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Research Article

Anti-cancerous Effect of *Ocimum sanctum* Against DMBA Induced Breast Cancer in Swiss Albino Mice

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Abstract
Worldwide, the prevalence of breast cancer has increased significantly in recent years. There is a higher mortality rate among female cancer patients globally compared to male ones. Despite the development of better medical care and the discovery of several new medications, it is still linked to a high death rate. The many therapeutic uses of *Ocimum sanctum* (L.) have led to its widespread usage in the ancient Indian medical system known as Ayurveda. The Indian subcontinent is home to this shrub more than any other. Having said that, data on its anticancer effects is scant. Therefore, the purpose of this research was to investigate if *Ocimum sanctum* leaf extract had any anticancer effects on mice that had been experimentally induced with 7,12-dimethylbenz(a)anthracene (DMBA) for breast cancer. The research used female Swiss Albino mice that were 20 mg/mL induced DMBA dissolved in olive oil and had an average weight of 150±10 g. The mice were 55 - 60 days old. Mice were given an oral dose of *Ocimum sanctum* ethanolic leaf extract (100 mg/kg b.w./day) when breast tumors had grown to a size of around 0.3 cm. Following this, the tumor volume was determined. There was a substantial decrease 47% in breast tumor volume ($p< 0.05$) and a drop in many serum biomarkers, including TNF- α level and serum malondialdehyde (MDA) levels, ($p< 0.0001$) after *Ocimum sanctum* administration. Following therapy with the ethanolic leaf extract of *Ocimum sanctum*, there was a notable ($p<0.0001$) enhancement in the kidney and liver serum biomarker values.
All things considered, the results of the research suggest that the ethanolic leaf extract of *Ocimum sanctum* has anti-cancer properties since it inhibits the growth of breast tumours in the mouse model. Additionally, the plant extract has a protective impact on the liver and kidneys. So, it may be used as a new, safe anti-cancer medication specifically for breast cancer.

Keywords: DMBA induced breast model; Tumour volume, TNF alpha, Leaf extract of *Ocimum sanctum,* novel drug discovery.

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Introduction

On a global scale, cancer ranks as the second most lethal disease. Cancer accounts for almost 16% of global mortality. Among malignancies affecting women, breast cancer has the greatest fatality rate. Breast cancer will account for about 6.9% of all female cancer deaths in

2020 (684,996) and for roughly 11.7% of all female cancer diagnoses (2,261,419) in 2020. This figure is expected to reach 2.1 million in 2018. The latest data from the Global Cancer Report shows that out of all the new cancer cases in India, 1,62,468 are breast cancer, making it 14% of the total (Globocan 2020; IARC 2020; WHO; 2018; Ferlay 2018).

Factors related to reproduction and heredity, prolonged estrogen exposure, never breast feeding, and other behavioral changes all increase the likelihood of breast cancer. The development of breast cancer is thought to be influenced by environmental factors as well. It is possible that people's poor eating habits and the low quality of the food they consume are the causes of the alarming increase in the prevalence of many illnesses, including breast cancer. To increase crop yields, modern farmers rely more and more on pesticides. Xenoestrogens are present in pesticides and food preservatives, however. The endocrine system is being disrupted by these synthetic xenoestrogens, leading to an increased risk of breast cancer. Polycyclic aromatic hydrocarbons (PAHs) are carcinogens that have been associated to an elevated breast cancer risk and are present in all forms of grilled, barbecued, and smoked meat. While PAHs are initially pro-carcinogens, they transform into active carcinogens via a cascade of events facilitated by cytochrome p450 enzymes inside the body (Paterni et al., 2017; Fernandez & Russo 2010; Kim et al., 2017; Parada et al., 2017; Rengarajan et al., 2015).

The increasing occurrence of breast cancer may be attributed to these factors as well as the dynamic lifestyles of contemporary women. Chemotherapy, radiation therapy, and a plethora of new anticancer medications are just a few examples of the improved cancer treatment choices made possible by the quick growth of modern medicine. The life expectancy of cancer patients is greatly increased by these treatments, although they do come with some unwanted side effects. The kidneys and liver take the brunt of the harmful effects of chemotherapy medications. Finding and developing safer, more effective, and less costly cancer medicines is, hence, an immediate need. Herbal remedies and dietary supplements have shown promise in animal trials as potential cancer treatments and chemo-preventives, with manageable adverse effects (Gharia et al., 2017; Miller et al., 2010; Li et al., 2019).

Therefore, to address this multifaceted issue, a bio-remedial strategy is required. The Indian holy basil, or *Ocimum sanctum*, has a long history of medicinal usage in the Ayurvedic system of Indian medicine. Holy basil has a long history of medicinal usage, with applications ranging from the treatment of cancer to inflammation, poor immunity, hepatoprotection, and lung illness. Tulsi has been the subject of hundreds of scientific studies looking at its possible medicinal properties; these studies have included in vitro, animal, and human trials. According to the findings of these studies, tulsi has a remarkable array of health benefits, including the following: antimicrobial (including antibacterial, antiviral, antifungal, antiprotozoal, antimalarial, and anthelmintic), mosquito repellent, anti-diarrheal, anti-oxidant, anti-cataract, anti-inflammatory, chemopreventive, radioprotective, hepato-protective, neuro-protective, cardio- cardio-protective, anti-diabetic, anti-hypercholesterolemia, anti-hypertensive, anticarcinogenic, analgesic, anti-pyretic, anti-allergic, immunomodulatory, central nervoand anticoagulant activities (Kumar & Patel., 2023; Baliga et al., 2016; Cohen 2014; Singh et al., 2007; Uma Devi 2001).

This work intends to fill a gap in the literature by investigating the anti-cancer effects of *Ocimum sanctum* leaf extract on DMBA-induced breast cancer in mice, since there has been very little research on breast cancer models.

Materials and Methods

Chemicals and reagents: Chemical 7,12-dimethylbenz(a)anthracene (DMBA) was procured from the Scientific chemical store in Patna, Bihar, India. The product number was D3254-1G and the lot number was PXLNG2901. The CAS number is 57-97-6. Here is the product code: 1009330344. None of the other substances used in this study deviated from the standard of 99% purity.

Ethanolic extract preparation of *Ocimum sanctum* leaves: The leaves of the *Ocimum sanctum* plant were collected from an Indian garden in Patna, Bihar. A famous botanist from Patna, Bihar, India, recognized the leaves. The leaves were shade dried for three days before being air dried at 37 degrees Celsius. The next step was to grind the leaves and let them soak in 100% ethanol for 24 hours. The ethanolic leaf extract mixture was filtered to eliminate any remaining particles. The filtrate was then subjected to ethanol extraction in a rota vapor apparatus. The leaf ethanolic extract dosage was adjusted to 100 mg/kg body weight after the LD50 value was established, which was 2100 mg/kg.

Experimental Animals: Twenty-four female Swiss Albino mice were provided by the Mahavir Cancer Sansthan and Research Centre's animal house in Patna, India (CPCSEA

Registration no. 1129/PO/ReBi/S/07/CPCSEA). The research investigations were approved by the Institutional Animal Ethics Committee (IAEC) with protocol number IAEC NO. 2021/1D06/10/21. All of the animal experimentation methods were carried out in accordance with the regulations established by the Committee for the Protection and Control of Experiments on Animals (CPCSEA), New Delhi. Food and water were made available to the mice at *ad libidum*. Before beginning the research, the mice were acclimated for seven days. Six mice were housed in each standard polypropylene cage for the studies. The mice were randomly allocated to either a control or treatment group. The mice were housed in a room with a constant temperature (24 2°C) and a light/dark cycle of 12 hours.

Design of the Study: Female mice of the Swiss albino strain (n=24) were split into three groups of six individuals, based on their ages (55-60 days) and weights (25-30 g).

Group I- Control group.

Group II- DMBA group - DMBA induced mice only.

Group III- DMBA + *Ocimum sanctum* group – DMBA-induced mice treated with *Ocimum sanctum* ethanolic leaf extract (100 mg/kg body weight per day) for 5 weeks after tumour development (about 0.6 cm).

At the completion of the treatment, the mice were anaesthetized with ketamine and sacrificed during the diestrous phase of their estrous cycle. In order to collect blood for analysis, the orbital puncture method was used. Serum was analyzed biochemically, inflammatory markers, and lipid peroxidation were measured. Breast tissues were fixed in 10% formalin for histological examination.

Tumour induction: Mammary gland tumours were induced in female Swiss Albino mice
(25± 5 g). About 55 days of age, these rodents were utilized for the study. A single dose of 7,12-dimethylbenz(a)anthracene (DMBA) dissolved in olive oil at a concentration of 15mg/Kg body weight was delivered intragastrically, as per the methodology of (Liu et al., 2017). Eighteen mice were palpated weekly in the beginning in the fourth week after DMBA injection to monitor tumour progression. After 20 weeks, every single one of the 18 DMBA-treated mice had developed tumours. At week 19, the first tumour was discovered.

Evaluation of mammary tumour volume: Breast tumour volumes were measured using a vernier calliper. Where L and B are the perpendicular tumour diameters in centimeters (cm), we were able to calculate the tumour's volume (V) using the formula V(cm3) = (L B2)/2.

Hematological parameters study: The obtained blood samples were examined using standard procedures to assess haematological parameters such as complete blood count, white blood cell count, platelet count, and haemoglobin percentage.

Biochemical assays: Biochemical analysis was performed using a UV - Vis spectrophotometer
(UV-10, Thermo Scientific, USA) in accordance with the established kit method (Coral crest).

Alkaline phosphatase (ALP) was measured using the method developed by Kind and King (1954), total bilirubin was measured using the method developed by Jendrassik and Grofs (1962), Kidney biomarkers urea, creatinine, and uric acid were analyzed using various techniques (Berthelot 1859, Fawcett & Scott 1960; Bones and Tausky 1945; Fossati and Prencipe 1980).

Lipid peroxidation (LPO): TBARS, a biomarker of LPO, was evaluated using the two-step heating approach (Draper and Hadley, 1990), which relies on the spectrophotometric evaluation of color reproduction during the reaction of thiobarbituric acid (TBA) with malondialdehyde (MDA). A 10% trichloroacetic acid (TCA) solution was added to 0.5 mL of serum in a centrifuge tube, and the mixture was heated in a water bath at 90°C for 15 minutes. The combination was centrifuged at 3000 rpm for 10 minutes after chilling at ambient temperature, and the resultant 2 mL supernatant was mixed with 1 mL of 0.675% TBA solution in a test tube before being heated in a water bath at 90°C for 15 minutes. Then, we measured the spectrum at 532 nm using a UV-visible spectrophotometer (a Thermo Scientific UV-10 USA).

Tumour necrosis factor-alpha (TNF- α) assay: The ELISA method was used to determine serum TNF- levels. A rat TNF- ELISA kit (Cat. No. 872.010.001) was manufactured by the French firm Diaclone. The blood TNF- level was determined using a Merck ELISA reader in accordance with the manufacturer's instructions and the published literature (Beutler et al, 1988).

Histopathology study: Breast tissue of mice was removed, sectioned, and preserved in 10% formalin for a full day. After being dehydrated in ethanol, the tissues were embedded in paraffin. Sections of tissue 5µm thick were cut and stained with haematoxylin and eosin for histological analysis.

Statistical analysis: The information is shown as a mean and its associated standard error of the mean (SEM). Tumour volume was compared between the DMBA and DMBA + *Ocimum sanctum* groups using a two-way analysis of variance (ANOVA) with time and medication as the two factors. One-way analysis of variance (ANOVA) and Tukey's multiple comparison tests were used to evaluate the statistical significance of the differences between the groups with regards to biochemical, LPO, and hormonal testing. GraphPad Prism 5 (GraphPad Software, Inc., San Diego, USA) was used for the analysis, and a significance level of $p < 0.05$ was used for the statistical tests.

Results

Morbidity and mortality: There was tumour growth within mammary teats 1, 4, and 5 in all six DMBA-exposed animals. Tumour development in the remaining six mice from teats 1,2, and 5 was greatly slowed in the DMBA + *Ocimum sanctum* group. There were no reported fatalities in any of the groups. Graphical representation of the DMBA group and the DMBA

Evaluation of Tumour volume: Both the DMBA and the DMBA + *Ocimum sanctum* groups had their tumour volumes grow with time. Tumour volume in DMBA-induced mice was decreased by a statistically significant amount ($p < 0.005$) when *Ocimum sanctum* ethanolic leaf extract was administered with DMBA, as shown in **Figure 1.** The final tumour volume was reduced by 47% because of the *Ocimum sanctum* leaf extract.

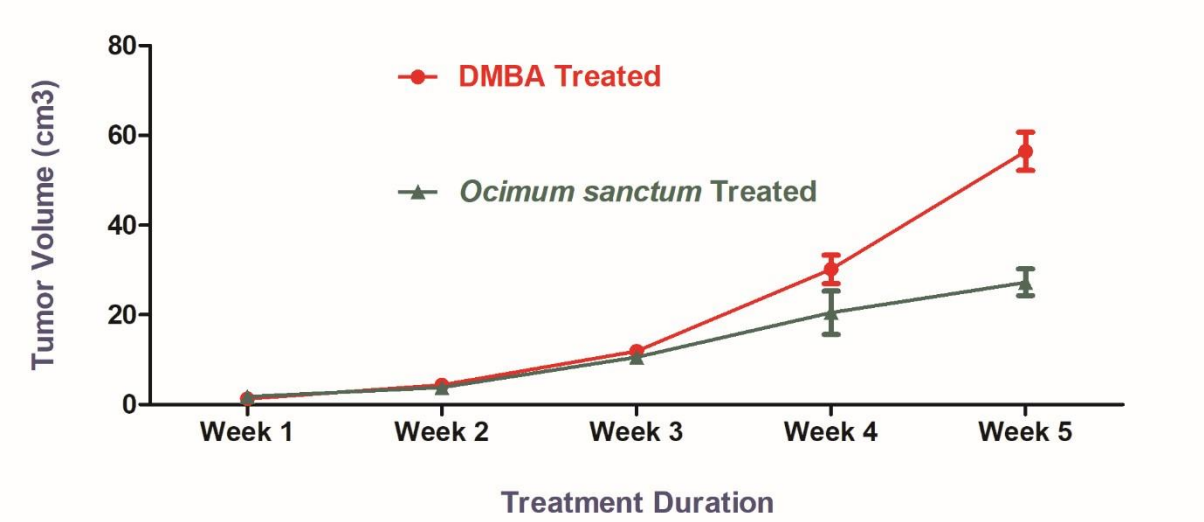

Figure 1: The effect the treatment had on tumour size reduction in the experimental groups. *Ocimum sanctum* was administered at a dosage of 100 mg/Kg body weight per day for 5 weeks after about 0.5 cm tumour growth in both the DMBA group and the DMBA + *Ocimum sanctum* group (Mean standard error of the mean, n=6).

Evaluation of malondialdehyde (MDA) level: Malondialdehyde (MDA), a marker of lipid peroxidation, was found to be significantly higher in the DMBA group compared to the control group ($p < 0.05$). However, the MDA level in the DMBA + *Ocimum sanctum* group reduced significantly ($p < 0.05$) compared to the DMBA group. **(Table 1.).**

Table 1. Levels of Lipid Peroxidation in different treatment groups

Parameters	Control	DMBA Treated	*Ocimum sanctum* Treated
Lipid Peroxidation (nmol/ml)	2.67 ± 0.83	148.25 ± 2.45	15.5 ± 1.89

The data are presented as mean ± S.E, n = 6, significance at $p < 0.05$.

Evaluation of TNF- α levels: There was a statistically significant increase in serum TNF-alpha between the DMBA-treated group and the control group ($p<0.05$). The blood TNF-alpha level was decreased in the DMBA + *Ocimum sanctum* group compared to the DMBA group ($p<0.05$) **(Table 2).**

Table 2. TNF alpha levels in different treatment groups

Parameters	Control	DMBA Treated	*Ocimum sanctum* Treated
TNF alpha (pg/mL)	6.56± 1.10	84.24 ± 2.77	17.45 ± 3.56

The data are presented as mean ± S.E, n = 6, significance at $p < 0.05$.

Evaluation of haematological parameters:
The haematological analysis revealed that the DMBA-treated mice had significantly lower levels of red blood cells, white blood cells, platelets, and haemoglobin percentage than the control group mice, whereas the *Ocimum sanctum* leaf extract-treated mice had significantly restored levels to normal ($p<0.05$). **(Table 3).**

Table 3. Haematological parameters

Parameters	Control	DMBA Treated	*Ocimum sanctum* Treated
RBC Count (× 10^6 mm $^{-3}$)	8.23 ± 1.75	3.47 ± 1.93	5.2 ± 0.56
WBC Count (mm $^{-3}$)	8600 ± 6.36	3200 ± 8.25	9200 ± 5.98
Platelets counts (×10^6 mm $^{-3}$)	2.4 ± 1.53	1.7 ± 1.11	2.6 ± 1.22
Haemoglobin (g/mL)	14.2 ± 1.97	8.2 ± 2.56	13.45 ± 1.98

The data are presented as mean ± S.E, n = 6, significance at $p < 0.05$.

Changes in liver and kidney serum biomarker parameters: In comparison to the control group, the DMBA group had significantly increased serum total bilirubin, ALT, and ALP levels ($p<0.05$). When compared to the DMBA group with the DMBA + *Ocimum sanctum* group, total bilirubin, ALT, AST, and ALP levels in the serum were all significantly lower in the DMBA + *Ocimum sanctum* group ($p<0.05$; Table 4). The DMBA group had substantially ($p<0.05$) greater serum creatinine, urea, and uric acid levels than the control group, indicating kidney impairment. In comparison to the DMBA group, serum urea and uric

acid levels were significantly lower in the DMBA + *Ocimum sanctum* group ($p<0.005$). **(Table 4).**

Table 4. Biochemical Parameters Study

Parameters	Control	DMBA Treated	*Ocimum sanctum* Treated
SGPT (U/mL)	35.23 ± 1.4	172.57 ± 2.67	50.34 ± 1.22
SGOT (U/mL)	30.67 ± 2.23	201.78 ± 4.23	60.94 ± 2.57
ALP (KA units)	5.95 ± 1.12	45.24 ± 3.66	10.56 ± 3.89
Urea (mg/dL)	29.78 ± 1.34	67.26 ± 6.12	46.92 ± 3.23
Uric acid (mg/dL)	3.56 ± 1.13	12.45 ± 1.56	10.61 ± 2.72
Creatinine (mg/dL)	0.74 ± 0.29	4.23 ± 1.19	1.22 ± 0.92

The data are presented as mean ± S.E, n = 6, significance at $p< 0.05$.

Histopathological findings:

Histological section of the breast tissue of DMBA (3mg/ml) shows mammary tumours. The section shows presence of mucin in ductal lumen, discontinuous basement membrane with papillary outgrowth, dense and highly granulated cytoplasm and high degree of proliferation. But after administration with *Ocimum sanctum* leaf extract at the dose of 100 mg/Kg body weight, there was significant restoration in the mammary gland cells [**Figure-2**].

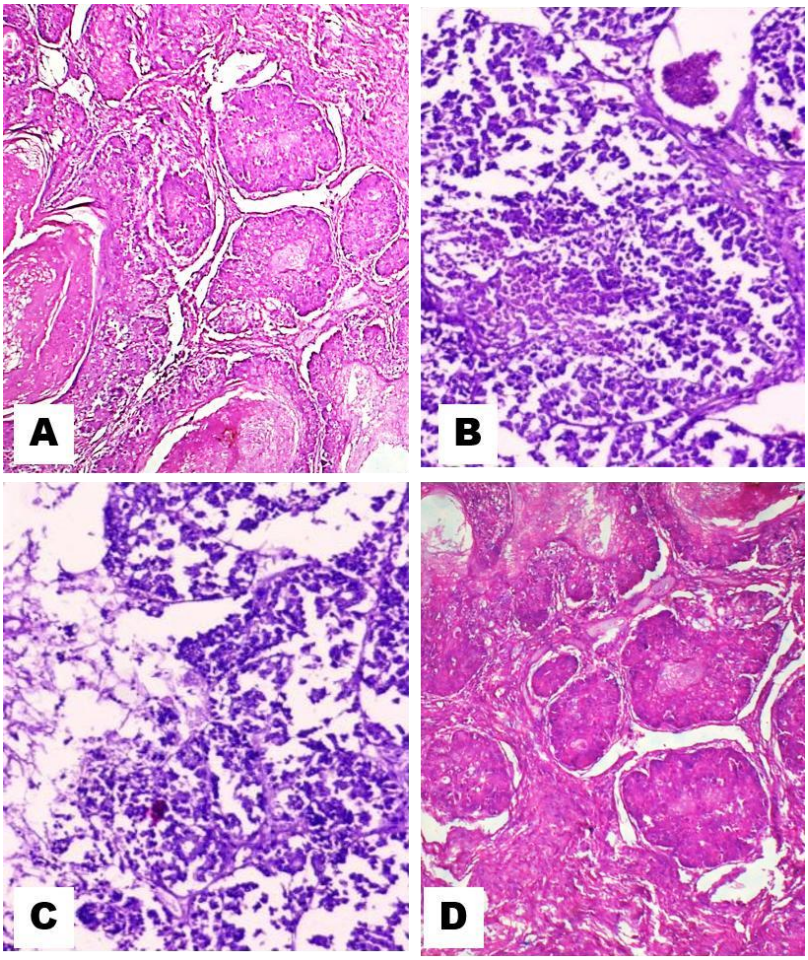

Figure 2: Histological section of tumor of Swiss Albino mice treated with DMBA and stained by Hematoxylin & Eosin (A) section of control mice mammary cells having normal arrangement of tissues . (HE-40x) , (B) Ductal tumour with discontinuous basement membrane with mucin (HE-40x), (C)- histological section of tumorous tissues with proliferative changes (HE-40x) , (D) Normalisation in the mammary cells due to *Ocimum sanctum* leaf extract treatment (HE- 40x).

Discussion

DMBA undergoes a transformation into the more powerful carcinogen known as DMBA-3,4dihydrodiol-1,2-epoxide (DMBA-DE) when it is subjected to metabolic activation by the cytop450 enzyme. At the same time that metabolic activity is taking place, several reactive oxygen species (ROS) are being produced, which disrupts the redox equilibrium of tissues. The formation of malondialdehyde (MDA), which is a byproduct of lipid peroxidation (LPO), is enhanced by

the reactive species identified here. The presence of high amounts of malondialdehyde (MDA) has been widely acknowledged as a sign of oxidative stress and antioxidant status in animal models of cancer as well as in human cancer patients. During the course of the current investigation, it was discovered that the levels of MDA in the serum were considerably greater in the DMBA group in comparison to the control group. However, as compared to the group that received DMBA, the group that received DMBA plus *Ocimum sanctum had* significantly lower blood MDA levels. It is possible to determine the antioxidant capability of the ethanolic leaf extract of *Ocimum sanctum* by observing its capacity to decrease the levels of malondialdehyde (MDA).

The carcinogenic process that is triggered by DMBA is characterized by an increase in the expression of the pro-inflammatory cytokine tumor necrosis factor-alpha (TNF-). Furthermore, the upregulation of the transcription factor NF-kB (nuclear factor-kB) that is mediated by TNF is essential for the survival and proliferation of neoplastic cells. One of the most important contributors to the advancement of breast cancer is elevated levels of TNF-. A comparison between the DMBA group and the control group revealed that the DMBA group had significantly greater levels of TNF- in their blood than the control group did. The blood TNF- level, on the other hand, was much lower in the group that received DMBA with *Ocimum sanctum* than it was in the group that received DMBA. The ethanolic seed extract from *Ocimum sanctum* has been shown to have anti-inflammatory activities, as shown by the reduction in blood TNF- levels during the study. In addition to its antioxidant action, the ethanolic extract of *Ocimum sanctum* has proliferation-regulating capabilities, which include its antiproliferative effects on T cells (Drishya et al., 2022[a,b]).

It was determined that the difference between the DMBA group and the DMBA + *Ocimum sanctum* group was statistically significant, despite the fact that the DMBA group exhibited a trend toward a smaller breast tumor volume than the DMBA group. Furthermore, a maximum of 47% tumor growth inhibition was also identified in the penultimate week of therapy. It is highly probable that there would have been a significant decrease in the mammary tumor volume of the group that was treated with medicinal plants if the treatment could have been prolonged for a longer duration at any point in time. Many of the anticancer medications that are now on the market are successful; nevertheless, a significant number of these medications come with major adverse effects that may have an effect on a variety of different sections of the body. Therefore, it is necessary to evaluate the effect that the substance extracted from the leaves of *Ocimum sanctum* has on essential organs such as the kidneys and the liver. In most cases, the liver is the organ responsible for the detoxification-related processing of xenobiotic substances such as DMBA. In addition to causing harm to the liver, the metabolism of the chemical carcinogen also caused oxidative stress. It was shown that the blood levels of ALT, AST, and ALP were higher in the group that was given DMBA compared to the other two groups. It is a symptom of liver injury when there is an increase in the serum hepatitis biomarker. The group who received DMBA in addition to *Ocimum sanctum* had considerably reduced levels of total bilirubin, ALT, AST, and ALP in their blood as compared to the group that received DMBA alone. It is possible that the ethanolic leaf extract of *Ocimum sanctum* has hepatoprotective properties since the serum levels of liver biomarker measures were lower in the group that received DMBA in addition to *Ocimum sanctum* at the same time. According to Parmar et al. (2011) and Kumar et al. (2014), there is a substantial amount of material accessible about relevant research on various models.

A vital organ, the kidney is responsible for not only eliminating harmful byproducts of metabolism but also producing compounds that are essential to the body. It is possible that renal impairment could hinder the excretion and metabolism of chemotherapeutic medications, which will ultimately result in an increase in the systemic toxicity of the medication. Urine, creatinine, and uric acid are all indicators of renal function, and it was discovered that the serum of the DMBA group had significantly greater levels of all three of these indices. There is evidence that DMBA has nephrotoxic effects, as shown by the higher level of renal biomarker. Compared to the group that only received DMBA, the group that received DMBA in combination with *Ocimum sanctum* showed a more significant reduction in blood levels of urea, creatinine, and uric acid. There is further evidence that the protective benefits of *Ocimum sanctum* leaf extract against DMBA-induced renal damage in rats are shown by the rapid recovery of serum kidney biomarker levels (Yadav and Bhatnagar 2007[a,b]; Hasanah et al., 2023).

There is a substantial amount of material accessible on the study that is linked to the various models. It has been shown by histopathological examination that the ethanolic seed extract of *Ocimum sanctum* has anti-proliferative effects. The breast tissue sections obtained from the DMBA group exhibited papillary projections, cystic dilatation, cellular sheet formation, pleomorphic, and patches of embryonic mesenchymal cells. These characteristics are all consistent with tubular-papillary carcinoma of the breast, as well as a more faster growth rate of the tumor. The majority of the fibrous structures are generated in the group that contains DMBA and *Ocimum sanctum*, which indicates that the rate of tumor development is slower in this group. When the final tumor volume of the group that had two treatments was evaluated, it provided further evidence of the antiproliferative characteristics. Antioxidants such as cirsilineol, circimaritin, isothymusin, apigenin, and rosameric acid were found in the extract of fresh leaves of *Ocimum sanctum*. Additionally, significant amounts of eugenol were found in the extract. At a concentration of 0.7%, the volatile oil found in the leaves of *Ocimum sanctum* is composed of about 71% eugenol and 20% methyl eugenol. Additional components of the oil include carvacrol and caryophyllene, which is a sesquiterpine hydrocarbon. The flavonoids orientin and andvicenin have been extracted from the leaf extract of *Ocimum sanctum* that was obtained using aqueous extraction (Devi 2001 & Gupta et al., 2002; Reshma et

al., 2005; Ahmad et al., 2024). These flavonoids are responsible for the significant role that they play in the regression of the tumor. One of the most important findings of the research was that there was a 47% reduction in the percentage of tumors that had been present. (Dhakal et al., 2023; Dhir et al., 2023; Sethi et al., 2023; Akhouri et al. 2020[a,b]; Kumar et al., 2024; Prakash et al., 2023) have all conducted research that are comparable to one another and have provided extensive documentation of their findings. Moreover, the tumor suppression by the administration of leaf extract of *Ocimum sanctum* on head and neck cell lines has been well established (Utispan et al., 2020). It has established as chemotherapeutic agent in oral cancer (Luke et al., 2021) and in breast cancer (Manaharan et al., 2016). It induces apoptosis in the lung tumour cells in A549 lung cancer cells in *in vitro* study (Magesh et al., 2009). The studies also establish that *Ocimum sanctum's* leaf extract has antioxidant properties along with anticancerous properties (Ashokkumar et al., 2024; Shimizu et al., 2013).

Conclusion

In view of these results, it is an intriguing possibility that the ethanolic leaf extract *of Ocimum sanctum* exhibits antitumorigenic properties, particularly with respect to its ability to neutralize free radicals. Furthermore, the plant extract contributes to the preservation of the kidneys and liver in their various functions. It can be thus concluded that the ethanolic extract of *Ocimum sanctum* leaf at the dose of 100 mg/kg body weight has the potential role and can be used as a chemotherapeutic agent for the treatment of breast cancer. Furthermore, more study is required in order to ascertain the molecular mechanism and mode of action of the leaf extract of *Ocimum sanctum*.

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Declaration of conflicting interests

The authors declare that they have no conflict of interest.

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