) against cisplatin-induced renal injury and to evaluate its antioxidant and anti-inflammatory effects in an experimental rat model. **Methodology :** This study explored lycopene's (LP) potential to mitigate cisplatin-triggered renal injury in a Sprague Dawley rat model. The study consisted of five groups (n=5): a control group receiving normal saline, a group administered with cisplatin (10 mg/kg), a group administered with lycopene (100 mg/kg), a group administered with cisplatin followed by lycopene, and a group administered with lycopene followed by cisplatin. The treatment lasted for 28 days. **Results :** The study found that lycopene co-treatment mitigated cisplatin-triggered kidney damage, oxidative stress, and inflammation. Lycopene restored kidney antioxidant enzyme activities and diminished renal inflammation markers. Histopathological examination revealed that lycopene treatment reversed cisplatin-triggered kidney damage and promoted renal tissue regeneration. **Conclusion:** These observations imply that lycopene may be a promising option for adjunctive therapy to reduce cisplatin-triggered nephrotoxicity.

Keywords: Renoprotective, Cisplatin, Lycopene, Nephrotoxicity, Sprague-dawley rats

1. Introduction

Cisplatin, a powerful platin-based chemo drug, stands as a cornerstone in the management of a wide array of solid cancers, including testicular, ovarian, bladder, head and neck, and lung cancers. Its efficacy stems from its ability to form intra- and interstrand crosslinks in DNA, ultimately disrupting DNA replication and transcription, leading to tumor cell death[1]. However, the clinical utility of cisplatin is significantly hampered by its dose-limiting toxicity, particularly its detrimental effects on the kidneys, known as nephrotoxicity[2]. A substantial number of patients receiving cisplatin-based chemotherapy experience kidney damage, underscoring the need for effective prevention and treatment strategies[3]. The kidneys' susceptibility to cisplatin toxicity can be attributed to their high blood flow and the presence of specific transporters that concentrate the drug within renal tubular cells[2]. The mechanisms underlying cisplatin-induced nephrotoxicity are complex and multifactorial, involving a cascade of interconnected events that culminate in renal dysfunction and structural damage[4], the key mechanisms include; **Oxidative Stress, Inflammation, Apoptosis, and Vasoconstriction**[4]. Cisplatin-induced nephrotoxicity typically manifests as acute kidney injury, characterized by a rapid decline in renal function, as evidenced by raised serum creatinine and blood urea nitrogen levels[5]. In severe cases, AKI can progress to chronic kidney disease, necessitating long-term dialysis or kidney transplantation[6].

Lycopene, a naturally occurring carotenoid pigment responsible for the vibrant red color of tomatoes and other fruits and vegetables, has garnered significant attention for its potent antioxidant and anti-inflammatory properties, suggesting its potential as a protective agent against various diseases, including cancers, Cardiovascular ailments, and neurodegenerative diseases [7]. Lycopene is a highly effective scavenger of free radicals, particularly singlet oxygen, a highly reactive oxygen species implicated in

oxidative damage to cells and tissues[8] and its antioxidant capacity surpasses that of other well-known antioxidants, such as beta-carotene and vitamin E[9]. Beyond its antioxidant effects, lycopene shows anti-inflammatory effects by modulating the expression of pro-inflammatory cytokines and enzymes involved in inflammatory pathways[10]. Emerging evidence from preclinical and clinical studies suggests that lycopene may confer protective effects against various renal insults, including drug-triggered nephrotoxicity, diabetic nephropathy, as well as ischemia-reperfusion injury[11]. These benefits are thought to result from lycopene's capacity to reduce oxidative stress, inflammation, and modulate cellular signalling pathways[12].

2. Materials and Methods

2.1 Biochemicals and Analytical-kits

Lycopene and various biochemical reagents, including catalase (CAT), glutathione peroxidase (GPx), nitric oxide (NO), thiobarbituric acid (TBA), 5', 5'-dithiobis-2-nitrobenzoic acid (DTNB), 1-chloro-2,4-dinitrobenzene (CDNB), glutathione (GSH), and epinephrine, were procured from Sigma Chemical Co. (St Louis, MO, U.S.A). ELISA kits for assessing tumor necrosis factor- α (TNF- α) and interleukin-1 β (IL-1 β) activity were purchased from e-bioscience, Inc. (San Diego, USA) and Elabscience Biotechnology Company (Beijing, China), respectively. The chemicals utilized were of analytical standard.

2.2 Experimental Protocols

Twenty-five adult male Sprague-Dawley rats (8 week-old, weighing 164 ± 7 g) were obtained from the Animal Breeding Unit, School of Basic Medical-Sciences, Federal University of Technology, Akure, Nigeria. The rats were kept in plastic cages under optimal lab conditions, with a 12-hour light-dark-cycle, controlled temp, and humidity. They had free access to feed and water and received proper care following the 'Guide for Laboratory

ry Animal Use' guidelines from the National Institute of Health. The study was conducted in compliance with US-NAS protocol and approved by the Federal University of Technology Akure Ethics-committee.

2.3 Experiment framework

The rats were divided into five groups (n=5), designated as groups A- E. Group A (control): Received normal saline (10ml.kg⁻¹ bwt, i.p.) daily; Group B: Received a single dose of cisplatin (CP, 10 mg.kg⁻¹ bwt, i.p.) on day 1; Group C: Received Lycopene (LP, 100 mg.kg⁻¹ bwt, i.p.) daily; Group D: Received a single dose of CP (10 mg.kg⁻¹ bwt, i.p.) on day 1, followed by LP (100 mg.kg⁻¹ bwt, i.p.) daily while Group E: Received LP (100 mg.kg⁻¹ bwt, i.p.) daily, with a single dose of CP (10 mg.kg⁻¹ bwt, i.p.) on the last day. The 28-day experiment adhered to the animal research rules of the Federal University of Technology Akure and the National Institute of Health's guidelines on laboratory animal care and use.

2.4 Animal Euthanasia and Specimen Collection

The animals were sacrificed by decapitation under ketamine/xylazine (60/6 mgkg⁻¹, i.p.) anesthesia, 24 hours after the last administration. Kidney tissues were isolated, and blood samples were collected from the heart. The blood samples were centrifuged at 3000 rpm for 10 minutes to separate the serum, which was then stored at -20°C until analysis. The tissues were washed with normal saline and prepared for histological screening. One part of the tissue was fixed in 10% phosphate-buffered-formalin

2.5 Body and Organ Weight Determination

Weekly body weight measurements were taken using a precise electronic balance (Scout Pro, Ohaus Corporation, USA). At sacrifice, the kidneys were weighed to determine their absolute weights, and their relative weights were calculated using the formula:

$$\text{Relative weight of kidney} = \frac{\text{Absolute weight of kidney}}{\text{Final body weight}} \times 100 \%$$

2.6 Renal Sample Homogenization

The left kidney of the rats was homogenized in 50 mM Tris-HCl buffer (pH 7.4) made up of 1.15% KCl to formulate a 20% (w/v) tissue homogenate using a Potter Elvehjem homogenizer. The homogenates were spun at 1,000 g for 10 minutes in a refrigerated centrifuge. The resulting supernatants were utilized to assess oxidative stress markers, cytokine profiles, and apoptotic protein levels.

2.7 Kidney Function Assessment

Kidney function was assessed by quantifying creatinine and blood urea nitrogen (BUN) levels. Creatinine-concentration was determined using the Jaffe reaction[13]. BUN levels were measured with a standard assay kit (Randox).

Table 1: Impact of lycopene on body weight, kidney weight, and relative kidney weight in Sprague Dawley rats with cisplatin-triggered nephrotoxicity

Parameter	Treatment groups				
	A (Control)	B (C.P)	C (L.P)	D (C.P+L.P)	E (L.P+C.P)
Initial body weight (g)	210.35±4.54	212.52±4.26	208.26±2.42	207.34±4.38	212.48±5.38
Final body weight (g)	282.04±10.21	198.35±3.38*	281.35±12.62 ^a	272.26±13.52 ^a	285.32±12.48 ^a
Weight gain (g)	71.69±5.67	14.17±0.88*	73.09±10.20 ^a	64.92±9.14 ^a	72.84±7.10 ^a
Absolute Kidney weight (g)	0.59±0.01	0.42±0.01*	0.59±0.00 ^a	0.57±0.01 ^a	0.58±0.01 ^a

Table 2: Lycopene's impact on kidney function in Sprague Dawley rats with cisplatin-triggered nephrotoxicity Data are Mean ± SEM (n=5/group), *: connotes a significant difference from control, a: connotes a significant difference from CP, b: connotes a significant difference from LP at p_{value}< 0.05, One-Way-ANOVA. Keys: LP Lycopene; CP: Cisplatin; β2-MG: Beta 2-microglobulin

3.2 Renal functional indices

Cisplatin treatment significantly increased serum levels of urea, creatinine, and β2-microglobulin (β2-MG) compared to the control group (p_{value}< 0.05). However, co-administration of lycopene

2.8 Oxidative and Nitrosative Stress Biomarker Detection

Renal RONS production was measured using a DCFH-DA assay[14, 15]. The reaction mixture contained 10 μL sample, 150 μL potassium phosphate buffer (0.1 M, pH 7.4), 35 μL distilled water, and 5 μL DCFH-DA (200 μM, final concentration 5 μM). DCF fluorescence was measured at 488 nm excitation and 525 nm emission wavelengths using a SpectraMax plate reader for 10 minutes. Data were presented as % of control.

2.9 Renal Pro-inflammatory Biomarker Assessment

Nitric oxide (NO) concentrations were determined using a Griess reagent-based assay[16]. Absorbance was measured at 540 nm after 15 minutes, and NO concentrations were calculated from a standard curve (Units/mg protein). Myeloperoxidase (MPO) activity was assessed using Granell's method[17]. Renal cytokines (IL-1β and TNF-α) and NF-κB expression were measured using ELISA kits, following the manufacturer's manual.

2.10 Kidney Tissue Processing and Staining

Kidney tissue samples were fixed in 10% buffered-formalin, embedded in paraffin, sectioned (5 μm), and stained with H&E[18]. The sections were evaluated by light-microscopy for tubular injury, necrosis, and inflammatory cell infiltration[19].

2.11 Statistical Evaluation of Results

Data were analyzed using GraphPad InStat 8 software (San Diego, CA, USA). And the results are presented as mean ± SEM. One-way ANOVA with Tukey's post-hoc test was used for multiple group comparisons, while Student's t-test was used for two-group comparisons. And statistics significance was taken as P_{value} < 0.05.

3. Results

Table 1: Impact of lycopene on body weight, kidney weight, and relative kidney weight in Sprague Dawley rats with cisplatin-triggered nephrotoxicity

Data are Mean ± SEM (n=5/group), *: connotes a significant difference from control, a: represents a significant difference from CP, b: connotes a significant difference from LP at p_{value}< 0.05, One-Way-ANOVA. Keys: LP Lycopene; CP: Cisplatin

3.1 Weights of body, kidney, and kidney relative to body

Compared to the control group, cisplatin treatment significantly reduced final body weight gain and absolute kidney weight (p<0.05). In contrast, co-administration of cisplatin and lycopene, as well as lycopene alone, increased final body weight, weight gain, and absolute kidney weight compared to cisplatin-treated animals (p<0.05). No significant changes in relative kidney weight were observed between groups (Table 1).

(LP) with cisplatin (CP) decreased these levels (p_{value}< 0.05). LP alone also decreased renal serum urea, creatinine, and β2-MG

levels compared to CP-treated rats (p_{value}< 0.05). In contrast, serum uric acid levels decreased in CP-treated rats (p_{value}< 0.05), but increased in CP+LP and LP+CP groups (p_{value}< 0.05). LP alone had no significant effect on serum uric acid levels (p_{value}< 0.05) (Table 2).

Table 3: Lycopene's influence on kidney oxidative-stress markers in Sprague Dawley rats with cisplatin-triggered nephrotoxicity Data are presented as Mean ± SEM (n=5/group), *: represents a significant difference from control, a: represents a significant difference from CP, b: represents a significant difference from LP

at $p_{\text{value}} < 0.05$, One-Way-ANOVA. Keys: LP Lycopene; CP: Cisplatin; NO: Nitric oxide; MPO: Myeloperoxidase; RONS: Reactive oxygen and nitrogen species; MDA: Malondialdehyde

3.3 Kidney oxidative-stress parameters

Cisplatin treatment increased renal levels of NO, MPO, RONS, and MDA compared to controls ($p < 0.05$). However, lycopene (LP) treatment, either alone or in combination with cisplatin (CP), decreased these levels ($p_{\text{value}} < 0.05$). LP alone also reduced renal NO, MPO, RONS, and MDA concentrations compared to CP-treated rats ($p_{\text{value}} < 0.05$). No significant differences were observed between LP, CP+LP, and LP+CP groups ($p > 0.05$) (Table 3). Table 4: Lycopene's impact on kidney antioxidant enzymes in Sprague Dawley rats with cisplatin-triggered nephrotoxicity. Data are presented as Mean $\pm$ SEM ($n=5/\text{group}$), *: connotes a significant difference from control, a: represents a significant difference from CP, b: connotes a significant difference from LP at $p_{\text{value}} < 0.05$, One-Way-ANOVA. Keys: LP Lycopene; CP: Cisplatin; SOD: Superoxide dismutase; GPx: Glutathione peroxidase; GST:

Glutathione S-transferase; GSH: Reduced glutathione; CAT: Catalase.

3.4 Renal antioxidant enzymes

Cisplatin treatment decreased renal SOD, CAT, GST, GPx, and GSH activities compared to controls ($p_{\text{value}} < 0.05$). However, lycopene (LP) co-administration (LP+CP and CP+LP) alleviated these decreases ($p_{\text{value}} < 0.05$). LP alone had no significant effect on enzyme activities compared to controls ($p_{\text{value}} < 0.05$). No significant differences were observed between LP, LP+CP, and CP+LP groups (Table 4). Figure 1: Effect of lycopene on IL1 β and TNF α on Cisplatin-induced nephron toxicity. Values are expressed as Mean $\pm$ S.E.M, $n=5$ in each group, *: connotes a significant difference from control, a: connotes a significant difference from CP, b: connotes a significant difference from LP, at $p_{\text{value}} < 0.05$, One-Way-ANOVA. Keys: LP: Lycopene; CP: Cisplatin

Table 2: Lycopene's impact on kidney function in Sprague Dawley rats with cisplatin-triggered nephrotoxicity

Parameter	Treatment groups				
	A (Control)	B (C.P)	C (L.P)	D (C.P+L.P)	E (L.P+C.P)
Creatinine mg/dl	1.850 $\pm$ 0.44	7.934 $\pm$ 1.43*	1.742 $\pm$ 0.40 ^b	2.744 $\pm$ 0.45 ^b	2.752 $\pm$ 0.42 ^b
Uric acid (mg/dl)	6.346 $\pm$ 0.31	2.034 $\pm$ 1.30*	7.252 $\pm$ 0.30 ^b	6.178 $\pm$ 0.42 ^b	6.098 $\pm$ 0.37 ^b
Urea (mg/dl)	23.67 $\pm$ 5.90	58.20 $\pm$ 8.74*	20.20 $\pm$ 5.54 ^b	27.23 $\pm$ 5.74 ^b	26.59 $\pm$ 5.21 ^b
β 2-MG ($\mu\text{mol/L}$)	0.8180 $\pm$ 0.35	3.830 $\pm$ 1.30*	0.7320 $\pm$ 0.32 ^b	1.206 $\pm$ 0.33	1.200 $\pm$ 0.30

Table 3: Lycopene's influence on kidney oxidative-stress markers in Sprague Dawley rats with cisplatin-triggered nephrotoxicity

Parameter	Treatment groups				
	A (Control)	B (C.P)	C (L.P)	D (C.P+L.P)	E (L.P+C.P)
Kidney NO (μmg protein)	1.776 $\pm$ 0.64	6.212 $\pm$ 1.71*	1.738 $\pm$ 0.68 ^b	2.132 $\pm$ 0.75	1.938 $\pm$ 0.70 ^b
Kidney MPO (μmg protein)	4.632 $\pm$ 1.71	11.40 $\pm$ 4.02	4.038 $\pm$ 1.40	5.324 $\pm$ 1.90	5.194 $\pm$ 1.99
Kidney RONS (μmol /mg protein)	96.16 $\pm$ 11.07	196.2 $\pm$ 17.80*	95.16 $\pm$ 11.45 ^b	104.8 $\pm$ 11.66 ^b	102.0 $\pm$ 11.85 ^b
Kidney MDA (μmol /mg protein)	2.860 $\pm$ 1.14	10.87 $\pm$ 3.53	2.676 $\pm$ 1.07	3.438 $\pm$ 1.32	3.078 $\pm$ 1.22

Table 4: Lycopene's impact on kidney antioxidant enzymes in Sprague Dawley rats with cisplatin-triggered nephrotoxicity

Parameter	Treatment groups				
	A (Control)	B (C.P)	C (L.P)	D (C.P+L.P)	E (L.P+C.P)
SOD (nmol/mg protein)	1.776 $\pm$ 0.64	6.212 $\pm$ 1.71*	1.738 $\pm$ 0.68 ^a	2.132 $\pm$ 0.75	1.938 $\pm$ 0.70 ^b
CAT (μmol /mg protein)	4.632 $\pm$ 1.71	11.40 $\pm$ 4.02	4.038 $\pm$ 1.40	5.324 $\pm$ 1.90	5.194 $\pm$ 1.99
GPx (μmol /mg protein)	96.16 $\pm$ 11.07	196.2 $\pm$ 17.80*	95.16 $\pm$ 11.45 ^b	104.8 $\pm$ 11.66 ^b	102.0 $\pm$ 11.85 ^b
GST (μmol /mg protein)	2.860 $\pm$ 1.14	10.87 $\pm$ 3.53	2.676 $\pm$ 1.07	3.438 $\pm$ 1.32	3.078 $\pm$ 1.22
GSH (μmol /mg protein)	4.370 $\pm$ 2.04	0.8280 $\pm$ 0.42	4.522 $\pm$ 2.04	3.838 $\pm$ 1.72	4.406 $\pm$ 2.13

3.5 Renal pro-inflammatory biomarkers

Cisplatin treatment increased renal IL1 β and TNF α levels compared to controls ($p_{\text{value}} < 0.05$). Co-treatment with lycopene (LP) attenuated these increases ($p_{\text{value}} < 0.05$). LP+CP and CP+LP groups had lower IL1 β and TNF α levels than CP alone, but higher than LP-treated group ($p_{\text{value}} < 0.05$). No significant differences were observed between control, LP, CP+LP, and LP+CP groups ($p_{\text{value}} < 0.05$) (Figure 1).

3.6 Histopathological Findings

Control Group (A): The kidney sections showed normal architecture with preserved glomeruli (G) and regular tubular contours (C). The proximal convoluted tubules (PT) and distal convoluted tubules (DT) appeared normal with intact nuclei of endothelial cells. Cisplatin Group (B): The kidney sections showed pronounced degenerative changes, focal inflammatory lesions, and widespread vascular congestion (arrow). Lycopene Group (C): The kidney sections appeared normal with intact glomeruli (G) and regular tubular contours (C). There were no signs of necrosis or cellular damage. Whereas in CP+LP and LP+CP Groups (D and E), the histopathological lesions were ameliorated, with marked regeneration of renal tissues. These findings suggest that lycopene co-treatment mitigated the nephrotoxic effects of cisplatin. The images (Figure 2A-E) show the histopathological changes in the kidney sections.

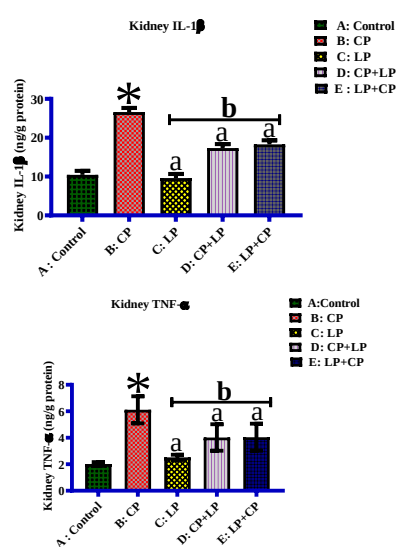


Figure 1: Effect of lycopene on IL1 β and TNF α on Cisplatin-induced nephron toxicity. Values are expressed as Mean $\pm$ S.E.M, $n=5$ in each group, *: connotes a significant difference from control, a: connotes a significant difference from CP, b: connotes a significant difference from LP, at $p_{\text{value}} < 0.05$, One-Way-ANOVA. Keys: LP: Lycopene; CP: Cisplatin

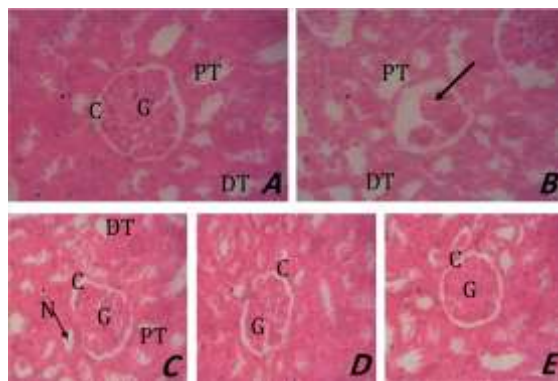


Figure 2: A: shows regular glomeruli and tubular contour as well as proximal and distal tubules. B: revealed obvious degeneration, focal-area of inflammation, and wide spread congestion of vessels. C: intact glomeruli and normal tubular contour. D & E shows histopathological lesion in renal cell. G: Glomeruli; C: Tubular Contour; DT: Distal Tubules; PT: Proximal Tubules; N: Nuclei; Arrow: Vessels. H&E stain, magnification X100, scale bar represents 50 μ m

4. Discussion

The actual mechanisms behind lycopene's kidney-protective effects are not yet fully understood, but several possible pathways have been suggested. Lycopene is a powerful antioxidant that can neutralize free radicals and reactive-oxygen species (ROS) [20], which are induced by cisplatin and contribute to kidney damage and dysfunction [21]. By reducing oxidative stress, lycopene may shield kidney cells from harm, lycopene has also been shown to regulate inflammatory pathways, reducing the production of inflammatory mediators and chemokines [22], which play a key role in cisplatin-triggered kidney damage [23]. Additionally, lycopene's inflammation-reducing potency may help mitigate the inflammatory response [10]. Studies have also revealed that cisplatin can trigger programmed cell death in renal cells, contributing to tissue damage [23], and on the other hand, lycopene has been implicated to demonstrate anti-apoptotic activity in various cell types, including renal cells [22]. And by inhibiting apoptosis, lycopene may preserve renal cell viability and function.

The results of this study demonstrate that lycopene pretreatment significantly attenuated cisplatin-induced renal injury in Sprague Dawley rats. This protective effect was evident in the reduced levels of renal serum urea, creatinine, and β 2-microglobulin (β 2-MG) in the lycopene-treated group compared to the cisplatin-only group ($p_{\text{value}} < 0.05$). Notably, there were no significant differences in these biomarkers among the groups treated with lycopene alone, cisplatin + lycopene, and lycopene + cisplatin ($p_{\text{value}} < 0.05$) [Table 2]. It was also noted that lycopene co-treatment (cisplatin + lycopene and lycopene + cisplatin) significantly diminished markers of inflammation (IL-1 β & TNF α) in renal tissues relative to the cisplatin-only group ($p_{\text{value}} < 0.05$). However, the levels of these biomarkers were higher in the cisplatin + lycopene and lycopene + cisplatin groups contrasted to the lycopene-only group ($p_{\text{value}} < 0.05$). The levels of renal IL-1 β and TNF- α were comparable between the control group and the lycopene, cisplatin + lycopene, and lycopene + cisplatin treatment groups ($p_{\text{value}} < 0.05$) [Figure 1]. Notably, Lycopene alone treatment showed decreased oxidative stress markers compared to cisplatin alone ($p_{\text{value}} < 0.05$), stressing its antioxidant potential. Furthermore, there were no significant differences in oxidative stress markers among the lycopene alone, lycopene + cisplatin, and cisplatin + lycopene groups ($p_{\text{value}} < 0.05$) [Table 3].

Cisplatin administration caused significant kidney oxidative damage, as evidenced by decreased activities of antioxidant-enzymes, including superoxide dismutase (SOD), catalase (CAT), glutathione S-transferase (GST), glutathione peroxidase (GPx), and reduced glutathione (GSH), compared to the control group ($p_{\text{value}} < 0.05$). This decline indicates compromised renal antioxidant defenses, potentially leading to tissue damage. However, pre-treatment and post-treatment with lycopene mitigated the cisplatin-induced decline in antioxidant enzymes. The lycopene +

cisplatin and cisplatin + lycopene groups showed alleviated decreases in SOD, CAT, GST, GPx, and GSH activities compared to the cisplatin alone group, suggesting lycopene's protective role in preserving renal antioxidant function. Obviously, lycopene alone did not significantly affect antioxidant enzyme activities compared to the control group ($p_{\text{value}} < 0.05$). Furthermore, there were no significant differences in the activities of SOD, CAT, GST, GPx, and GSH among the lycopene, lycopene + cisplatin, and cisplatin + lycopene groups [Table 4]. This suggests that lycopene maintains baseline antioxidant levels and effectively counteracts cisplatin-triggered oxidative stress, thereby preserving renal antioxidant function.

Histopathological analysis further supported these findings, revealing significant damage to kidney architecture in rats treated with cisplatin alone, including obvious degeneration, localized inflammation, and widespread vascular congestion, indicative of severe nephrotoxicity [23]. In stark contrast, rats treated with lycopene (LP) alone exhibit normal kidney architecture, and healthy endothelial cells. This suggests that Lycopene and cisplatin (CP+LP and LP+CP) markedly ameliorates the histopathological lesions, indicating Lycopene's protective effects against cisplatin-induced nephrotoxicity. These results support holds promise in mitigating kidney damage caused by cisplatin, which is in line with previous ascertainment by Xingyu Pan and colleagues suggesting that lycopene does not induce adverse effects on kidney histology [24].

Lycopene's renoprotective effects are attributed to its free radical-scavenging and inflammation-modulating effects, evidenced by histological findings. By preserving kidney structure and facilitating tissue repair, lycopene shows promise as a complementary treatment to mitigate cisplatin-induced kidney damage. However, further research is needed to elucidate the molecular pathways driving lycopene's cytoprotective actions and explore its potential therapeutic applications. The findings suggest that prophylactic administration of lycopene can mitigate cisplatin's nephrotoxic effects, corroborating previous studies on lycopene's protective effects in various experimental models. For example, lycopene has been shown to attenuate associated inflammatory reactions and apoptosis in aristolochic acid nephropathy [12] and exhibit nephroprotective potential in adenine-triggered renal injury in rats [25]. Collectively, these studies support lycopene's promise as a therapeutic option for protecting against renal damage.

5. Conclusion

Lycopene, a naturally occurring compound with a favourable safety profile, displayed exceptional ability to mitigate cisplatin-induced nephrotoxicity and preserve renal function which could significantly improve the well-being of cancer individuals receiving cisplatin chemotherapy. This indicates that Lycopene could serve as a useful supplementary therapy to mitigate cisplatin-triggered nephrotoxicity. Its antioxidant activity and ability to mop up reactive oxygen species may safeguard kidney cells from injury. Dietary supplementation with lycopene-rich foods, such as tomatoes, may also help alleviate cisplatin-induced kidney damage. The statistically significant reductions in oxidative stress markers support the potential therapeutic benefits of lycopene. However, further studies are needed to explore lycopene's mechanisms, optimal dosing regimens, and effectiveness in real-world applications. Robust clinical trials are crucial to evaluate the effectiveness and tolerability of lycopene supplementation in human subjects undergoing cisplatin treatment. These trials should investigate optimal dosages, treatment durations, and long-term effects of lycopene supplementation.

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Authors contribution

SAA and JAS took the lead, handling experiments, data analysis, and drafting the publication. VOO and PBA pitched in with pathology and biochemical expertise, and everyone contributed to the final manuscript. The final version was collectively endorsed by all contributing authors.

Ethics statement

The institutional animal care and use committee (IACUC) at School of Basic Medical Sciences, FUTA approved the experimental procedures.

Consent for publication

All contributing authors gave consent for this manuscript to be considered for publication in your journal

Competing interests

We declare no conflict of interest.

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