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Evaluation of Antioxidant and anti-Inflammatory Activities of 4-((quinolin-2-yl) methyleneamino)-1,2-dihydro-2,3-dimethyl-1-phenylpyrazol-5-one on Ehrlich Ascites Carcinoma Bearing Mice

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Abstract

There is a persistent need for new chemotherapeutic drugs, indicating a vital requirement for innovative techniques. The purpose of the preset study was to assess the protective capabilities of 4-((quinolin-2-yl) methyleneamino)-1,2-dihydro-2,3-dimethyl-1-phenylpyrazol-5-one (QMP) against the biochemical alterations induced by Ehrlich ascites carcinoma (EAC) cells in mice. One hundred male of Swiss albino mice were divided into 5 groups. The groups were labeled as follows: G1 (negative control), G2 (1% DMSO), G3 (QMP), G4 (EAC), and G5 (EAC +QMP). The anticancer efficacy of (QMP) was determined by assessing antioxidant, hematological parameters, and the level of TNF-α. EAC group had significant elevations in hematological parameters, NO, MDA, and TNF-α levels. In contrast, the (EAC+ QMP) group had decreased levels of hematological parameters, NO, MDA, and TNF-α. The findings of the present study suggest that (QMP) possesses anti-inflammatory and antioxidant activities, which have the ability to reduce oxidative stress and TNF-α in EAC cells by enhancing the balance between oxidants and antioxidant mechanisms.

Keywords: QMP, EAC cells, anticancer, anti-inflammatory, antioxidants.

Introduction

Cancer is an intricate and multifaceted illness involving abnormal cell growth and proliferation. Cancer growth and progression primarily rely on the cellular accumulation of several genetic and epigenetic processes(Rana et al., 2020) . Cancer can occur due to changes in the tumor suppressor gene, oncogene, and microRNA gene. Cancer can also develop due to the abnormal buildup of specific cells resulting from excessive cell division, insufficient cell death, or a combination of both(Rana et al., 2020) .

EAC, which has resemblance to human cancers, is distinguished by its rapid and undifferentiated growth, shortened lifespan, and 100% malignancy (Ozaslan et al., 2011).

Furthermore, EAC exhibits a high degree of sensitivity to chemotherapy, making it a commonly employed subject in cancer research, antineoplastic investigations, and studies related to chemotherapy (Ozaslan et al., 2011). Although chemotherapeutic medications are widely utilized for cancer treatment, it is unfortunate that most of these drugs are not selective for cancer cells, leading to various types of organ damage (Kainsa et al., 2012) .

Reactive oxygen species (ROS), originating from both intracellular and extracellular sources, interact with cellular proteins and DNA, leading to unstable genomes, alterations in DNA bases, and genetic mutations (Al-Mamun et al., 2016). Research indicates a strong correlation between an imbalance in antioxidant levels and the development of several life-threatening conditions such as neurological diseases, cardiovascular disorders, aging, and cancer(Rana et al., 2020).

A wide range of therapeutic approaches for cancer have been established, such as radiotherapy, chemotherapy, surgery, hormone therapy, and the more recent addition of immunotherapy (Khorshid, 2011). Hence, the quest for powerful, specific, and safe anticancer substances is a crucial aspect of modern cancer research(Devegowda et al., 2010). The harmful outcomes of chemotherapy are often ascribed to its disrupting influence on healthy cells. Hence, the main obstacles to the clinical efficacy of chemotherapy persist in the form of its potential harm to healthy tissues, as well as the development of resistance to the drugs by cancer cells, especially towards traditional anticancer treatments(Rostom, 2010).

In order to acquire azomethine compounds, Schiff bases are commonly generated through the process of refluxing primary amines with carbonyl compounds (Pui et al., 2011). Schiff bases are highly valuable and significant research subjects due to their extensive use in various pharmaceutical and medicinal applications. These include their effectiveness as antimicrobial agents (Malladi et al., 2013; Patil et al., 2015), anti-inflammatory (Alam et al., 2012; Sathe et al., 2011), antifungal (Guo et al., 2007; Raman et al., 2008), antiviral(Kumar et al., 2010), analgesic(Pandey et al., 2012; Chinnasamy et al., 2010) , anticonvulsant (Kurdekar et al., 2012), antitubercular (Aboul-Fadl et al., 2003), antioxidant (Aburas et al., 2013; Guo et al., 2005), anticancer(Ali et al., 2012), antimalarial (Alam et al., 2014) and so forth.

The research undertaken in the later part of the 20th century focused mostly on studying the pain-relieving and fever-reducing capabilities displayed by antipyrine Schiff bases (Eltayeb et al., 2020).

Antipyrine's anticancer effects have recently sparked a significant increase in interest. A set of 12 pyrazol-3-one Schiff's bases was prepared and then assessed on breast (MCF7) cell lines and human lung (A549). Certain chemicals from this collection showed promising results when tested on the breast cancer cell line (Bensaber et al., 2014).

Subsequently, the main purpose of this study was to evaluate anti-cancer properties of 4-((quinolin-2-yl)methyleneamino)-1,2-dihydro-2,3-dimethyl-1-phenylpyrazol-5-one (QMP) contrary to EAC cells. Additionally, the study aimed to investigate the changes in oxidative stress, hematological variables, and TNF-α levels associated with these effects.

Materials and Methods

Chemistry

The aforementioned methods (Morgan et al., 2017) (Fig. 1)were used to prepare 4-((quinolin-2-yl) methyleneamino)-1,2-dihydro-2,3-dimethyl-1-phenylpyrazol-5-one(QMP).To create a solution, the compound was dissolved in 1% DMSO.

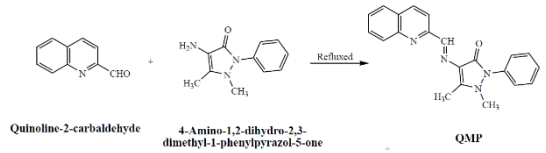

Fig.1: Synthesis of Schiff base (QMP).

Animals

Male Swiss albino mice weighing between twenty and twenty-five grams, were acquired from the Regional Center for Mycology and Biotechnology at Al Azhar University in Cairo, Egypt. Prior to the start of the experiment, the mice were placed in steel mesh cages at the Animal House of the Faculty of Science in Damietta University. During this acclimatization period, the mice were provided

with pellets and water freely for seven days.

Transplantation of tumor cells

In order to get EAC cells, which were then suspended in sterile isotonic saline, donor mice were acquired from the Egyptian National Cancer Institute at Cairo University. A healthy mouse underwent an intraperitoneal transplantation of 2.5 million cells.

(LD50) of QMP

The median lethal dose (LD50) of the compound was determined by applying Meier and Theakston's approach (Meier and Theakston, 1986). The suggested minimal dose must be determined by investigations aimed at determining the LD50. The compound was injected into forty mice (4 mice per dose) at the following recommended concentrations: 1, 1.5, 2, 2.5, 3, 3.5, 4, 6, 8, and 10 mg/kg in order to calculate the compound's LD50. After then, the mice were watched for a full day. For a period of twenty-four hours, four dosages of 50, 100, 150, and 200 mg/kg were injected into a group of sixteen mice.

Experimental design

A total of one hundred male of Swiss albino mice, each weighing between twenty and twenty-five g, were placed into five groups each of twenty mice, as illustrated in (**Fig.2**).

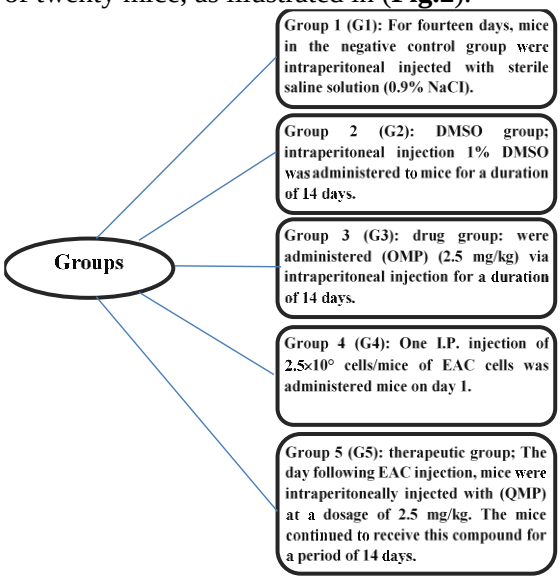

Fig.2: Experimental design

Blood sampling

Co_2 was used to euthanize the mice as the experimental time came to a close. A cautious approach was taken to access the peritoneal cavity. The blood samples were collected in an EDTA glass tube and used for assembling a comprehensive blood profile.

Tissue sampling

Following the extraction of liver tissue from each mouse, it was rinsed with cold saline solution. In order to simplify the process of preparing the liver tissue for analysis, the first part of the tissue was obtained and kept in phosphate-buffered saline (PBS) with a pH of 7.4.

MTT assay

The in vitro cytotoxicity was evaluated using a conventional MTT assay, with some modifications to suit the particular test system (Mosmann, 1983). In summary, EAC cells obtained from the peritoneum of mice that were injected with EAC were diluted to a concentration of 1×10^5 cells/ml using RPMI media containing 10% FBS. 100 µl of EAC cells were placed in each well of a 96-well plate. The plate was then incubated for 48 hours at 37oC in a CO_2 incubator. During this incubation, different doses of the drug being studied and 5 FU were added to the wells. After removing the media, the cell cultures were incubated at a temperature of 37 degrees Celsius for a duration of 4 hours with 100 µl of MTT reagent at a concentration of 1 mg/ml. The formazan formed by the live cells was dissolved in 100 µl of DMSO to create a solution. The cell solution in a 96-well plate was incubated on an incubation shaker for 5 minutes. The absorbance at 570 nm was then measured using a microplate reader. Based on these measurements, the IC50 and percentage cytotoxicity were deducted.

Assessments

Hematological investigation

The Sysmex kx-21n automated hematology analyzer (JAPAN CARE CO., LTD) was used to examine the complete blood count (CBC).

Oxidative stress markers evaluation in liver homogenate

The level of malondialdehyde (MDA) was evaluated using Satoh's protocol(Satoh,

1978) with a kit produced by Biodiagnostic Company. Montgomery *et al*.(Montgomery and Dymock, 1961) employed a commercially available instrument (Biodiagnostic Company, Egypt) to figure out nitric oxide (NO).

Investigation of Tumor Necrosis Factor Alpha (TNF-α) levels in liver homogenate by the Enzyme-Linked Immunosorbent Assay (ELISA)

The TNF-α ELISA Kit was purchased from ELK Biotechnology Company in Wuhan, China. Before conducting the experiment, all reagents were prepared. After being incubated at a temperature of 37°C for a total of 80 minutes, a well without any substance was filled with 100 µl of the standard working solution. Another well without any substance contained 100 µl of the sample, and a third well had 100 µl of the standard working solution. The liquid was removed from each well. The experiment was ended one to two minutes after adding 200 L of Wash Solution to each well. By firmly placing the plate onto absorbent paper, all of the remaining liquid was completely removed from each well. Three full cycles of washing. Subsequently, each well was placed in an incubator set at a temperature of 37°C for a period of 50 minutes. During this time, a volume of 100 µl of Biotinylated Antibody working solution was added to each well. A total of three aspirations and washes were carried out. After adding 100 µl of Streptavidin-HRP working solution, each well was incubated at 37°C for 50 minutes. The aspiration was repeated a total of five times. Each well was incubated for 20 minutes at 37°C in a light-free environment using 90 L of TMB Substrate Solution. Each well was supplemented with an additional 50 L of stop reagent. The color of the wells transitioned from blue to yellow. The optical density (O.D.) was measured at a wavelength of 450 nm using ELISA reader. The intensity of the color is proportional to the concentration of TNF-α.

Statistical analysis

Analysis was conducted using the 26th version of the Statistical Package for the Social Sciences (SPSS). The results were presented as the mean ± standard deviation. The ANOVA test was employed to compare the mean values of the investigated variables among different groups. P-values below 0.001 are regarded as extraordinarily significant, P-values below 0.01 are regarded as to be extremely significant and P-values below 0.05 are regarded as significant. Pearson's correlation test was used to establish the relationship between the factors being studied, using the same computer program. (El-Ansary et al., 2021).

Results

(LD_{50}) Median lethal dose of QMP

In order to establish the level of toxicity of QMP, the LD50 was computed by administering the drug intraperitoneally. The study findings indicated that the substance was deemed safe for ingestion up to a dosage of 200 mg/kg, beyond which no instances of death were observed.

MTT evaluation

QMP exhibited cytotoxicity towards EAC cells, with the degree of toxicity depending on its concentration. This was measured using the MTT assay, and the IC50 value of QMP was found to be 66.14 mM/ml.

Biochemical monitoring

Hematological criteria variations

The impacts of QMP on mice's hematological variables were displayed in (**Fig. 3**).

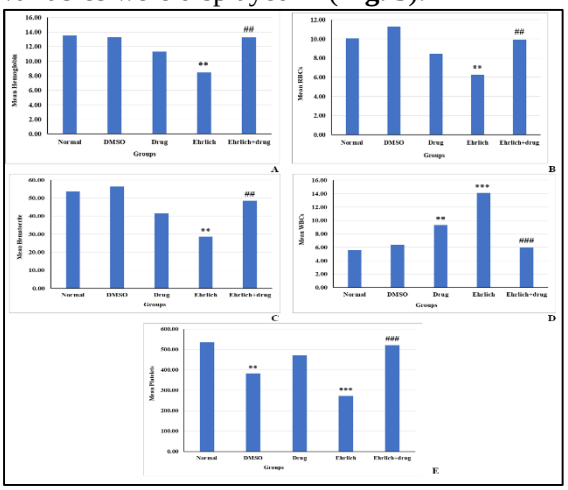

Fig.3: Effect of QMP on hematological parameters in all different studied groups. **A** Hemoglobin, **B** RBCs, **C** Hematocrit, **D** WBCs and **E** Platelets**.** Results were expressed as mean. N.S. at (P > 0.05) was deemed as non-significant. (*) at (P < 0.05) was

deemed as significant, (**) at (P < 0.01) was deemed as very significant and (***) at (P <0.001) was deemed as highly significant when all groups compared to negative control group. ### =highly significant (P < 0.001), ## = very significant (P < 0.01) and #= significant (P < 0.05) when therapeutic group compared to positive control group.

The experimental group treated with EAC exhibited a reduction in red blood cell count (RBCs), hematocrit (HCT) values, and hemoglobin (Hb) concentration by a factor of less than 0.01 compared to the control group. In addition, there was a significant decrease (P < 0.001) in the number of EAC-bearing cells compared to the negative control group, which also resulted in a decrease in the number of platelets (PLT). In contrast, the EAC-bearing group exhibited a higher number of white blood cells (WBCs) compared to the negative control group, with a p-value greater than 0.05. In contrast, when exposed to (QMP) for a period of two weeks after EAC induction, there was a notable and statistically significant rise (P < 0.01) in the quantity of red blood cells (RBCs), concentration of hemoglobin (Hb), value of hematocrit (HCT), and count of platelets (PLT) (P < 0.001) compared to the group with EAC tumors. In contrast, the quantity of white blood cells (WBCs) significantly decreased (P < 0.001) compared to the group with EAC tumors.

Antioxidant assays variations

The levels of malondialdehyde (MDA) and nitric oxide (NO) in the liver tissues of each study group were summarized in (**Fig.4**).

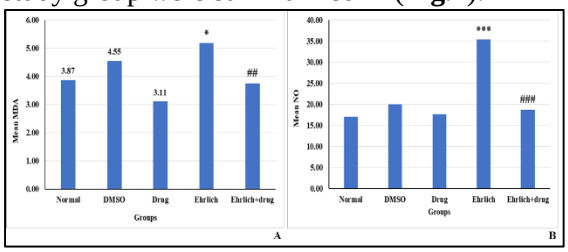

Fig.4: Effect of QMP on MDA and NO levels in all different studied groups. **A** MDA levels, **B** NO levels. Results were expressed as mean. N.S. at (P > 0.05) was deemed as non-significant. (*) at (P < 0.05) was deemed as significant, (**) at (P < 0.01) was deemed as very significant and (***) at (P <0.001) was deemed as highly significant when all groups compared to negative control group. ### =highly significant (P < 0.001), ## = very significant (P < 0.01) and #= significant (P < 0.05) when therapeutic group compared to positive control group.

In liver tissue, the average NO level in the negative control group was 17.07± 1.38 (µmol/L). The EAC-bearing group's value improved highly considerably to 35.41±4.72 (µmol/L) (P < 0.001), while the drug group's value increased to 17.65±1.50 (µmol/L) (P>0.05). In comparison to the EAC-bearing group, the QMP treatment dramatically decreased the levels of nitric oxide in liver tissue to 18.69±3.55 (µmol/L) (P < 0.001).

The average concentration of MDA for the negative control group was 3.87± 0.45 (nmol/g.tissue) in liver tissue. At 4.55±0.85 (nmol/g. tissue), the drug group's value was marginally lower (P > 0.05), whereas the EAC-bearing group's value was significantly higher (P < 0.05) at 5.19±0.56 (nmol/g. tissue).In compared to the EAC-bearing group, administration of QMP showed a very significant mitigation of MDA in the liver tissue, with the therapeutic group's MDA levels falling to 3.74±0.99 (nmol/g. tissue) (P < 0.01).

Alterations in the level of TNF-α

The negative control group's liver tissue had an average TNF-α level of 589.08 ±82.22 pg/mL. In the medication group, the value decreased marginally to 600.60±72.84 (pg/mL) (P > 0.05), but in the EAC-bearing group, it climbed dramatically to 1701.74±91.14 (pg/mL) (P < 0.001). Compared to the EAC-bearing group, TNF-α levels in the liver tissue were significantly lower after QMP was administered, falling to 609.42±51.42 (pg/mL) (P < 0.001) (**Table 1**).

Table 1: Effectiveness of QMP on TNF-α level in various studied groups.

Group TNF- α (pg/mL)	Mean ± S.D
Negative control	589.08 ± 82.22
DMSO control	571.40 ± 88.95
Drug (QMP) control	600.60 ± 72.85
Ehrlich group (positive control group)	1701.74 ± 91.14***
EAC- bearing mice treated with QMP (therapeutic group)	609.42 ± 51.42c

Results were expressed as Mean ± S.D. N.S. at (P > 0.05) was deemed as non-significant. (*) at (P < 0.05) was deemed as significant, (**) at (P < 0.01) was deemed as very significant and (***) at (P <0.001) was deemed as highly significant when all groups compared to negative control group. c =highly significant (P < 0.001), b = very significant (P < 0.01) and a= significant (P < 0.05) when therapeutic group compared to positive control group.

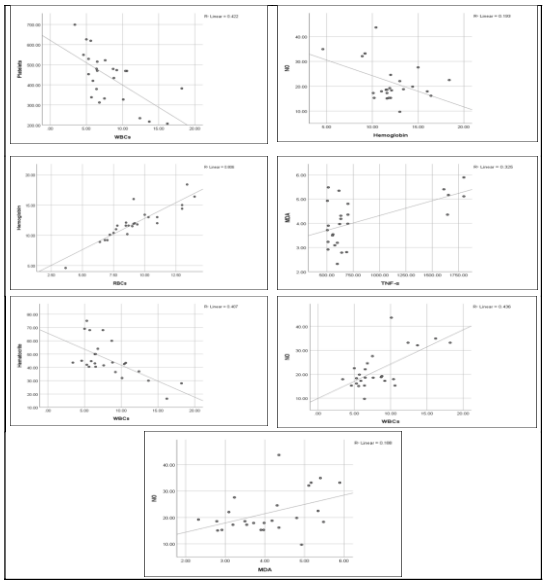

Fig.5: Pearson's correlation tests between laboratory parameters in all studied groups.

Pearson's correlation

The findings of Pearson's correlation analysis demonstrate that the correlation between laboratory parameters in all investigated groups is extraordinarily significant at the 0.001 level, very significant at the 0.01 level, and significant at the 0.05 level, as displayed in (**Table 2**) and (**Fig. 5**).

Table 2: Pearson's correlation analysis between laboratory parameters in all studied groups.

		TNF- α	MDA	NO	Hemoglobin	RBCs	WBCs	Platelets	Hematocrit
TNF- α	r		0.570**	0.855***	-0.616**	-0.579**	.820***	-0.661***	-0.588**
	P		0.003	0.000	0.001	0.002	0.000	0.000	0.002
MDA	r	0.570**		0.433*	-0.166	-0.131	0.395	-0.382	-0.120
	P	0.003		0.030	0.426	0.534	0.051	0.060	0.568
NO	r	0.855***	0.433*		-0.439*	-0.405*	0.660***	-0.665***	-0.412*
	P	0.000	0.030		0.028	0.045	0.000	0.000	0.041
Hemoglobin	r	-0.616**	-0.166	-0.439*		0.898***	-0.721***	0.608**	0.875***
	P	0.001	0.426	0.028		0.000	0.000	0.001	0.000
RBCs	r	-0.579**	-0.131	-0.405*	0.898***		-0.651***	0.358	0.968***
	P	0.002	0.534	0.045	0.000		0.000	0.079	0.000
WBCs	r	0.820***	0.395	0.660***	-0.721***	-0.651***		-0.650***	-0.638**
	P	0.000	0.051	0.000	0.000	0.000		0.000	0.001
Platelets	r	-0.661***	-0.382	-0.665***	0.608**	0.358	-0.650***		0.340
	P	0.000	0.060	0.000	0.001	0.079	0.000		0.097
Hematocrit	r	-0.588**	-0.120	-0.412*	0.875***	0.968***	-0.638**	0.340	
	P	0.002	0.568	0.041	0.000	0.000	0.001	0.097	

*Correlation is significant at (P < 0.05); **Correlation is very significant at (P < 0.01); ***Correlation is highly significant at (P < 0.001).

Discussion

Cancer continues to be a significant public health issue, causing millions of deaths each year(Nirmala et al., 2023). EAC exhibits similar traits to human cancers, such as its accelerated proliferation, absence of cellular specialization, and vulnerability to treatment (Kabel et al., 2013). The presence of reactive oxygen species (ROS) in women's bodies is associated with the onset of breast cancer. The buildup of substances leads to DNA damage, mutations, and abnormalities in the chromosomes. These factors contribute to the disruption of tissues and the occurrence of injuries (DeVita Jr et al., 2012; Gupta et al., 2012). As a result, the growth of a tumor inside an animal's body might hinder the proper functioning of essential organs such as the kidney and liver. EAC, which bears similarities to breast cancer, is believed to have developed as an unplanned occurrence of breast carcinoma(Somasagara et al., 2012). Evidence has shown that EAC cells have the ability to migrate into interior tissues, where they trigger the accumulation of inflammatory cells and the breakdown of mitochondria (Tousson et al., 2020).

Multiple anti-cancer medications are employed, which, despite their potent anti-tumor efficacy, induce unfavorable side effects in humans and have a considerable impact on the normal cells of the host(Hamdy et al., 2024). Hence, the efficacy of natural and safe products in the prevention and/or treatment of cancer has been enhanced(Moram et al., 2015; Karim El-Said et al., 2023a).

Observing alterations in hematological and oxidative indicators has further substantiated the compound's therapeutic effects on animals carrying EAC.

According to the current findings, the

hematological parameters of EAC mice were significantly different from those of the negative control. Microcytic hypochromic anemia was the outcome of these reductions in RBCs count, Hb concentration, PLT count, HCT value. These findings concurred with those of (Hamdy et al., 2024), (Morsi et al., 2023)and (Abd-Elghany et al., 2022). Hashem *et al.* (Hashem et al., 2020a), also observed similar results, linking these effects to the suppressive effect of EAC on erythropoiesis, which may be caused by hemolytic, myelopathic, or iron deficient situations.

Another possible explanation is that the molecular pathways responsible for proinflammatory cytokine-induced anemia may be separate from the down-regulation of erythropoietin hormone and deficit in iron metabolism. Conversely, the excessive production of TNF-α in EAC mice hindered the generation of Hb in this group(Morceau et al., 2006). Patients with chronic inflammatory illnesses may have a drop in serum iron levels. This could be attributed to an increase in TNF-α, which leads to a decrease in the production of RBCs and a decline in the lifespan of RBCs(McSherry and Valli, 1988). The membranes of erythrocytes are more prone to oxidative stress because they contain a significant amount of polyunsaturated fatty acids, which are more susceptible to oxidative damage. Erythrocytes are highly vulnerable to peroxide stress because they contain a significant amount of iron, which is a powerful catalyst for the generation of reactive oxygen species. Additionally, erythrocytes are constantly exposed to high levels of oxygen pressure, further increasing their susceptibility to peroxide stress(Manoharan et al., 2009). The susceptibility of erythrocytes to peroxides was proven by the increased white blood cell count, decreased hemoglobin value, and reduced red blood cell count (Chatterjee et al., 2011). The WBCs count was significantly increased in EAC mice than negative control. In line with the findings, (Badr et al., 2011) discovered that mice with EAC (Ehrlich Ascites Carcinoma) showed notable elevations in white blood cell, granulocyte, and monocyte levels. These increases are likely a result of the acute inflammatory response and/or oxidative stress caused by the growth of Ehrlich cells (Hashem et al., 2020b).

The therapeutic process for QMP has successfully reinstated the standard levels of (RBCs) and (Hb). Additionally, it has the potential to significantly enhance the white blood cell count. The findings were in line with the results reported by Islam *et al.* (Islam et al., 2013). Based on our research, QMP demonstrates a safeguarding impact on the hematopoietic system.

Cancer patients often suffer from cachexia, a syndrome marked by a gradual loss of body fat and muscle mass, resulting in significant weakness. The etiology of this syndrome is thought to be the result of the secretion of cytokines, such as TNF-α, by macrophages(Gueta et al., 2010; Bachmann et al., 2008). TNF is a crucial cytokine involved in protecting the body, maintaining a balanced immune system, and causing inflammation. It is also a highly versatile cytokin (Warren et al., 2009). In this trial, the levels of TNF-α were significantly and markedly higher in group 4 compared to group 1. The rise in TNF- α levels in the mice with tumors may be due to an increase in lipid peroxidation-inducing ROS generated by macrophages. This is noteworthy because it has a role in the development of liver injury(Hoek and Pastorino, 2002). The results of the study are consistent with the findings reported Abd El-Dayem *et al.* (El-Dayem et al., 2013),who observed higher levels of TNF-α in female mice with Ehrlich ascites cancer. Administration of QMP suppresses the spike in EAC levels induced by TNF- α. According to the reported data, QMP demonstrates a remarkable capacity to eradicate a diverse array of free radicals.

Prior research has demonstrated that reactive oxygen species (ROSs) play a role in both the initiation and promotion of cancer(Mohammed et al., 2022). The current study revealed significant relationships between changes in antioxidant systems. Significantly elevated levels of MDA and NO were detected in the tumor tissues of the EAC group. Aligned with a prior investigation conducted by (Abd El-Aziz et al., 2014) ,(Karim Samy El-Said et al., 2023b),(Antar et al., 2024) and (Sindhuri et al., 2023), who observed that the presence of an Ehrlich tumor resulted in significantly increased level of malondialdehyde (MDA).Our findings agree with (Saad et al., 2017), that stated that antioxidants concomitant decrease coupled with elevated MDA in animals with tumours implicate an oxidative stress state, and, subsequently, tissue and cellular damage and, likely, hepatocytes and

EAC cells damage.

Our results are in agreement with numerous studies, including (El-Masry et al., 2019) and (ELAblack et al., 2020) have noted that NO levels were increased in EAC bearing mice group. This could be explained by the work of others,(Raso et al., 2001) who demonstrated that increased lipid peroxidation and its product MDA can stimulate host cells, primarily macrophages or monocytes, to generate and release nitric oxide via stimulating of inducible nitric oxide synthetase (iNOS) activity, resulting in DNA and tissue damage(Raso et al., 2001). The present research revealed that QMP effectively regulated the activity of antioxidant enzymes. This was verified by the reduction in concentrations of MDA and NO. The data suggest that QMP has antioxidant and free radical scavenging properties. The aforementioned data indicate that the delivery of QMP to the tumor leads to enhancements in antioxidant parameters to alleviate oxidative stress, and elevate the levels of tumor marker chemicals such as TNF-α.

Conclusion

This study discovered the therapeutic possibilities of QMP in treating changes in hematological parameters, antioxidant parameters, and TNF-α alteration generated by Ehrlich ascites carcinoma. This study will help researchers uncover important aspects of cancer that have not been explored by many scientists. Consequently, a new hypothesis about treatments can be inferred.

Authors' contributions

R.F.Z, G.M.R, and A.Z.E conceptualized and conducted experiments; R.F.Z, G.M.R, and A.Z.E aided in the evaluation and/or explication of data. R.F.Z and G.M.R drafted the manuscript and R.F.Z, G.M.R, and A.Z.E revised it for significant logical content. The manuscript has been read and approved by all of the authors.

Competing interests

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval

The Research Ethics Committee at Faculty of Medicine, Benha University, Egypt (REC-FOMBU) investigated and approved each of the mentioned experimental procedures. Permit No. (MS.9.2.2023 According to all applicable rules and regulations, including the ARRIVE guidelines (Percie du Sert et al., 2020) , every experiment was carried out.

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الملخص العربي

عنوان البحث: تقييم النشاط المضاد للأكسدة والمضاد للالتهابات لـ ٤- ((الكينولين -٢-ييل) ميثيلين أمينو) -١'٢ثنائي هيدرو-٣,٢-ثنائي ميثيل-١فينيلبيرازول-٥-واحد علي الفئران الحاملة لسرطان استسقاء إيرليش

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هناك حاجة مستمرة إلى عقاقير علاجية كيميائية جديدة، مما يشير إلى ضرورة حيوية للتقنيات المبتكرة. فالغرض من هذه الدراسة هو تقييم القدرات الوقائية لـ ٤- ((الكينولين -٢-ييل) ميثيلين أمينو) -٢'١ثنائي هيدرو-٣,٢-ثنائي ميثيل-١فينيلبيرازول-٥-واحد ((QMPفي مواجهة التغيرات في الإجهاد المؤكسد، وعلم الدم، و عامل نخر الورم ألفا التي تولدها خلايا ايرليش في الفئران. وقد اشتملت هذه الدراسة علي ١٠٠ من الفئران البيضاء السويسرية الذكرية البالغة تم تقسيمها إلى ٥ مجموعات بالتساوي المجموعة الأولي (الضابطة السالبة)،المجموعة الثانية(مجموعة الداي ميثيل سالفو أوكسيد)،المجموعة الثالثة((QMP،المجموعة الرابعة (خلايا ايرليش)،المجموعة الخامسة (مجموعة خلايا ايرليش معالجة ب(. QMPوقد تم تقييم التأثير المضاد للأورام ل ((QMP من خلال تقييم دلالات أمراض الدم، ودلالات مضادات الأكسدة، ومستوي عامل نخر الورم ألفا. وشهدت مجموعة خلايا ايرليش زيادات كبيرة في مستويات دلالات أمراض الدم ، ودلالات مضادات الأكسدة ومستوي عامل نخر الورم ألفا . على النقيض من ذلك، لوحظ انخفاض مستويات دلالات أمراض الدم ، مستوي المالونالدهيد، وأكسيد النيتريك، وعامل نخر الورم ألفا في مجموعة (خلايا ايرليش معالجة ب (.QMPتشير نتائجنا إلى خصائص مضادات الأورام ومضادات الأكسدة لـ ((QMPمع إمكانية تقليل الضغط التأكسدي المرتبط بخلايا ايرليش عن طريق زيادة نظام الدفاع المضاد للأكسدة.