Study of the Effect of Morgina Oleifera on Chromosome Abnormalities in white Mice

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Abstract
The present work was designed to detect the genetic effects of the aqueous extract of Moringa oleifera leaves and to show the effectiveness of this extract in inhibiting the targeted genetic mutations by the carboplatin. Three concentrations of the extract were chosen to study the genetic effects. The body these concentrations were given for 35 days to white mice and based on some genetic tests that included chromosomal aberrations in bone marrow cells and after reaching the best dose, for example, from Moringa oleifera 1500 gm/ kg which is the dose that gave the least number of chromosome deviations, the effect of this dose is studied In protecting the cells of the bone marrow from the side effects of the carboplatin drug, the effect of the drug carboplatin was studied at the same time period and at a dose of 90 mg / kg of body weight.
Keywords: Chromosome abnormalities, Moringa oleifera, White mice.

1. Introduction

Because of the tremendous cognitive and technical progress in the manufacture of medicines and chemical preparations, modern medicine has proven its effectiveness in treating most of the known diseases, but it soon stopped helpless in the face of some dangerous diseases, which prompted many researchers and scientists to find ways such as herbal medicine to eliminate chronic diseases that did not He is able to find a treatment for it, as its effects have become a civilization of the human race because it may target its genetic material, causing a mutation that can be passed on to generations (Abdulla and Gruber, 2000; Lucock, 1999; Filiberti et al., 1997).
The protective effect of the medicinal plant is mainly due to the fact that it contains a group of chemical compounds that are available in sufficient quantities to limit the development and growth of cancer cells, which gives them the ability to prevent cancer. Due to the recent increasing confrontation towards medicinal plants for preventive or curative use, the Moringa tree, which is characterized by high stability towards self-oxidation, as well as its antioxidant role and inhibitory activity for many types of bacteria and fungi (Alhusnan and Alkahtani, 2019), was chosen. The effectiveness of its leaves lies in the fact that it contains flavonoids, corticosteroids and saponins (Nazmy et al., 2016). Its leaves are also edible and are of high nutritional and therapeutic value due to their rich content of vitamin A, vitamin E, vitamin C and minerals, especially calcium and potassium, and contain many antioxidants, amino acids and carotenoids (Nihad et al., 2019). Moringa leaves are used as an effective treatment for malnutrition because they contain a group of chemicals in the leaves, pods and seeds (Jwa., 2019). Anti-cancer drugs may cause many effects, including the effect on DNA, and this effect results in DNA damage that leads to chromosomal aberrations that cause chromosomal instability and mutations (Degrassi et al., 2004; Attia, 2008). Carboplatin is one of the most effective drugs in the treatment of cancerous diseases since 1981 (Vijayalaxmi and D`souza,2004). This drug is used to treat breast cancer (Brambilla et al., 1993), lung cancer and urinary bladder cancer (Hartmann and Lipp, 2003). Among the side effects caused by chemotherapy drugs, including platinum drugs, are hematological toxicity, which affects the bone marrow functions and the production of blood cells, which causes anemia due to a lack of blood cells and platelets (Kamimura et al., 2016).
The current study was proposed and completed to shed light on the genetic effects of carboplatin and the moringa plant, through the use of the aqueous extract of Moringa leaves and its content of effective compounds to reduce and reduce the occurrence of genetic mutations of carboplatin using the CA test for chromosomal aberrations.

Plant collection and identification Moringa leaves

were obtained from the farm of the assistant professor, Dr. Abbas, one of the teachers of the Department of Life Sciences, University of Al-Qadisiyah in October 2021. He was diagnosed by the assistant professor, the doctor, who specializes in plant classification, Dr. Suhaila Hussein Al-Lami, and the plant leaves were cleaned well, then grinded. In the herb grinder to get a fine powder and keep in clean plastic containers until use.

Aqueous extraction method Moringa plant

Fresh Moringa leaves were air dried for 7 days at 30°C and then the leaves were crushed in an electric grinder until a fine powder was obtained. The room after covering it, and then filtering the cell using several layers of medical gauze to get rid of plankton and then placing the solution in clean and sterile metal dishes and drying the extract using the oven for four days at a temperature of 40 degrees Celsius, which gives a greenish-brown color, the weight of

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the dried extract was about 22 Then, the dried extract was weighed and reformulated in water pH 6.8 to obtain a stockpile of 200 mg.

Doses and concentrations of aqueous extract Moringa leaves

The plant extract was prepared according to and appropriate to the cytogenetic study in the bone marrow cells of male albino mice. Three concentrations of the aqueous extract were used 1500, 500, 250 mg/kg of body weight, then the mice were administered orally using a syringe Modified for this purpose and preparation The main concentrations The aqueous extract was dissolved in distilled water (Olufunsho et al., 2012).

Carboplatin dose

The carboplatin dose of 90 mg/kg was selected on the basis of body weight and equivalent to the therapeutic human dose of 400 mg/kg (Basit et al., 2021). Carboplatin was dissolved in distilled water and injected into the peritoneal cavity of mice as a single 0.1 ml dose.

Laboratory animals

were used in this study 60 male white mice, their weights ranged between (30-25) grams and their ages ranged between (7-14) days. They were obtained from the animal house of the Department of Life Sciences, College of Science, University of Kufa. The animals were bred in The animal house belongs to the College of Science, University of Al-Qadisiyah. The animals were left for two weeks to acclimatize under laboratory conditions of suitable ventilation and at a temperature of (25) Celsius. That's what animals used in experiments. Design of experimental study Choosing a dose of *Moringa oleifera* extract

The experiment assigns (30) males to six mice per group. This stage included studying the genetic effects of the Moringa extract using three doses according to (Olufunsho et al., 2012) and the dose of carboplatin according to (Basit et al., 2021). The first group, negative control: the animals were left without treatment other than distilled water for 35 days. The second group, the wave control: the rats were injected daily with the carboplatinum mutagen in the peritoneal cavity At a concentration of 90 mg kg for 35 days. The third group: Orally administered using a syringe liberated for this purpose, a plant extract Moringa at a concentration of 250 mg kg for 35 days. Fourth group: Orally administered using a syringe modified for this purpose plant extract Moringa at a concentration of 500 mg/kg for 35 days. Fifth group: Orally administered using a syringe Suhoor for this purpose plant extract Moringa at a concentration of 1500 mg kg for 35 days. After the end of the period, the animals were explained for the purpose of conducting genetic tests, and in light of the results of these groups, the optimum dose of the extract was chosen for the purpose of conducting an interaction with one of the genetically mutagenic drugs (Mutagenic) and this drug is Carbopltin, and the body weight of the experimental animals was calculated before and after treatment with the extract for mice.

The study of the interaction between the optimal dose (mg/kg) of the aqueous extract of Moringa and the drug carboplatin to study the mechanism by which the extract of Moringa works. 6) mice for each group, i.e. a total of (30) proximal mice:

The first group, negative control: the animals were left without treatment except for distilled water for 35 days.

The second group, the wave control: the rats are injected daily with the carbo-platinum airport in the peritoneal cavity at a concentration of 90 mg kg for 35 days.

Group III: Treatment with the plant extract before the mutator Al-Omran dosed the plant extract in the optimal concentration three weeks before the mutator for 35 days of treatment.

Fourth group: Treatment with the plant extract with the mutagenic periodically, the plant extract is dosed at the optimum concentration, and then it is injected with the mutagenic for a period of 35 days from the treatment.

Fifth group - treatment with the plant extract after the muzzar Perch for genetic testing.

Cytogenetic study

Each rat was injected (0.25 ml) of collagen solution at a concentration (0.5 mg/ml) intraperitoneally two hours before killing the animals to stop the animals. M cells at the metaphase.

2- Sacrifice the animals by anesthetizing them with chloroform.

3 - Stabilizing the animals on their ventral side on the autopsy board and the ventral side of the animals, and the thigh area was wiped with 70% ethanol, the animal was dissected by cutting the skin directly and the organs were extracted from their sites

4- Then the femur is taken after cleaning it from the tissues and muscles and it is cut from the middle in a position perpendicular to the edge of the test tube. Using a sterile syringe, 5 ml of phosphate buffer solution (PBS) is injected to wash it and drop the bone marrow into the test tubes.

5- The tubes were centrifuged at a speed of (2000 rpm) for 10 minutes.

6- The supernatant was removed and (5 ml) of potassium chloride (KCl) was added to the precipitate and hypotonic at a concentration 0.075 ml tubes were then incubated in a shaking water bath at (37°C) for (30 minutes).

7- The tubes were extracted from the water bath and built in a centrifuge at a speed of 2000 cycles/ minutes) for (10 minutes).

8- The cap was removed, and the prepared fixative solution was gradually added to the precipitate in the form of drops that spilled onto the inner wall of the tube with continuous shaking, then completed the volume of the added stabilizer to reach (5 ml).

9- The tubes were placed at a temperature (4 degrees Celsius) for half an hour for the purpose of fixing the cells

10- The tubes were centrifuged at a speed (2000 rpm) for 5 minutes, then the supernatant was removed, and the cells were suspended again in an appropriate volume (1-1 ml) of cold fixative.
11- The tubes containing the fixed cells were shaken and (8-6) drops of the contents of the tube were dropped onto a clean glass slide vertically from a distance of about (3 feet) to allow the cells to spread well, then the slides were dried on a hot plate (50 m).

Chromosomal aberration test

The slides were examined under an ordinary light microscope under the xenical lens (100). Cells are in the tropics of cell division, when chromosomal aberrations are evident, and can Estimation of the percentage of these aberrations (Allen et al., 1977).

2. Statistical Analysis

The results of the data were analyzed statistically by using the statistical analysis program (SPSS 23) discovery version 2015 by finding the mean + standard error (meanom), and using the SE M Least significant difference (LSD) test. Statistical data between experimental groups on animals was analyzed using the method one way ANOVA and - two sample T-Test for analysis of control groups). The results are considered significant if the p-value is less than 0.05 (Sorlic, 1995).

3. The Result

The table showed a moral rise of 0.05 >p in the percentage of chromosomal deviations in the positive control treatment of 2.492 compared to negative control treatment of 1.689, The water extract coefficient of the Moringa Oleifera leaves showed a moral decrease of 0.05 >p in the percentage of chromosomal deviations of the three tracks (1500, 500, 250) mg/kg, at 1,175, 1,405, 1,577 respectively compared to negative control, There is also a moral decrease of 0.05 >p in all three transactions of the water extract of Moringa Oleifera leaves compared to positive control

Table (1): Effect of carboplatin and various compositions of the water extract of Moringa Oleifera leaves on the appearance of chromosomal deviations.

Parameters Groups	Deletion % (mean±SD)	Dicentric % (mean±SD)	Acentric % (mean±SD)	Ring % (mean±SD)	Chromosome break% (mean±SD)	Total % (mean±SD)
Control	A 0.2146+0.0737	A 0.5083+0.098	A 0.481+0.1074	A 0.1856+0.0646	A 0.2998+0.1279	A 1.689+0.329
Carboplatin	AB 0.4036+0.1087	A 0.6533+0.0966	A 0.6041+0.1034	A 0.3771+0.0857	AB 0.4541+0.1161	B 2.492+0.297
Moringa 250mg	B 0.2847+0.1172	B 0.3062+0.1151	B 0.3092+0.0736	AB 0.3379+0.1293	AB 0.3392+0.0957	BC 1.577+0.34
Moringa 500mg	B 0.2658+0.1206	B 0.2977+0.1129	B 0.2473+0.1257	AB 0.2986+0.064	AB 0.2959+0.1104	BC 1.405+0.259
Moringa 1500mg	B 0.2441+0.0675	B 0.2206+0.1389	B 0.2152+0.0742	B 0.2484+0.129	B 0.2467+0.1457	C 1.175+0.401
Sign.	Sign.	Sign.	Sign.	Sign.	Sign.	Sign.
P-value	0.046	0.0007	0.00005	0.049	0.0317	0.00002

The table shows a moral rise of 0.05 >p in the proportion of chromosomal deviations in the positive control treatment of 2.5357 compared to negative control of 1.6418, While the rate of deviations in interference coefficients decreased (before, together, after) and the moral decrease was 0.05 >p in interference coefficients, the interference treatment together was 1.652 and more than two interference factors (before, after)1.941, 2.036 respectively compared to positive control, While there are no moral differences between the interference treatment together with the negative control treatment.

Table (2): effect of interference between carboplatin and water extract of Moringa Oleifera leaves (before, together, after) on the percentage of chromosomal deviations

Parameters Groups	Deletion % (mean±SD)	Dicentric % (mean±SD)	Acentric % (mean±SD)	Ring % (mean±SD)	Chromosome break% (mean±SD)	Total % (mean±SD)
Control	A0.2762+0.131	A0.4818+0.1065	A0.3066+0.1112	A0.2722+0.1188	A0.305+0.1102	A1.6418+0.0562
Carboplatin	A0.3658+0.0793	B0.6392+0.1206	AB0.6102+0.1494	A0.4034+0.1697	B0.5172+0.0655	B2.5357+0.2035
Moringa 1500mg+Car	A0.331+0.0873	B0.4412+0.1349	BC0.4742+0.1539	A0.4076+0.078	B0.3824+0.117	BC2.036+0.256
Car+ Moringa 1500mg	A0.2946+0.1323	B0.4615+0.0804	BC0.403+0.0757	A0.4077+0.0948	B0.3741+0.0878	C1.941+0.348
Carb. = Moringa 1500mg	A0.2577+0.0763	B0.3441+0.1037	C0.3389+0.0786	A0.3408+0.0893	B0.3704+0.0965	C1.652+0.296
Sign.	Non-Sign.	Sign.	Sign.	Non-Sign.	Sign.	Sign.
P-value	0.501	0.008	0.005	0.285	0.035	0.0005

4. Discussion

Studied cellular criteria to choose the optimal dose of the aqueous extract of Moringa oleifera leaves chromosomal deviations in chromosomal Aberration in bone marrow (CA) led to various doses of hydroenotic extract *Moringa Oleifera* leaves

To reduce the frequency of chromosomal deviations that appear in the table (1-1). The water extract of *Moringa Oleifera* leaves contains natural compounds that do not have genetic toxicity to bone marrow cells such as flavonoids, soapin, etc. that have led to a decrease in the average number of cells with fine nuclei or chromosomal deviations. Studies have shown that flavonoid compounds significantly reduce total chromosomal deviation and these substances can increase the programmed death of abnormal cells. Since most cells suffer from deviation.

Flavonoid compounds found in plants are of great importance in preventing carcinogenicity by protecting DNA damage and stimulating repair pathways, and regulates many important cellular events such as cell cycle and apoptosis (Twari and Mishra, 2017). Flavonoids are powerful antioxidants and have a wide range of biochemical functions, participating in immune functions and gene expression, capillary and cerebral blood flow and liver function, enzyme activity and platelet aggregation and cholesterol. The beneficial health effects associated with these compounds are believed to reduce the risk of coronary heart disease and various types of cancer mainly from antioxidant activity, including the removal of heavy metal from metal ions and the inhibition of fat peroxide (Formica and Regelson, 1995). Studies conducted by Hedges and Lister, 2007, show that kerosene compounds reduce the onset of cancerous tumors, promote stomach ulcer healing and prevent the proliferation of ovarian, breast and colon cancer cells. Studies have shown that terpenes are effective against various types of cancers, including and colon cancer .

Carboplatin cellular tests of carboplatin effect on chromosomal deviations

consider bone marrow to be a rich source of both hematopoietic stem cells and stem cells as well as where adult cell group differentiates (Acton, 2013). These cells are highly sensitive to mutation-causing agents, and are therefore highly sensitive to DNA damage that can cause mutations and genetic disorders and can be particularly dangerous in undifferentiated cells in the bone marrow (Antunes et al., 1999). If these cells survive and multiply, the risk of secondary cancer becomes much higher (Travis et al., 1996). The main objective during chemotherapy is to avoid the destruction of non-cancer cells from the unfavorable side effects of therapeutic drugs. The benefit of using natural edible antioxidants can reduce the incidence of these harmful effects and some may help prevent dna damage caused by these drugs, according to several studies (Mora et al., 2002). The ability of free radicals to interact in chemically stable molecules with anti-cancer drugs can be used to reduce oxidative stress and thus help prevent oxidative damage to DNA and other cellular molecules (Treml and Smejk et al., 2016). Widespread use of chemotherapy drugs can cause cancer treatment to improve the lives of cancer patients, but some anti-cancer drugs can cause a number of direct symptoms and toxicity, and many anti-cancer drugs can be mutagenic or carcinogenic.

Carboplatin is an anti-tumor drug with side effects. A 2017 Chen et al. study showed that carboplatin caused serious bone marrow damage and the disappearance of bone barriers and hemoid fibrosis. The toxic effect of carboplatin is myelosuppression bone marrow inhibition and the main symptoms of carboplatin bone marrow depression include thromboblatin, neutrophils, neutrophils and anaemia, which occurs in 20-40% of people treated with carboplatin and more than 90% in patients treated with a high dose of carboplatin (Groopman and Itri, 1999). Bone marrow suppression depends on the concentration of dose when taking carboplatin because platinum-based drugs cause damage to bone marrow cell DNA (Chen et al., 2017). Carboplatin myeloid toxicity is formed by generating free radicals that attack DNA in bone marrow cells (Moon et al., 2011; Lin et al., 2010). Carboplatin can also cause damage to DNA despite the age of short bone marrow cells (Patra et al., 2018).

The mechanism of action of platinum drugs is linked to DNA cross-linking to toxicity events in hematopoietic stem cells (Weijl et al., 2004). Carboplatin also targets salafi cells in the bone marrow that include part of the hematopoietic stem mesinoid cells (Das et al., 2008). Carboplatin also reduced egg blood cells (Kohono, 1995). Carboplatin has a similar effect to sysplatin but has fewer side effects (Hatfield et al., 2016). Treatment with cisplatin increases SOD activity in bone marrow cells while reducing GSPX level and these changes are associated with low GST, GSH and moral decline in hematopoietic cells and the growth of mesinkin stem cell colonies (Das et al., 2008). Carboplatin also reduces the level of glutathione in the bone marrow (Abd-Allh et al., 2005). ... ...

choosing the optimal dose for aqueous extract of Moringa Oleifera leaves for the purpose of electing the appropriate concentration of aqueous extract for moringa leaf and using it in the work of the intervention experiment with the drug

reviewed the results Statistics in table (1.1) on the effects of different concentrations of the water extract of moringa leaves (1500,500,250 mg/kg) on the genetic criteria studied (cell division coefficient), Chromosomal deviations, micronuclearities, sperm deformities, the 1,500mg/kg dose of moringa leaf aqueous extract was adopted as an optimal dose for interfering trials with the desolate drug carboplatin in mice for the purpose of reducing the effect of chemotherapy on the healthy cells of the animal,

although there are some statistical differences in the results between the treatment of this concentration (1500 mg/kg) and the treatment of negative control
Studied cellular parameters after choosing the optimal does of aqueous extract of *Moringa Oliefera* leaves
chromosomal deviations Chromosom aberration
results indicated that the percentage of chromosomal deviations led to a gradual decrease in interference coefficients (prior, Together, yet, they make a moral difference from the treatment of positive control, in which the rate of deviations was high. As a result, the water extract of Moringa Oleifera leaves in all interference coefficients showed a high and clear efficiency in inhibiting the toxic effects of carpoplatin, which reduced the values of chromosomal deviations of bone marrow cells of mice. The treatment of interference together was lower in the proportion of chromosomal deviations and this indicates the efficiency of this treatment in preparing cells to counteract the toxic effects of carpoplatin, the inhibitive effectiveness of the water extract of Moringa Oleifera leaves in transactions (before, Together) of giving the drug was higher than the effectiveness of inhibition after giving the drug due to the fact that inhibitors that are effective (before, together).
The results of the current study showed that the water extract of Moringa Oleifera leaves reduces the genetic toxicity caused by carboplatin. All doses of extract selected from the plant have protected the genetic material in the mother cells of the bone marrow by reducing the percentage of chromosomal deviations, as these cells are highly sensitive to drugs that affect cellular division or interfere with the dna tape multiplier mechanism, as these cells have a high split rate, are responsible for the formation of all blood cells and have a short period of time to divide up to 24 hours, All this qualifies them to be the most affected cells with the chemical treatments used in the treatment of many cancers and to damage this type of cell leads to a sharp decrease in all blood cells and this is one of the important side effects of people treated with chemical properties so the use of such extracts may improve the treatment of tumors by chemical treatments. Furthermore, the study showed that patients receiving anti-tumor agents suffer from bone marrow toxicity that causes cell deficiency in the marrow and reduced the effectiveness of hematopoietic tissue (Barreto et al., 2014). The results indicate the cellular toxicity of carboplatin may be caused by free radicals that attack DNA, resulting in the generation of SOD, GST in marrow cells as treatment with carpoplatin has led to a high rate of deviations, such as stretching, breaks and gaps in the bone marrow, and the results show that Moringa Oleifera plays a protective role against carboplatin mutations. I suggest using plant antioxidants to reduce chromosomal deviations caused by carboplatin. The results of this study are consistent with (Rao et al., 2001). Who found that the plant-based anti-components of Moringa Oleifera reduced the genetic and cellular toxicity that occurs in mice and rats through radiation exposure, as predare with Moringa Oleifera extract and then radiation exposure significantly reduced the percentage of chromosomal deviation and micronuclearity.
Consistent with a (Farag et al.,2018) study that suggested that ethanol extract from Moringa Oleifera leaves has therapeutic and protective factors that reduce the toxicity of aflatoxinB1 in mice. It is also consistent with a study (Aboelhassan et al., 2018) who referred to the high protective role of moringa leaf extract against genetic changes resulting from b1 aflatoxin and tissue changes in the liver and kidneys in mice,(Radwan et al., 2015), also emphasized the preventive and therapeutic role of Moringa Oleifera leaf extract, reducing genetic and cellular toxicity in mice through treatment with ccl4, which was used to induce liver damage similar to that caused by hepatitis Fyros. in human patients. The results of our study are consistent with the study showing that low non-toxic doses of Moringa Oleifera leaf extract protect bone marrow chromosomes and increase the survival of mice exposed to kama irradiation on the body, due to the antioxidant vitamin C moringa contained, which is responsible for its antioxidant properties and radiation protection of the extract (Anoop and Rao, 2001). Vegetables and fruits are a good source of antioxidants because they contain many phytochemicals, as these natural factors are supposed to have the potential to reduce cellular toxicity and reduce physiological side effects (Landis-Piwowar and Lyer, 2014; Siddiqui et al., 2006). Vegetables contain phenols, carotenoids and vitamin C (Fimognari et al., 2002). Important biological activities of these substances, such as antioxidant, inflammatory, anti-allergic and tumor activity, have been identified
Flavonoids act as powerful anti-mutation antioxidants that protect healthy cells with rapid division coefficients and free radical abrasions (Samejima et al., 1995). Many fruits and vegetables also prevent chromosomal and DNA damage in animals (Nersesyan and Miyata et al., 2004) It has been clarified by explaining the role of anti-mutation plants, one of which may be related to the containment of many powerful antioxidants by plant products, and the observed protective effect on Moringa Oleifera against the cellular toxicity of carpoplatin exhaled drug may be the result of the positive role of the water extract of Moringa Oleifera leaves and its effective substances such as vitamins, beta-carotene and minerals. Selenium, zinc and other compounds (Galuppo et al., 2014; Azad et al., 2017) that has contributed to reducing chromosomal deviations.
Many components of Moringa Oliveira, such as polyphenols and various carotenoids, improve the immune system, induce free radicals and reduce the production of DNA mutations in different mammary cells that have previously been exposed to a variety

of oxidized conditions (Nicolle et al., 2003; Van Breda et al., 2005; Sriniva san et al., 2007; Devaraj et al., 2006). Furthermore, polyphenols found in Moringa Oleifera have been presented in other studies to inhibit a particular protein found in the bone marrow and increase antioxidants in sperm (Abdou et al., 2012a). Many micro-components of Morenga Oliveira have also been considered as an anti-cancer, and have been presented in other studies to reduce the risk of ovarian cancer, lung cancer, prostate cancer in humans and mice (Cramer et al., 2001; Van Breda et al., 2005; Gitenay et al., 2007)

The results of the current study showed that the water extract of Moringa Oleifera leaves reduces the genetic toxicity caused by carboplatin. All doses of extract selected from the plant have protected the genetic material in the mother cells of the bone marrow by reducing the percentage of chromosomal deviations, as these cells are highly sensitive to drugs that affect cellular division or interfere with the dna tape multiplier mechanism, as these cells have a high split rate, are responsible for the formation of all blood cells and have a short period of time to divide up to 24 hours, All this qualifies them to be the most affected cells with the chemical treatments used in the treatment of many cancers and to damage this type of cell leads to a sharp decrease in all blood cells and this is one of the important side effects of people treated with chemical properties so the use of such extracts may improve the treatment of tumors by chemical treatments. Furthermore, Furthermore, this study revealed that the water extract of Moringa Oleifera leaves contains therapeutic and protective factors used to reduce the genetic toxicity of carboplatin in mice.

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