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Evaluation of the antifungal effects of *Mentha piperita L.* and *Ocimum basilicum L.* extracts on the antifungal, lung and colon cancer cells

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ABSTRACT

The therapeutic properties of *Mentha piperita* and *Ocimum basilicum* are the subject of a current experimental investigation. The isolated population was stimulated and cultivated on SDA medium, and the fungal organisms utilized in the study were acquired from the College of Science, University of Karbala laboratory. Mint then *Ocimum basilicum* were extracted from those plants, which were taken from the botanical garden, thoroughly cleaned, and dried in the open before being processed into a fine powder using a grinder. Following treatment with peppermint and *Ocimum basilicum*, the viability of a lung cancer cell line was assessed using the MTT assay on a Soxhlet device. Using a 25%concentration, the results demonstrated the effect of the plant extracts on the development of the common skin disease *Trichophyton rubrum*. The results indicated statistically significant differences between the two extracts at this concentration, showing a marked increase in inhibition of 47.84% for peppermint and 49.63% for *Ocimum basilicum*, with a p-value of 0.0061. At the 25% concentration, both *Ocimum basilicum* and *Mentha piperita* extracts showed an effect on A549 cancer cells, with peppermint inhibiting 43% and basil inhibiting 37%. The consequences of preparations of *Ocimum basilicum* and peppermint *Mentha piperita* on colon cancer cells are shown. The *Mentha piperita* extract had a 38% percent inhibitory impact when given at a 25% percent dosage, whereas the *Ocimum basilicum* extract demonstrated a 44% percent inhibiting impact.

Keywords: Colon cancer, Lung cancer, *Mentha piperita*, *Ocimum basilicum*, *Trichophyton rubrum*

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Introduction

Trichophyton rubrum constitutes a fungus that is responsible for a number of fungus diseases of the skin, including ringworm of the body (Tinea corporis), jock allergy (Tinea cruris), nail fungus caused by (Tinea unguium), and foot infections in athletes (Tinea pedis). One of the greatest common causes of skin infections caused by fungi globally is the fungus known as *Trichophyton rubrum* [1]. The cutaneous fungal infections have been globally and are predicted to impact 20-25% of the global population [2,3]. Fungal infections are classified into three genera: *Tricophyton*, *Microsporum*, and *Epidermophyton* [4]. Dermatophytosis is a skin infection caused by a dermatophytic fungus in keratinized tissues [5]. As a fatal disease that claims hundreds of thousands of lives every year, malignancy is a major health concern. Scientists have focused on this ailment and tried to discover a cure, focusing on complementary therapies including the use of medicinal plants because of the negative consequences that pharmaceutical medicines had on people's health [6]. Lung carcinoma is the leading cause of cancer-related death for both men and women, and it constitutes one for the most common and fatal types of disease in around the globe. Cancer of the pulmonary system can develop when aberrant cells in the lung begin to grow out of regulation, obstructing respiration and potentially spreading across different body areas [7]. Lung cancer can be divided into two primary categories by doctors: Non-small cell carcinoma of the lung, abbreviated non-small cell lung cancer, is among the most common kind, accounting for around 85% of occurrences. This is capable of being separated into subcategories like carcinoma of the squamous cells and carcinoma. Smoking is frequently caused by developing small-cell carcinoma of the lungs (SCLC), which develops faster than usual. Among the factors and causes of cancer of the lung include cigarette smoking, which is the primary cause, as well as smoking shisha, tobacco products and smokes [8]. In addition to being used as food and medicinal products, herbs also have antimicrobial, cancer-preventing, and immune-boosting properties. Basil (Ocimum basilicum) represents one among these plants, and it has long been regarded as a herb of healing in numerous societies to cure a range of illnesses, including cancer [9]. According to new studies, compounds from basil could have anticancer effects, especially when it comes to respiratory and tumors in the colon. According to recent research, compounds from basil may have curative properties, especially when it comes to lung and colon cancer. Because it

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triggers apoptosis, or programmed cell death, in human lung cancer cells (A549) via mitochondria- Basil extraction exhibits cancer-fighting qualities through interdependent mechanisms [10]. Cancer cells are destroyed by a mechanism of metabolism that stimulates the generation of reactive oxygen species (ROS). Inflammation of molecules like caspase-3 and caspase-9 is a process that promote apoptotic. The inhibition of Bcl-2 and other antioxidant molecules. Inhibiting Bcl-2 and other antioxidant molecules. The expression of enzymes like both MMP-2 and MMP-9 is decreased when the process known as angiogenesis, the development of new blood vessels, is inhibited [11]. The fragrant herb spearmint (Mentha piperita) is utilized in popular as well as traditional medicine to cure a variety of illnesses, including malignancy. According to recent research, peppermint compounds could possess therapeutic properties, especially when it comes to lung and gastrointestinal cancers. According to recent research, mint preparations might have curative properties, particularly when it comes to lung and cancer of the colon [12]. Peppermint essential oil has anticancer effects versus lung cancer caused by non-small cell (A549) cells, according to a 2022 study on the topic published in the Indian Journal of Experimental Biology. Following one day of chemotherapy, the medication significantly reduced the ability to survive of malignancy cells, attaining an IC_{50} value of 2.12%. Additionally, structural changes within the cells themselves were noted, suggesting that apoptosis (programmed cell death) had been induced [13]. These cells' changes in shape suggested that apoptosis, also known as programmed cell death had been induced. Spearmint essential oil and its impact on cancer of the gastrointestinal tract. According to a 2020 MDPI investigation, the oil in question possesses anticancer properties against human colon cancer cells (HCT 116). In HCT 116 tumor cells, the vegetable oil exhibited minimal anti-cancer properties, moderate antioxidant activity, and antimicrobial properties. In noncancerous cells (HaCaT), however, the cytotoxic effect was negligible [14].

The aim of the current study is to determine the effect of two plant extracts, *Mentha* and *basil*, in inhibiting the growth of dermatophytes *Trichophyton* rubrum and determine the effect of these extracts on A549 pulmonary carcinoma cell line’s and tumors in the colon.

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Methods

After the mint and basil plants were collected from the biological garden, they were cleaned, washed with water, air-dried, and ground into powder using a laboratory grinder, [15, 16] as shown in Figure 1, which illustrates the basil and mentha plants.

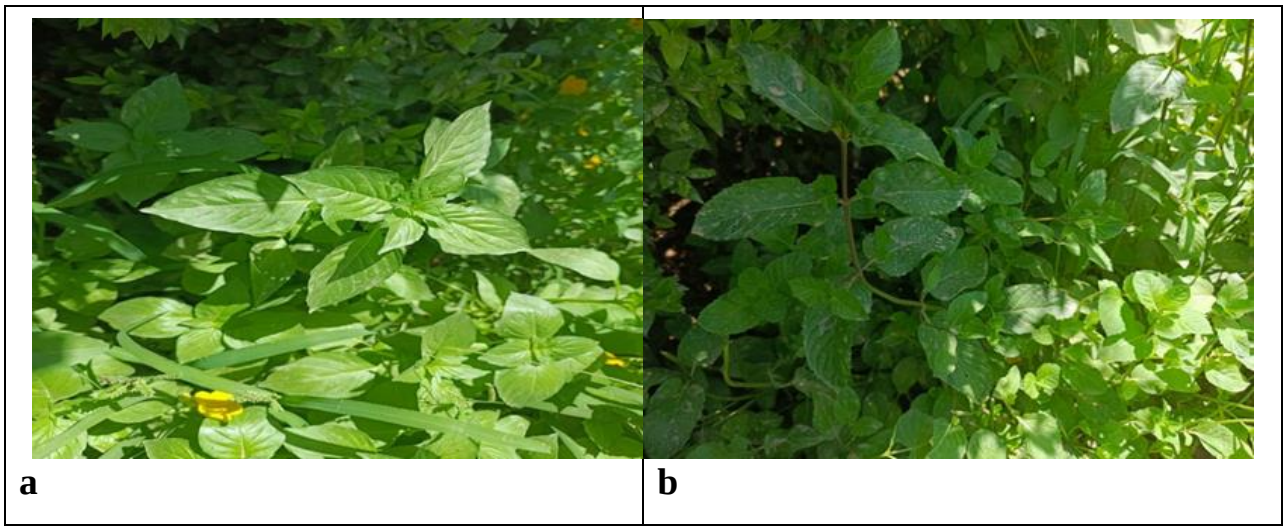

Figure 1: Real images of a)Basil plant, and b)the Mentha plant.

A Soxhlet device was utilized to extract the mentha and basil, and the 100 grams of vegetative material were put in a thimble and extracted with seventy percent alcohol over one day at 64 degrees Celsius. The alcohol was then separated away from the natural extract using an evaporator that rotates [17, 18]. The isolated organism had been activated and cultivated on SDA medium, and the fungal organisms used during the investigation were acquired from the College of Science, University of Karbala laboratory. Following treatment with Mentha and Basil, the continued existence of cancerous lung cell lines was assessed utilizing the MTT test methodology [19]. Items in the Kit Potential dissolution of cancerous lung cell types after chemotherapy with Mentha and basil using the MMT test technique, one milliliter of an MTT solution in ten glassware flasks [20]. The cell lines were prepared and destroyed, in (1×10 mL^{-1}) compliance with a paragraph on deleting and establishing lineages of cells. Consequently, a bar of sterile material was then set over the tissue hangers in a plate with 96 rectangular pits, and the whole thing was meticulously overwritten to a final dimensions of 200 microliters. Hugged at 37°C with 5% CO_2 for a full day before removing the center section. The right proportions of

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menthe and basil (50, 100, 200, and 250%) were placed onto the dish to make it look more appealing. The typical electrons combination was used on three separate occasions for each concentration. For twenty-four hours, the plate was incubated at 37 $^{\circ}_{C}$. -Each pit should contain 10 microliters of MTT solution at a concentration of 0.45 mg/mL [20].

Statistical analysis-GraphPad Prism version 9 (GraphPad Software Inc., La Jolla,CA).

Results

The results shown in Table 1 illustrate the effect of 50% concentrations of both peppermint and basil extracts on the prevalence of the dermatophyte Trichophyton rubrum. At concentrations of 38.76% and 38.56%, respectively, the peppermint and basil preparations exhibited similar inhibitory effects on fungal growth; a p-value greater than 0.9657 indicates no statistically significant difference between them. With percentages of 40.53% for mint and 41.74% for basil and one hundred percent dosage exhibited a comparable inhibiting effect; P values larger than 0.8776 indicated no scientifically meaningful differences. Investigators found that the inhibitory impact increased significantly at a concentration level of twenty times, with percentages of 44.85% for mint and Through proportions of 47.84% for mint and 49.63% for basil, the results showed a substantial boost in the amount of inhibition at a dosage for twenty-five percent. At this dosage level, both basil and mint extracts showed differences significantly from one another with a significance level (P) of 0.0061. 45.73% for basil, with P values better than 0.7655.

Table 1: Evaluation of the antifungal effects of *Mentha piperita* and *Ocimum basilicum* extracts on the fungus *Trichophyton rubrum*

CON. %	Mentha	Basil	significancy	P- Value
50%	38.76	38.56	NS	>0.9657
100%	40.53	41.74	NS	>0.8776
200%	44.85	45.73	**	0.7655
250%	47.84	49.63	**	0.0061

NS: Nonsignificant, **: P value >0.05, SD: Standard deviation

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The impact of preparations of mint (Mentha) and basil (Basil) on A549 lung malignant cells are shown in the incoming data in Table (2), together with a statistical assessment of the significance threshold at various concentrations. The mentha extract had an inhibitory impact of 13% at fifty percent concentration while the basil extract exhibited an inhibiting impact of eleven percent. There is no statistically significant distinction among the two extracts if the P value is higher than 0.8758. The menthol extraction showed an eighty percent inhibition impact at 100% dose, while the basil extraction had a 24% inhibitory effect. There is no statistically noteworthy distinction among the extracts if the P value is higher than 0.8549. 200% concentration. The extract from mentha exhibited an inhibiting effect of 31%, whereas the basil extract had an inhibitory effect of 29%. The P value of 0.0043 indicates a statistically significant difference between the extracts at this concentration .At a concentration of 250%, the mentha extract had an inhibitory effect of 32%, whereas the basil extract had an inhibitory effect of 37 %. The P value of 0.0025 indicates a statistically significant difference between the extracts at this concentration. IC50 values: Mentha 1364.1 micrometers Basil: 1847.3 micrometers. These values indicate that the mentha extract is more effective at inhibiting the growth of A549 cells than the basil.

Table 2: Evaluation of the cytotoxic effects of *Mentha piperita* and *Ocimum basilicum* extracts on a lung cancer cell line (A 459)

Concentration of treatments	Percentage rate Vital after treatment. Basil% ±SD	Percentage rate Vital after treatment. mentha % ±SD	Significance	P- Value
50%	**11±1.74**	**13±1.38**	**N.S**	**>0.8758**
100%	**24±2.84**	**18±0.63**	**N.S**	**>0.8549**
200%	**31±1.74**	**24±1.67**	**S**	**0.0043**
250%	**37±2.48**	**32±1.48**	**S**	**0.0025**
	IC50: 1847.3	**IC50: 1364.1**		

(N.S.) Nonsignificant, S: P value >0.05, SD: standard deviation

Having a difference that is statistically significant (P value) at multiple concentrations, the findings in Table 3 show the effects of extracts of spearmint (Mentha) and basil (Basil) on cells that develop colon cancer. fourteen per cent of the pathogenic bacteria were inhibited by the fifty

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percent (NS) Nonsignificant, S: P value >0.05, SD: standard deviation mentha supplement, while 16% of the bacteria were inhibited by the basil extract. There is no statistically significant difference between the extracts if the test statistic is higher than 0.8758. The suppressive impact of the basil extract was twenty-six percent, whereas that of a hundred percent menthol extract dosage was twenty-two percent. A P value greater than 0.8549 indicates no statistically significant difference between the extracts. At a concentration of 200%, the mentha extract had an inhibitory effect of 29%, whereas the basil extract had an inhibitory effect of 33 %. A P value greater than 0.0043 indicates that there was no statistically significant difference between the extracts. At a concentration of 250%, the mentha extract had an inhibitory effect of 38%, whereas the basil extract had an inhibitory effect of 44%. A P value of 0.0025 indicates a statistically significant difference between the extracts at this concentration. IC50 values: Basil: 1583.1 micro molar. Mentha1754.3 micrometer these values indicate that basil extract is more effective in inhibiting the growth of colon cancer cells than mentha.

Table 3: Evaluation of the cytotoxic effects of *Mentha piperita* and *Ocimum basilicum* extracts on colon cancer.

Concentration of treatments	Basil	Mentha	significance	P- Value
50%	16±1.65	14±2.65	N.S.	>0.8758
100%	26±1.48	22±1.57	N.S.	>0.8549
200%	33±0.53	29±2.84	N.S.	>0.0043
250%	44±1.49	38±0.47	S	0.0025
	IC50: 1583. 1	IC50: 1754.3		

Discussion

According to recent studies, mentha preparations cause apoptosis via controlling caspase proteins, which lowers the survival of cancer cells and raises the level of reactive oxygen species (ROS) levels in cells [21]. Additionally, a different investigation showed that extract from the

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plant Mentha piperita is harmful to colonic tumor cells HCT-116. Significant substances like peppermint as well as menthone are in charge of the above impact, according to the outcomes of gasoline evaluation using chromatographic [22]. The chemical composition of peppermint essential oil (Mentha piperita L.) contains 27 compounds. The main compounds are: menthone (28.970%), menthol (22.396%), eucalyptol (12.556%), menthol acetate (8.436%), mint-3 (7.044%), limonene (3.816%), caryophyllene (3.760%), piperine (2.686%), beta-pinene (2.204%), alpha-pinene (1.974%), and menthofuran (1.681%). After detection using GC-Mass, It has biological effects (antimicrobial, antioxidant, anti-inflammatory and cytotoxic to various cancer cells) [23]. Linalool, a chemical found in the flowers of Ocimum basilicum oil, has been shown in a research using basil preparations to have an anticancer impact by inhibiting the growth of A549 cells with lung cancer through improving G0/G1 cell cycle arrest and decreasing cell division [24]. Additionally, a different study discovered that the liquid extract taken from the basil plant Clinopodium nepeta is toxic to HCT-116 colon tumor cells as well as A549 cancer of the lungs cells An examination using gasoline chromatography as well as the technique of mass spectrometry showed that important chemicals including carvacrol, as well as limonene are responsible for this impact. Research have shown that both mentha and basil preparations possess anticancer characteristics; nevertheless, the potency of each of these extracts may vary dependent on the kind of cancer and concentration. For instance, studies show that compounds with basil had a greater effect upon cancer cells in the lungs, while compounds with spearmint might be far more successful at suppressing colon cancer cells [25]. The oils that originate from mint varieties, such as Mentha piperita and Mentha spicata, are plants that have been shown to exhibit antifungal properties against Trichophyton rubrum. In order to show revealed Mentha spicata oil was more successful against *T. rubrum* than the extract of Mentha pulegium, gases chromatography research revealed the fact that the oil's main component, carvone, contributed to its antifungal activity at a percentage of 62.9% [26].

Conclusions

The present study shows that the preparations from mentha and basil have encouraging potential as an anticancer agents in the treatment of lung cancer. However, the many clinical studies are still required to confirm its safety and efficacy.

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Reference:

[1] Nazzaro, F., Fratianni, F., De Martino, L., Coppola, R., & De Feo, V. (2013). Effect of essential oils on pathogenic bacteria. *Pharmaceuticals*, *6*(12), 1451–1474. https://doi.org/10.3390/ph6121451PMC+1BioMed Central+1

[2] Deng, R., Wang, X., & Li, R. (2023). Dermatophyte infection: from fungal pathogenicity to host immune responses. Frontiers in Immunology, 14, 1285887, https://doi.org/10.3389/fimmu.2023.1285887.

[3] Havlickova, B., Czaika, V. A., & Friedrich, M. (2008). Epidemiological trends in skin mycoses worldwide. Mycoses, 51, 2-15. https://doi.org/10.1111/j.1439-0507.2008.01606.x.

[4] Shalaby, M. F. M., El-Din, A. N., & El-Hamd, M. A. (2016). Isolation, identification, and in vitro antifungal susceptibility testing of dermatophytes from clinical samples at Sohag University Hospital in Egypt. Electronic physician, 8(6), 2557. doi:10.19082/2557.

[5] Grumbt, M., Monod, M., Yamada, T., Hertweck, C., Kunert, J., & Staib, P. (2013). Keratin degradation by dermatophytes relies on cysteine dioxygenase and a sulfite efflux pump. Journal of Investigative Dermatology, 133(6), 1550-1555. https://doi.org/10.1038/jid.2013.41.

[6] Alkharsan N, Al-Laith ZN, Al Masoodi SZ, Al-Ibrahemi N (2025). Study role of gold and silver nanoparticles on antibacterial activity and lung cancer cell line (A 549) Adv. Life Sci. 12(1): 71-75.

[7] Memarzia, L., & Khosravi, A. D. (2023). Therapeutic effects of medicinal plants and their constituents on lung cancer: In vitro, in vivo, and clinical evidence. *Journal of Cellular and Molecular Medicine*. https://doi.org/10.1111/jcmm.17936Wiley Online Library.

[8] Alkhateeb, M. A., Al-Otaibi, W. R., Al-Gabbani, Q., Alsakran, A. A., Alnafjan, A. A., Alotaibi, A. M., & Al-Qahtani, W. S. (2021). Fractionated leaf extracts of Ocimum gratissimum inhibit the proliferation and induce apoptosis of A549 lung adenocarcinoma cells. *Journal of Medicinal Plants, 19*(1), 1-13. https://doi.org/10.1186/s11356-021-14534-0PMC

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Health and Medical Science

Al-Zahraa Journal for Health and Medical Sciences 2025; **3**:23-33 **Vol. 3, No.4, 2025**
www.zjhms.alzahraa.edu.iq

[9] Al-Yasssiry, A.S., Aljenaby, H.K.A., Al-Masoody, I.H., and Al-Ibrahemi, N. (2024). Biofertilizers Effect on the Active Compounds of Sweet Basil Ocimum basilicum L. *SABRAO J. Breed. Genet.*, 56(1), 0-0.

[10] Alkhateeb, M. A., Al-Otaibi, W. R., Al-Gabbani, Q., Alsakran, A. A., Alnafjan, A. A., Alotaibi, A. M., & Al-Qahtani, W. S. (2021). Low-temperature extracts of purple blossoms of basil (Ocimum basilicum L.) intervened mitochondrial translocation contributes prompted apoptosis in human breast cancer cells. *Biological Research, 54*(1), 2. https://doi.org/10.1186/s40659-020-00324-0PMC

[11] Tariq, S., Wani, S., Rasool, W., Shafi, K., Bhat, M. A., Prabhakar, A., Shalla, A. H., & Rather, M. A. (2019). A comprehensive review of the antibacterial, antifungal and antiviral potential of essential oils and their chemical constituents against drug-resistant microbial pathogens. *Microbial Pathogenesis, 134*, 103580.

[12] Al-Ibrahemi, N., Al-Laith, Z.N., Al-Yassiry, A., and Al-Masaoodi, N.H. (2022). Phytochemical Study of Volatile Oil for the Ocimum basilicum L. and Mentha spicata by Gas Chromatography Technique. *IOP Conf. Ser.: Earth Environ. Sci.*, 1755-1315, 2031.

[13] Nazzaro, F., Fratianni, F., De Martino, L., Coppola, R., & De Feo, V. (2013). Effect of essential oils on pathogenic bacteria. *Pharmaceuticals, 6*(12), 1451–1474. https://doi.org/10.3390/ph6121451PMC+1BioMed Central+1

[14] Vit, P., Huq, F., Barth, O., Campo, M., Pérez-Pérez, E., TomásBarberán, F., & Santos, E. (2015). Use of Propolis in Cancer Research. British Journal of Medicine and Medical Research, 8(2), 88–109.

[15] AL-Ibrahemi .N; Hasan.R.M. (2019). Identification of Artemisinin compound in Artemisia herba alba belong to the Asteracea by HPLC and GC/MS. Al-Kufa University Journal for Biology. 11(2). 2073-8854.

[16] AL-Ibrahemi .N; Hasan.R.M; Alslman.K. (2020).Effect of Zinc Oxid nanoparticles on the oxidant stress (Malonaldehde MDA, lipid peroxidation level LPO) and antioxidant GSH glutation) Medico-Legal Update. 20(1), 882-888.

[17] Al-Ghazali, L.H., Al-Masoody, I.H., Ismael, M.H., and Al-Ibrahemi, N. (2023). Effect of Alcohol Extract, Volatile Oil, and Alkaloid Isolated from Capsicum frutescens L. Fruits on Candida albicans. IOP Conf. Ser.: Earth Environ. Sci., 1225(1), 012075.

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Health and Medical Science

Al-Zahraa Journal for Health and Medical Sciences 2025; **3**:23-33 **Vol. 3, No.4, 2025**
www.zjhms.alzahraa.edu.iq

[18] Salman, T.A., Ahmed, A.T., Oleiwi, G., and Al-Ibrahemi, N. (2023). Study of the Effect of Oil Extract of Dill (Anethum graveolens L.) Plant on Oxidative Stress Parameters of Liver Enzymes in Male Rats. *IOP Conf. Ser.: Earth Environ. Sci.*, 1215(1), 012059.

[19] Ahmed SA, Al-Shanon AF, Al-Saffar AZ, Tawang A, Al Obaidi JR. Antiproliferative and cell cycle arrest potentials of 3-O-acetyl-11-keto-β-boswellic acid against MCF-7 cells in vitro. Journal of Genetic Engineering and Biotechnology, (2023); 21(1): 75.

[20] Fridlender, M., Kapulnik, Y., & Koltai, H. (2015). Plant derived substances with anticancer activity: From folklore to practice. Frontiers in Plant Science, 6(OCTOBER), 1–9.

[21] Fatima, S., Irfan, M., Shahzad, M. N., & Raza, A. (2023). Menthol induces apoptosis and autophagy in NB4 and Molt-4 leukemia cell lines. PeerJ, 11, e15049. https://doi.org/10.7717/peerj.15049

[22] Abdollahi, M., Ebrahimzadeh, M. A., Nabavi, S. F., & Nabavi, S. M. (2020). Effect of peppermint on chemotherapy-induced nausea, vomiting, and anorexia in breast cancer patients: A randomized controlled trial. Journal of Herbal Medicine, 24, 100389.

[23] Dolghi A., Coricovac D., Dinu S., Pinzaru I., Adriana C.,Dehelean , Grosu C., Chioran D., Eugen P. Merghes , Andrei C. S. (2022).Chemical and Antimicrobial Characterization of Mentha piperita L. and Rosmarinus officinalis L. Essential Oils and In Vitro Potential Cytotoxic Effect in Human Colorectal Carcinoma Cells, 19;27(18):6106. doi: 10.3390/molecules27186106

[24] Kehkashan, A. Q., Ahsana, D., Siddiqui, B. S., Nurul, K., Huma, A., Shakil, A., Shaista, E., Shazia, H., & Sabira, B**.** (2010). Anticancer activity of *Ocimum basilicum* and the effect of ursolic acid on the cytoskeleton of MCF-7 human breast cancer cells. Letters in Drug Design & Discovery, *7*(10), 726–732.

[25] Hanachi, P., Fakhrnezhad, F. R., Zarringhalami, R., & Orhan, I. E. (2021). Cytotoxicity of *Ocimum basilicum* and Impatiens *walleriana* extracts on AGS and SKOV-3 cancer cell lines by flow cytometry analysis. International Journal of Cancer Management, *14*(3), e102610. https://doi.org/10.5812/ijcm.102610

[26] Naji, L., Ghazanfari, Z., Rahmani, H., & Hemati, S. (2024). Inhalation aromatherapy with peppermint essential oil to reduce chemotherapy-induced nausea and vomiting in children with leukemia: A clinical trial. Complementary Therapies in Medicine, 75, 102978. https://pubmed.ncbi.nlm.nih.gov/38518690

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