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Cardioprotective Effects of *Moringa oleifera* in Cisplatin-Intoxicated Rats

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Abstract

CISPLATIN is an anticancer medication with systemic side effects that limit its use. *Moringa oleifera* is a medical plant with antioxidant and protective properties. Thus, this study determined the protective impact of *M. oleifera* against cisplatin-induced cardiotoxicity. The rats were randomly separated into six groups. Group (1) normal rats; groups (2) and (3) received *M. oleifera* leaf extract orally at 250 and 500 mg/kg b.wt., respectively, for 28 days; and group (4) was given a single dosage of cisplatin at 10 mg/kg b.wt. i.p. on the 20th day of the experiment, while groups (5) and (6) were given orally *M. oleifera* at the same doses as groups (2) and (3), then cisplatin at a similar dose to group (4). Cisplatin administration resulted in significant cardiac histopathological changes, with markedly increased cardiac markers, oxidative stress markers, and lipid profile, whereas antioxidant markers were dramatically lowered compared with the control group. Administration of *M. oleifera* improves biochemical and histological parameters in a dose-dependent manner. The current study proposed that *Moringa oleifera* extract improves changes in biochemical parameters and heart histopathology in cisplatin-intoxicated rats, and it could be used in combination with cisplatin to reduce cardiotoxicity.

Keywords: cardiotoxicity, cisplatin, *Moringa oleifera*, oxidative stress, rats.

Introduction

Cisplatin (cis-diamminedichloroplatinum II) is a chemotherapeutic drug used to treat many types of cancer, including leukaemia, sarcoma, lymphoma, mammary gland, lung, and ovarian cancer [1]. Despite its advantages, numerous experimental studies have revealed the widespread harmful side effects of cisplatin [2]. Although cardiotoxicity is not considered a typical cisplatin side effect, a range of cardiotoxic findings that arise during or shortly after cisplatin administration have recently been reported [3].

The antineoplastic action of cisplatin interferes with DNA synthesis and repair pathways in cancer cells [4]. Similar to most chemotherapeutic medications, cisplatin does not differentiate between normal and cancerous cells; it destroys fast-growing cells regardless of whether they are cancer cells or not [5]. Furthermore, a trigger of cisplatin-induced damage is oxidative stress triggered by free radical production [6]. Recently, there has been a great deal of interest in the protective effects and mechanisms of naturally occurring compounds in dietary food that have antioxidant activities and may be useful in decreasing cisplatin-induced damage in several tissues [7, 8].

Moringa oleifera is related to the *Moringaceae* family and is high in nutrition because it contains important phytochemicals in its seeds, petals, and leaves [9]. Moringa leaf extract contains polyphenols, antioxidants, catalase, and oxidases. As a result, it demonstrated significant nutritional and pharmacological benefits, including protection against cardiovascular, neurological, and hepatorenal problems. It also exhibits antipyretic, anticancer, antioxidant, and anti-inflammatory effects [10, 11].

Subsequently, our study was conducted to assess the effect of *Moringa oleifera* leaf extract on cisplatin-induced cardiac toxicity in rats by measuring cardiac parameters, lipid profile, oxidant and antioxidant parameters, as well as histopathological and immunohistochemical examination.

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Materials and Methods

Chemicals

Cisplatin 50 mg/50 ml was purchased from Mylan Company (France). Biochemical parameters (aspartate aminotransferase, cholesterol, triglycerides, and high-density lipoprotein) were measured in sera using CliniChem kits (Budapest). Malondialdehyde, catalase, and superoxide dismutase kits were obtained from Cell Biolabs, Inc. (San Diego, USA). Cayman Chemical Company (USA) supplied the lipid hydroperoxide kit. The cardiac troponin-I kit was obtained from Kamiya Biomedical Company, (USA). However, creatine kinase-MB was obtained from CliniChem, (Budapest).

Moringa olifera leaf extract

The National Research Centre in Giza provided *Moringa oleifera* leaf extract, which was prepared according to Abdel-Daim [12].

Experimental animals

We obtained sixty male Wister rats (150–200 g) from the National Research Centre in Dokki, Cairo, Egypt. The rats were maintained in plastic cages in the laboratory animal house at the Faculty of Veterinary Medicine, Suez Canal University, Egypt, and adapted for one week before the trial under observation to ensure that they were pathogen-free before beginning. They were kept in a controlled laboratory setting with a temperature of 20–25 °C, a 12/12 h light/dark cycle, and were provided with an unlimited amount of water and food. The animals received human care, and the experiment was carried out in compliance with institutional protocols.

Experimental design

Six equal groups of rats (10 rats each) were prepared. The control group served as the normal group, which received saline for 28 days. The MO250 group received oral 250 mg/kg b.wt. *M. oleifera* leaf extract daily for 28 days [13]. In the MO500 group, *M. oleifera* leaf extract was given at a dose of 500 mg/kg b.wt. oral daily for 28 days [13]. The CP group received a single intraperitoneal dosage of 10 mg/kg b.wt. cisplatin on day 20 of the experiment [14]. The MO250+CP group received 250 mg/kg b.wt. *M. oleifera* leaf extract orally daily for 28 days and 10 mg /kg b. wt. cisplatin intraperitoneally on day 20 of the experiment. The MO500+CP group was given 500 mg/kg b.wt. *M. oleifera* leaf extract oral daily for 28 days, and a single dose of 10 mg /kg b. wt. cisplatin intraperitoneally on day 20 of the experiment.

Blood and tissue sampling

On days 21 and 28 of the trial, five rats were haphazardly selected from each group. Under tetrahydrofuran anaesthesia, blood samples were directly collected from the hearts of the animals. The blood samples were placed in plain tubes and left to coagulate for 30 min. at room temperature before being centrifuged for 15 min. at 1000 ×g. Then, the sera were separated and stored at – 20 °C for biochemical assessment. After scarification, the heart samples were extracted, washed in ice-cold buffer saline, and plotted dry. Then, a part of each heart was homogenized and then centrifuged [15]. Tissue homogenates were stored at – 20 °C for MDA, SOD, CAT, and LOOH assessment. Only on day 28 of the experiment another part from each heart sample was preserved in 10% formalin for histological and immunohistochemical investigation.

Serum biochemical analysis

Creatine kinase–MB (CK-MB) was measured according to Morison [16]. Aspartate aminotransferase (AST) activity was assessed as described by Reitman and Frankel [17]. Cardiac troponin-I (cTnI) followed the manufacturer's directives. Total cholesterol and triglycerides were measured in accordance with the methods of Richmond [18] and Fossati and Prencipe [19], respectively. High-density liporotein (HDL-c) was determined using Burstein's method [20]. Low-density lipoprotein (LDL-c) and very low-density lipoprotein (VLDL-c) were estimated by the equation of Friedewald [21]. The athero index was calculated using the formula of Pandya [22]. Catalase (CAT) and superoxide dismutase (SOD) were estimated as described previously by Hadwan [23] and Koivunen and Krogsrud [24], respectively. Malondialdehyde (MDA) and lipid hydroperoxide (LOOH) were assessed as described by Armstrong and Browne [25] and Mihaljević [26], respectively.

Histopathology

Routine histopathology procedures were performed on formalin-fixed heart tissue. We prepared thin paraffin sections and stained them with hematoxylin and eosin [27]. Furthermore, paraffin-embedded hearts were sectioned into 5 µm thickness and mounted on positively charged slides for Caspase 3 immunohistochemistry [28].

Statistical analysis

SPSS version 20 was used to analyze the data and conduct one-way ANOVA. Then, the means were compared using a post hoc Duncan test. P-values < 0.05 are defined as statistically significant. The data are presented as the mean ± SEM [29].

Results

Biochemical analysis

Cardiac markers

As shown in figure (1), on the days 21 and 28 of the experiment, the activities of CK-MB, AST, and cTnI level in the MO250 and MO500 groups were

not significantly different from those in the control group. In contrast, the CP group showed a considerable increase compared with the control group. The CP+MO250 and CP+MO500 groups revealed a considerable reduction compared with the CP group. Furthermore, the CP+MO500 group showed a substantial decrease compared with the CP+MO250 group.

Lipid profile

As indicated in Table (1), on days 21 and 28 of the experiment, the values of triglycerides, cholesterol, HDL-c, LDL-c, VLDL-c, and the athero index did not show significant differences between the control, MO250, and MO500 groups. In contrast, the CP group showed a substantial elevation in levels of triglycerides, cholesterol, LDL-c, V LDL-c, and the athero index, but a significant drop in HDL-c levels compared with the control group. When compared with the CP group, the CP+MO250 and CP+MO500 groups had significantly lower triglycerides, cholesterol, LDL -c, VLDL-c, and the athero-index, besides a significantly higher HDL-c. Furthermore, the CP+MO500 group showed considerable improvement over the CP+MO250 group.

Antioxidant and oxidative stress parameters

As shown in tables (2, 3), on days 21 and 28 of the trial, CAT and SOD activity in serum and cardiac tissue were not markedly different between the MO250 and MO500 groups and the control group. However, the CP group showed a considerable decrease compared with the control group. The CP+MO250 and CP+MO500 groups showed a marked increase compared with the CP group. Furthermore, the CP+MO500 group exhibited a considerable increase above the CP+MO250 group. The levels of MDA and LOOH in serum and heart tissues were not substantially different between the MO250 and MO500 groups and the control group. However, the CP group exhibited a significant increase compared with the control group. The levels of MDA and LOOH in the CP+MO250 and CP+MO500 groups were markedly lower than those in the CP group. Furthermore, the CP+MO500 group showed a considerable decrease compared with the CP+MO250 group.

Histopathology

Histopathological investigation of cardiac sections revealed regularly arranged cardiac muscle fibers having single, ovoid, and centrally located nuclei in the control, MO250, and MO500 groups. However, cardiac sections from the CP group showed disarrayed cardiac muscle fibers due to congestion of blood vessels, interstitial edema and hemorrhage with shrinkage of cardiac muscle fibers. Better histological sections were observed in the CP+MO250 group, with slightly dilated blood vessels and less interstitial edema than in the CP group. Improvements in histological sections were observed in the CP+MO500 group with very mild interstitial edema (Figure 2).

Immunostaining of cardiac sections against caspase-3 revealed negative to weakly stained muscle fibers in the control, MO250, and MO500 groups. The number of positively stained muscle fibers caspase-3 markedly increased with area of tissue damage in the CP group. Caspase-3 expression levels were significantly lower in muscle fibers in the CP+MO250 group and weakly stained in muscle fibers in the CP+MO500 group (Figure 3).

Discussion

The development of cardiac problems during or after cisplatin therapy is a serious issue [3]. Cisplatin has been shown to cause oxidative damage in many tissues; thus, using natural antioxidants is a potential strategy in this regard. This investigation focused on the protective effects of *M. oleifera* against cisplatin cardiotoxicity. Our results showed a considerable increase in the serum CK-MB, AST activities, and cTnI level in the cisplatin group. Our results agreed with an earlier study reporting a marked elevation in CK activity and cTnI level in mice treated with CP alone. CP therapy may cause damage to the cardiac cell membrane, increasing its permeability and allowing these markers to pass into the bloodstream [30]. However, pretreatment with *M. oleifera* (CP+MO250 and CP+MO500) significantly reduced CK-MB, AST activities, and cTnI levels near the normal level. These findings were consistent with those of Khalil [11], who observed a significant decrease in these biomarkers following coadministration with *M. oleifera* ethanolic extract. This is due to its protective action on the heart, which reduces myocardial injury and consequently limits enzyme leakage from the myocardium. Vincosamide, an indole alkaloid derived from *M. oleifera* leaves, has cardioprotective properties that help to avoid the breakdown of cardiac myofibrils and thus improve heart contractility. These results were confirmed by histopathological and immunohistochemical analyses, which indicated heart tissue damage in the CP group. Similarly, our data agreed with those of Anbar [31], who reported that cisplatin is a cardiotoxic agent that leads to myocardial cells destruction and myocardial endothelial damage. Moreover, our histopathological and immunohistochemical analyses confirmed the protective effects of *M. oleifera* against cardiac toxicity. These findings agreed with Gouda [32], who reported that *M. oleifera* extract protects against cardiac damage. This effect could be attributed to polyphenol-containing compounds that activate mitochondrial metabolism, improve the expression of respiratory chain components, and improve oxygen tissue uptake. Furthermore, it can also block apoptosis [33].

The cisplatin group showed significantly higher levels of triglycerides, total cholesterol, LDL-c, VLDL-c, and the Athero-index, as well as a marked drop in HDL-c. Our findings were consistent with those of Hussein [34], who reported a rise in the lipid profile of cisplatin-intoxicated rats. This may be because cisplatin inhibits lipid metabolism. According to Mubarak [35], cisplatin may also suppress cytochrome P450, which reduces cholesterol 7–hydroxylase activity, which is the enzyme in charge of bile acid production from cholesterol. Moreover, another study stated that this could be due to hepatocellular dysfunction and poor lipid metabolism [36]. However, the CP+MO250 and CP+MO500 groups had significantly lower triglycerides, total cholesterol, LDL-c, and VLDL-c levels than the CP group. This finding provides biochemical support for the use of *M. oleifera* leaf extract as an antihyperlipidemic drug [37]. Our data were aligned with Tabassum [38], who reported that *M. oleifera* leaves have a hypolipidemic impact. This decrease in the levels of the lipid profile could be associated with the presence of flavonoids, phenolic substances, and polyphenols, which inhibit the intestinal absorption of dietary cholesterol [39].

Reactive oxygen species (ROS) are byproducts of CP metabolism and a major cause of subsequent cardiac lesions induced by chemotherapeutic agents. ROS formation initiates mitochondria-mediated apoptosis, resulting in lipid peroxidation and membrane injury in cardiomyocytes, ultimately leading to necrosis or apoptosis [40]. In the current study, the cisplatin group exhibited a marked reduction in CAT and SOD activities, as well as an elevation in the MDA and LOOH levels. These findings are in agreement with Zhang [41], who reported that cisplatin may dramatically lower antioxidant capacity, such as CAT and SOD activity, and raise MDA levels compared with the normal control group. A further study found a considerable elevation in the level of LOOH in the cisplatin-intoxicated group compared with the control group [42]. The rise in MDA and LOOH levels could be due to cisplatin therapy, which induces oxygen free radical generation and enhances lipid peroxidation [43, 44]. However, the CP+MO250 and CP+MO500 groups, showed a significant improvement compared with the cisplatin group. The current data are consistent with Oseni [45], who reported that treatment with *M. oleifera* leaf aqueous extracts initiated a rise in catalase and SOD activities. Similarly, Owoade [46] stated that, the *M. oleifera* extract increased catalase and SOD biosynthesis. Moreover, it was reported that *M. oleifera* administration exerted a considerable reduction in cardiac MDA level [47]. Previous studies have demonstrated the protective and antioxidant effects of *M. oleifera* in several tissues, including the heart [32]. Same result stated that administration of *M. oleifera* significantly restore cardiac dysfunction through its antioxidant activities [45].

Conclusion

Finally, it can be concluded that cisplatin administration had multiple negative effects on the heart, including alterations in cardiac markers, lipid profile, and redox state, as well as histopathological and immunohistochemical examinations. *M. oleifera* leaf extract exhibited a protective effect against cisplatin cardiotoxicity because it contains potent antioxidant phytochemicals. According to the current investigation, *M. oleifera* is a promising option in combination with cisplatin to minimize oxidative stress that causes cardiac damage, while maintaining anticancer activity.

Funding statements

This research did not receive specific funding from any sources.

Conflict of interest

The authors declare no conflicts of interest.

Ethical approval

The design of the experiment was approved by the Research Ethics Committee of the Faculty of Veterinary Medicine, Suez Canal University, Ismailia, Egypt (the approval no. 2020060).

TABLE 1. Serum lipid profile in different groups on days 21 and 28 post-treatment.

Parameters / Treatment	Total cholesterol(mg /dl)	Triglycerides (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)	Athero Index
Day 21 of the experiment						
Control	55.78± 0.26 ^{d}	62.04 ± 0.61 ^{d}	18.50 ± 0.36 ^{b}	24.71 ± 0.34 ^{d}	12.58± 0.12 ^{d}	3.40 ± 0.06 ^{d}
MO250	55.50± 0.20 ^{d}	63.06 ± 0.29 ^{d}	18.91 ± 0.19 ^{b}	23.56 ± 0.32 ^{de}	12.61± 0.05 ^{d}	3.33 ± 0.02 ^{d}
MO500	56.03± 0.20 ^{d}	62.81 ± 0.36 ^{d}	20.74 ± 0.24 ^{a}	22.73 ± 0.41 ^{e}	12.56± 0.07 ^{d}	3.03 ±0.04 ^{d}
CP	82.94 ±0.56 ^{a}	101.95±0.53 ^{a}	12.31 ± 0.36 ^{e}	49.41 ± 0.82 ^{a}	20.32± 0.17 ^{a}	8.28 ± 0.30 ^{a}
CP+MO250	74.17± 0.35 ^{b}	84.20 ± 0.51 ^{b}	13.72 ± 0.26 ^{d}	43.73 ± 0.64 ^{b}	16.84± 0.10 ^{b}	6.14 ± 0.10 ^{b}
CP+MO500	67.23± 0.39 ^{c}	74.76 ± 0.30 ^{c}	14.84 ± 0.30 ^{c}	38.18 ± 0.51 ^{c}	14.90± 0.09 ^{c}	5.03 ± 0.08 ^{c}
Day 28 of the experiment						
Control	54.75 ± 0.40 ^{d}	62.91± 0.49 ^{e}	18.81 ± 0.32 ^{b}	23.36 ± 0.48 ^{d}	12.58± 0.10 ^{d}	3.35 ± 0.07 ^{d}
MO250	54.70 ± 0.42 ^{d}	64.21± 0.14 ^{d}	19.49 ± 0.26 ^{b}	22.46 ± 0.14 ^{de}	12.75± 0.08 ^{d}	3.27 ± 0.04 ^{de}
MO500	55.01 ± 0.36 ^{d}	61.80 ± 0.17 ^{f}	20.73 ± 0.27 ^{a}	21.92 ±0.36 ^{e}	12.36± 0.03 ^{e}	2.98 ± 0.04 ^{e}
CP	81.35 ± 0.21 ^{a}	100.53±0.34 ^{a}	11.95 ± 0.27 ^{d}	49.83 ± 0.26 ^{a}	20.11± 0.07 ^{a}	8.43 ± 0.20 ^{a}
CP+MO250	70.55 ± 0.31 ^{b}	77.00 ± 0.19 ^{b}	14.46 ± 0.21 ^{c}	40.70 ± 0.46 ^{b}	15.40± 0.04 ^{b}	5.33 ± 0.07 ^{b}
CP+MO500	61.14 ± 0.30 ^{c}	71.79 ± 0.42 ^{c}	15.10 ± 0.39 ^{c}	31.68 ±0.53 ^{c}	14.36± 0.08 ^{c}	4.77 ± 0.13 ^{c}

Data are expressed as means ± SEM (n = 10). Values with different superscripts in the same column are significantly different at P < 0.05. MO *Moringa oleifera*, CP cisplatin, HDL high-density lipoprotein, LDL low-density lipoprotein, VLDL very low -density lipoprotein.

TABLE 2. Serum oxidant and antioxidant parameters in different groups on days 21 and 28 post-treatment.

Parameters / Treatment	**CAT** (U/ml protein)	**SOD** (mU/µl protein)	**MDA** (µM/ml)	**LOOH** (nmol/ml)
Day 21 of the experiment				
Control	12.91± 0.20 ^{a}	48.70± 0.15 ^{a}	0.64± 0.01 ^{d}	0.28± 0.00 ^{d}
MO250	12.94± 0.09 ^{a}	48.71± 0.08 ^{a}	0.64± 0.00 ^{d}	0.28±0.00 ^{d}
MO500	13.16± 0.26 ^{a}	48.93± 0.10 ^{a}	0.64± 0.00 ^{d}	0.28± 0.00 ^{d}
CP	7.23± 0.04 ^{d}	28.43± 0.12 ^{d}	1.49± 0.01 ^{a}	0.77± 0.00 ^{a}
CP+MO250	8.53± 0.07 ^{c}	34.14± 0.13 ^{c}	1.19± 0.00 ^{b}	0.68± 0.00 ^{b}
CP+MO500	10.37± 0.10 ^{b}	39.18± 0.24 ^{b}	0.94± 0.00 ^{c}	0.57±0.01 ^{c}
Day 28 of the experiment				
Control	12.79± 0.06 ^{a}	48.57± 0.37 ^{a}	0.64± 0.00 ^{d}	0.28± 0.00 ^{d}
MO250	12.83± 0.13 ^{a}	48.91± 0.09 ^{a}	0.64± 0.01 ^{d}	0.28± 0.00 ^{d}
MO500	12.85± 0.13 ^{a}	49.34± 0.05 ^{a}	0.64±0.00 ^{d}	0.28±0.00 ^{d}
CP	8.36± 0.05 ^{d}	34.00± 0.26 ^{d}	1.24± 0.01 ^{a}	0.66± 0.00 ^{a}
CP+MO250	9.85± 0.04 ^{c}	40.28± 0.22 ^{c}	0.98± 0.00 ^{b}	0.53± 0.01 ^{b}
CP+MO500	11.91± 0.11 ^{b}	44.37± 0.40 ^{b}	0.75± 0.00 ^{c}	0.33± 0.01 ^{c}

Data are expressed as means ± SEM (n = 10). Values with different superscripts in the same column are significantly different at P < 0.05. MO *Moringa oleifera*, CP cisplatin, CAT catalase, SOD superoxide dismutase, MDA malondialdehyde, and LOOH lipid hydroperoxide.

TABLE 3. Heart oxidant and antioxidant parameters in different groups on days 21 and 28 post-treatment.

Parameters Treatment	CAT (U/mg protein)	SOD (mU/µg protein)	MDA (µM/mg tissue)	LOOH (nmol/mg tissue)
Day 21 of the experiment				
Control	50.47 ± 0.09 [a]	129.75 ± 0.60 [a]	10.40 ± 0.04 [d]	1.15 ± 0.00 [d]
MO250	51.24 ± 0.17 [a]	132.83±1.00 [a]	10.40 ± 0.02 [d]	1.14 ± 0.00 [d]
MO500	50.84 ± 0.09 [a]	131.08± 0.81 [a]	10.34 ± 0.02 [d]	1.14 ± 0.00 [d]
CP	25.06 ± 0.14 [d]	73.97 ± 0.58 [d]	38.23 ± 0.24 [a]	3.46 ± 0.01 [a]
CP+MO250	31.16 ± 0.13 [c]	83.26 ± 0.23 [c]	30.78 ± 0.33 [b]	2.87 ± 0.01 [b]
CP+MO500	38.66 ± 0.15 [b]	91.08 ± 0.24 [b]	23.48 ± 0.20 [c]	2.28 ± 0.00 [c]
Day 28 of the experiment				
Control	50.58 ± .07 [a]	130.40 ± 0.36 [a]	10.47 ± 0.04 [d]	1.15 ± 0.00 [d]
MO250	51.10 ± .12 [a]	132.15 ± 0.43 [a]	10.32 ± 0.03 [d]	1.15 ± 0.00 [d]
MO500	51.10 ± .14 [a]	132.15 ± 0.61 [a]	10.39 ±0.03 [d]	1.15 ± 0.00 [d]
CP	32.78 ± .13 [d]	80.60 ± 0.30 [d]	33.38 ± 0.12 [a]	3.18 ± 0.01 [a]
CP+MO250	37.16 ± .16 [c]	91.80 ± 0.49 [c]	24.87 ± 0.18 [b]	2.47 ±0.01 [b]
CP+MO500	42.95 ± .47 [b]	110.53±0.37 [b]	15.81 ± 0.23 [c]	1.54 ± 0.02 [c]

Data are expressed as means ± SEM (n = 10). Values with different superscripts in the same column are significantly different at P < 0.05. MO *Moringa oleifera*, CP cisplatin, CAT catalase, SOD superoxide dismutase, MDA malondialdehyde, and LOOH lipid hydroperoxide.

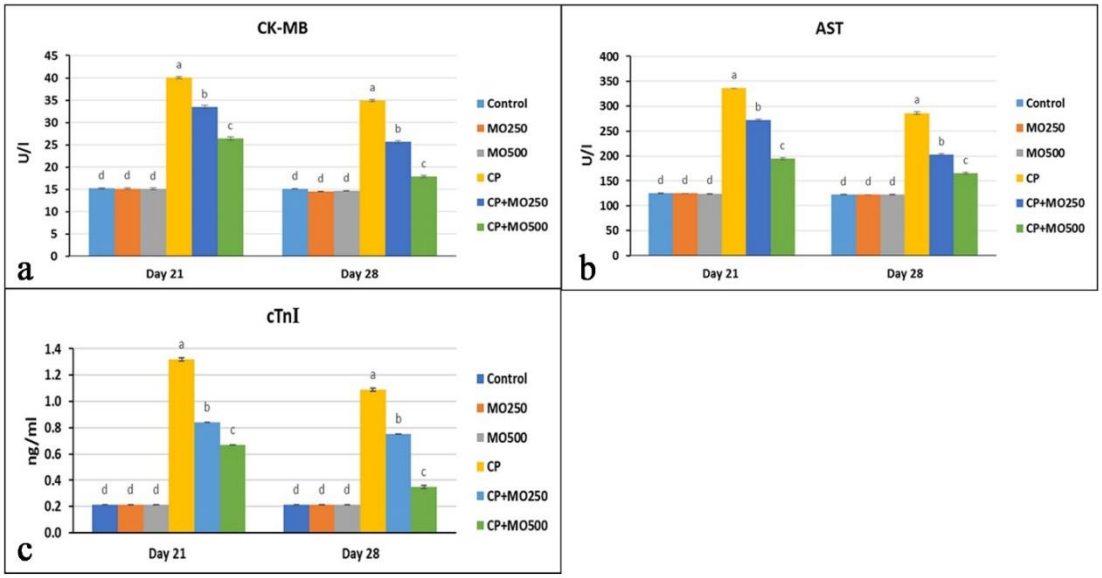

Fig. 1. Protective effects of *Moringa oleifera* (250 and 500 mg/kgb.wt.) on cisplatin intoxicated rats. (a) Creatine kinase –MB; (b) Alanine aminotransferase; (c) Cardiac troponin-I.

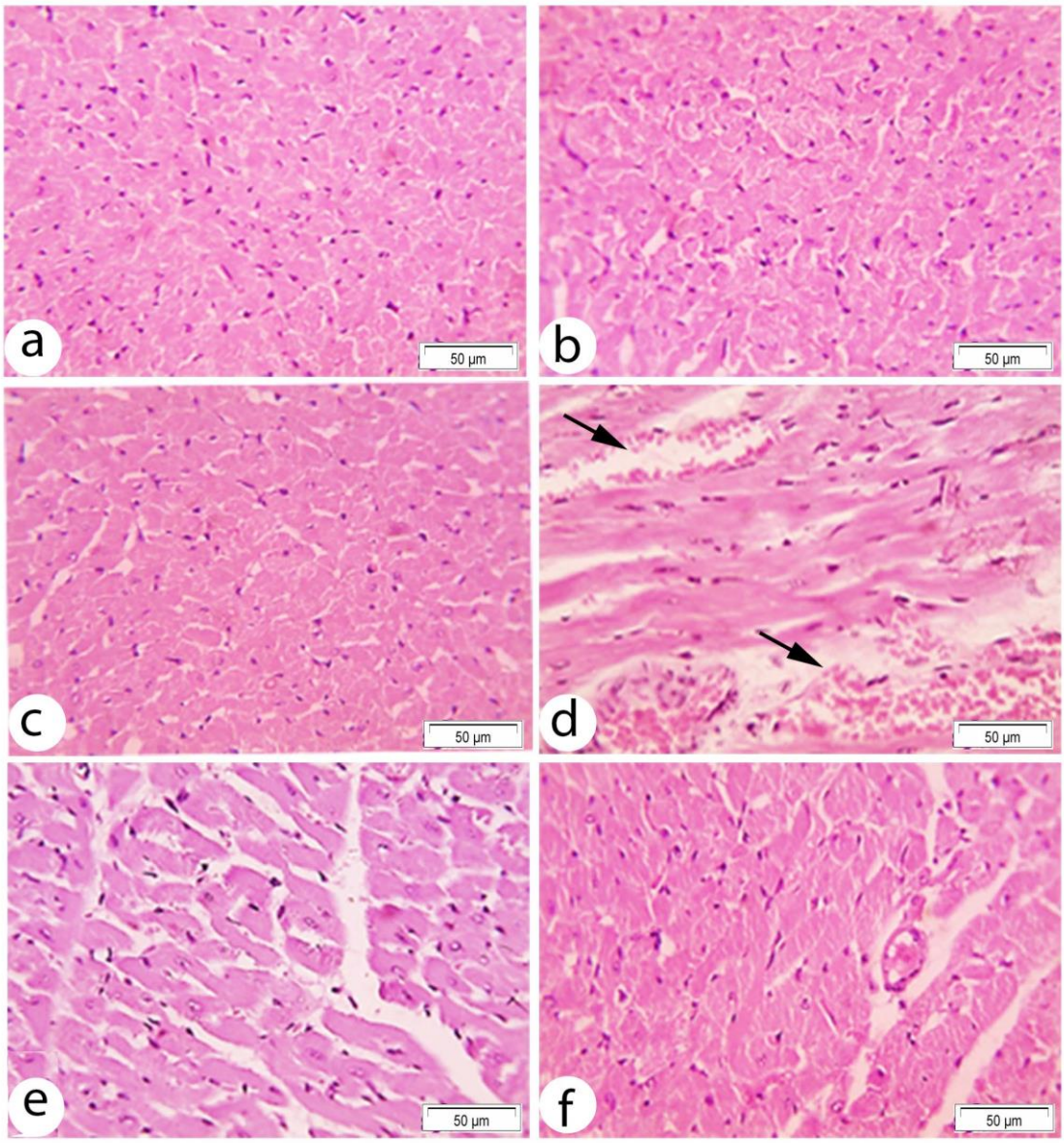

Fig. 2. Microscopic images of H&E-stained cardiac sections. Control group (a), MO250 group (b), MO500 group (c) showing regularly arranged cardiac muscle fibers having single, ovoid, and centrally located nuclei. CP group (d) showing degenerated cardiac muscle fibers and interstitial edema along with congestion of blood vessels (arrows). CP+MO250 group (e) and CP+MO500 group (f) showing mild improvement of histopathological lesions. X: 400 bar 50.

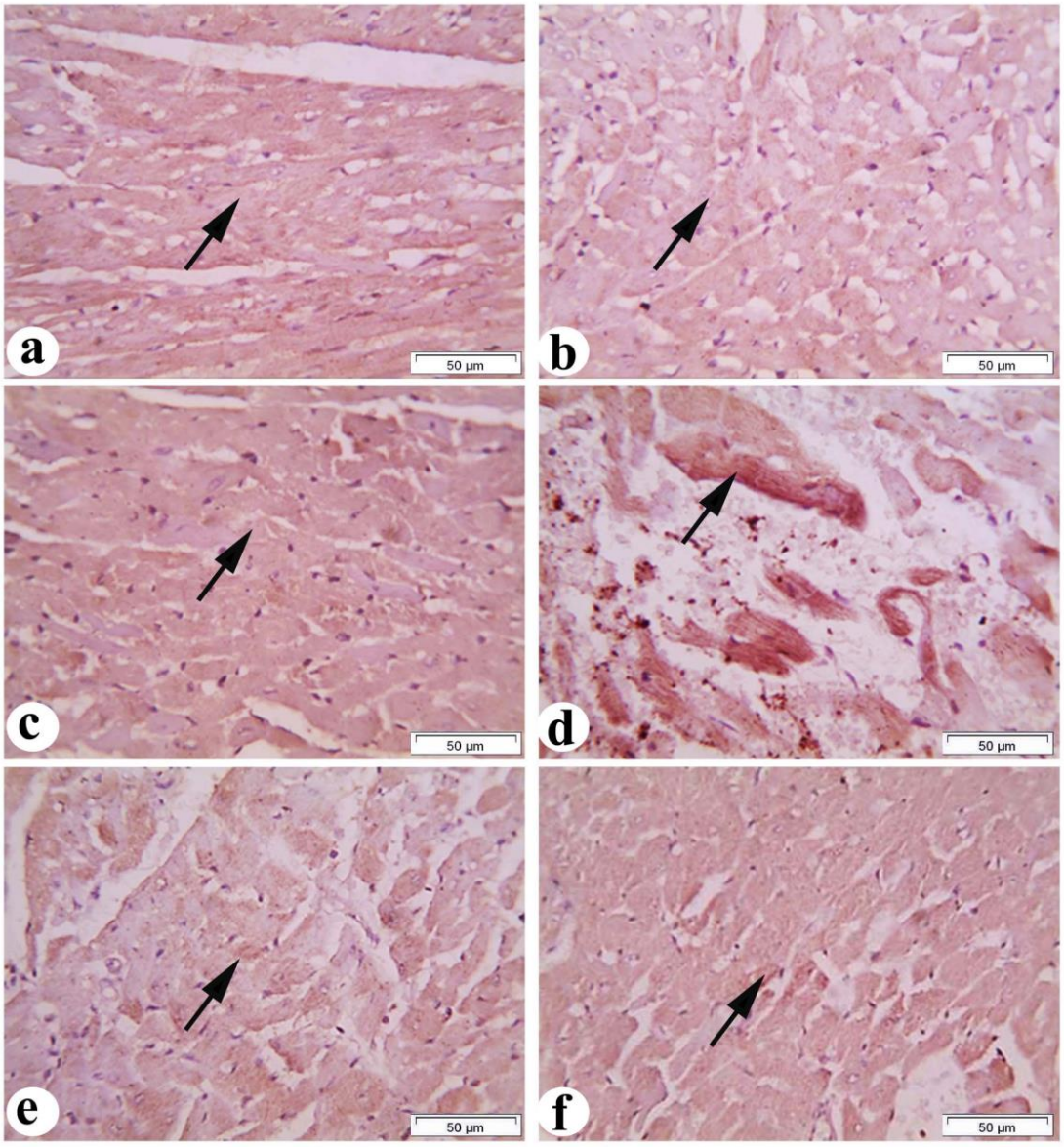

Fig. 3. Microscopic images of immunostained cardiac sections against caspase-3. Control group (a), MO250 group (b), and MO500 group (c) showing negative to weakly stained muscle fibers (arrows). CP group (d) showing intense positively stained muscle fibers associated with marked damage (arrow). CP+MO250 group (e) and CP+MO500 group (f) showing marked decrease in positive staining (arrows). X: 400 bar 50.

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التأثيرات الوقائية للقلب للمورينجا أوليفرا فى الجرذان المسممة بالسيسبلاتين

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الملخص

السيسبلاتين هو دواء مضاد للسرطان وله آثار جانبية جهازية تحد من استخدامه. مورينجا أوليفرا هو نبات طبي له خصائص مضادة للأكسدة وواقية. ولذلك حددت هذه الدراسة التأثير الوقائي للمورينجا أوليفرا ضد تسمم القلب الناجم عن السيسبلاتين. تم فصل الجرذان بشكل عشوائي إلى ست مجموعات. المجموعة (1) الجرذان العادية؛ تلقت المجموعتان (2) و (3) مستخلص أوراق مورينجا أوليفرا عن طريق الفم بمعدل 250 و 500 ملجم / كجم من وزن الجسم، على التوالي، لمدة 28 يومًا؛ والمجموعة (4) أعطيت جرعة واحدة من السيسبلاتين بجرعة 10 ملجم/كجم من وزن الجسم في اليوم العشرين من التجربة، بينما أعطيت المجموعتان (5) و (6) مورينجا أوليفرا عن طريق الفم بنفس جرعات المجموعتين (2) و (3)، ثم أعطيت السيسبلاتين بجرعة مماثلة للمجموعة (4). و قد أدى تناول السيسبلاتين إلى تغيرات نسيجية مرضية كبيرة في القلب، مع زيادة ملحوظة في مؤشرات القلب، ومؤشرات الإجهاد التأكسدي، ومستوى الدهون، في حين انخفضت مضادات الأكسدة بشكل كبير مقارنة مع مجموعة التحكم. بينما اظهرت النتائج ان تناول مورينجا أوليفرا ادى الى تحسين القياسات البيوكيميائية والنسيجية بطريقة تعتمد على الجرعة. لذلك تقترح الدراسة الحالية أن مستخلص المورينجا أوليفيرا يحسن التغيرات في القياسات البيوكيميائية والنسيجية للقلب في الجرذان المسممة بالسيسبلاتين، ويمكن استخدامه مع السيسبلاتين لتقليل سُمية القلب.

الكلمات المفتاحية: سُمية القلب ، سيسبلاتين ، مورينجا أوليفيرا ، الاجهاد التأكسدى، الجرذان.