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Research Article

Therapeutic effects of Ammi Majus: A review study

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Abstract

Background: The Medicinal use of plants in many countries of the world, including former Iran, has a long history. In most developed countries, traditional medicine has been supported by the government in various dimensions And it has assumed a large share of providing people's health in the country's health system.

Methods: This review study was conducted with the keywords "Ammi majus, bishop's weed, lady's lace, vaye, white flower, anti-inflammatory, antibacterial, anti-inflammatory, antioxidant and cytotoxic, vitiligo, psoriasis" with the aim of investigating the therapeutic effects of Ammi majus. And based on the results of the studies reviewed in this article, Ammi majus can be used therapeutically with its antibacterial, anti-inflammatory and anti-tumor effects, as well as its effectiveness in the treatment of vitiligo. To extract articles, databases PubMed, Google Scholar, and Science Direct were searched.

Results: Today, in the world, there is a greater desire to use medicinal plants due to their antimicrobial, antioxidant properties and having fewer side effects than chemical compounds.

Conclusion: Ammi Majus has been used since ancient times in the medical system of different countries such as Egypt, Oman, and Iraq as a herbal medicine to treat psoriasis, tinea, and vitiligo, and to regulate menstruation and as a diuretic.

Keywords: *Ammi majus seed*, Antioxidant, Analgesics, coumarins, Anti-Inflammatories

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Introduction

The Ammi majus plant (Wayeh) or white flower is a herbaceous plant of the Apiaceae family with a height of 80-100 cm, which can be increased up to 2 meters if light and nutrition are provided and in competition with other plants. Its common name is Bishop's Weed. It has a similar appearance to carrots, but unlike carrots, its fruit is covered with curved and hook-like threads. The extent of its distribution in Egypt is especially in the Nile River Delta. In fact, this plant is native to Egypt. Also, it grows in the Mediterranean area - West Africa and in some areas of Iran, North America, Argentina, Chile, Mexico and in some areas of Europe and Asia (1-3).

May magus plant is distributed in most regions of Iran with warm and moderate climate. Its distribution in Iran is found in the center, northeast, south and southeast and in provinces such as (Kerman, Khuzestan, Bushehr, Hormozgan, Khorasan, Tehran). This plant contains compounds such as amoidin, (xanthotoxin, methoxalen), amidine (imperatorine, bergabten, furanocoumarin), gum, mucilage, and amblyferon (4). Herbal therapy is one of the oldest treatments identified by humans and the use of medicinal plants has been considered for a long time (5). In Egypt, this plant is used to treat skin disorders, especially lek and pis disease, psoriasis and leukoderma (6, 7). In addition, this plant has many other medicinal properties such as anti-muscle spasms, heart booster, anti-angina, anti-palpitations. Heart, menstrual regulator, diuretic, anti-inflammatory, treatment of kidney stones, anti-infection, especially digestive system infections. This plant contains biologically active compounds such as furanocoumarins and flavinose (8-10). Many experiments have been conducted on the effect of this plant on vitiligo. In one of these experiments, the crystals that make up Amy Magis were administered orally and cutaneously to patients with vitiligo, and on a part of the skin of the affected people that was exposed to sunlight. Unlike the control group, melanogenesis was seen (2).

Methods

In this review, the articles registered in English and Farsi without language restrictions in the reliable scientific databases of PubMed, Google Scholar, and Science Direct using the keywords "Ammi majus", bishop's weed, lady's lace, Vaye, Gol Sefid, Anti-inflammatory, antibacterial, anti-inflammatory, antioxidant and cytotoxic, vitiligo, psoriasis" was investigated with the aim of investigating the therapeutic effects of Ammi majus.

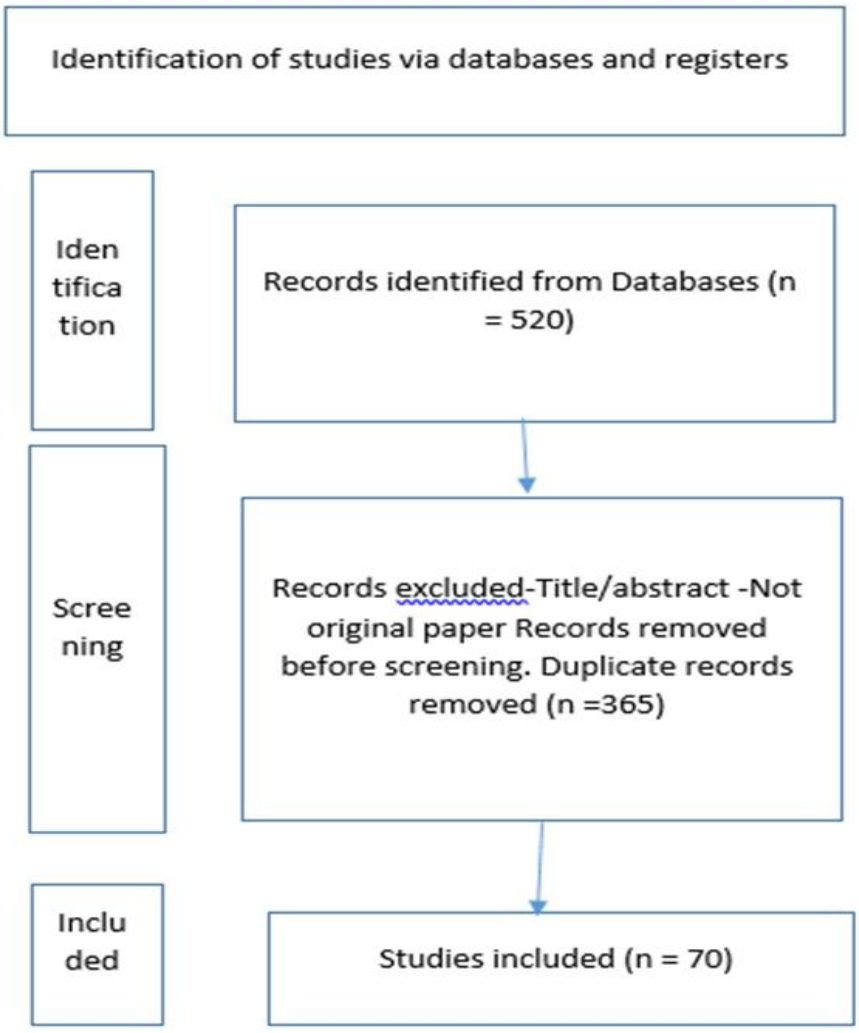


Figure 1. Diagram of how studies were selected

Results

Chemical compounds

By researching the aerial parts of Ami Majus plant, which was collected from West Asia (Saudi Arabia), they were able to isolate 3 new types of coumarins from this plant (11, 12) (Table 1).

Table 1 - Coumarins isolated from Ammi majus

pyranocoumarin	5-isobutylcoumarin-6-C-glucoside
Furanocoumarin	6,7,9-Trimethoxy-3-(8′-methoxy-2′-oxo-2H-chromen-3-yl)-2H-furo[3,2-g]chromen-2(3H)-one
pyrone coumarin	, 6-hydroxy-3-(2-hydroxypropyl)-7-methoxy-4 methyl coumarin

The cytotoxic effects of these coumarins were investigated on malignant lung (A549), malignant breast (MCF-7) and malignant colon (hct116) cell lines, and the results showed that pyrone coumarin had a cytotoxic effect on all cell lines. cell types were mentioned and pyranocoumarin had no cytotoxic effect only on hct116 cell line, but it had cytotoxic effects on two lines (MCF-7) and (A549) and furanocoumarin showed a very strong effect on hct116 cells (8).

In another study, the furanocoumarin content in the fruit of this plant was measured using thespectrophotometric method. Furanocoumarins are antibacterial and antifungal compounds that are used in insecticides and larvicides and to destroy insect eggs (13) and also as anticoagulants and The drug is used against Parkinson's (14, 15).

In the study on the components of the fruit of Ami Majus plant, it was found that the fruit of this plant contains amorphous glucoside 1%, tannin 0.45%, oleoresin 4.76%, acrid oil 3.2%, fixed oil 12.92%, proteins 13.83%, cellulose 22.4%. % is (12).

During the studies conducted on the Pakistani species of Ami Majus, 2 flavonoid compounds quercetin and kaempferol were found in Ami Majus fruit (16).

Table No. 2-types of fatty acids in Ammi majus plant (17)

Conc. (ppm)	Name	
0.03	C6:0; Hexanoic acid, methyl ester	**1**
0.02	C8:0; Carylic acid ,methyl ester	**2**
0.01	C10:0; Capric acid, methyl ester	**3**
0.09	C12:0; Lauric acid, methyl ester	**4**
0.18	C14:0; Myristic acid, methyl ester	**5**
0.05	C15:0; Pentadecanoic acid,methyl ester	**6**

3.98	C16:0; Palmitic acid, methyl ester	**7**
0.08	C16:0; Palmitoleic acid, methyl ester	**8**
0.11	C17:0; Margaric acid, methyl ester	**9**
0.58	C18:0; Stearic acid,methyl ester	**10**
5.60	C18:0; Oleic acid, methyl ester	**11**
0.21	C18:0; Elaidic acid, methyl ester	**12**
9.00	C18:0; Linoleic acid, methyl ester	**13**
1.42	C18:0; Linolenic acid, methyl ester	**14**
0.08	C20:0; Arachidic acid, methyl ester	**15**
0.23	C22:0; Behenic acid, methyl ester	**16**
0.09	C23:0; Tricosnoic acid, methyl ester	**17**
0.24	C24:0; Tetracosanoic acid, methyl ester	**18**

During a study, it was shown that plants that belong to the Apiaceae or Rutaceae family are a source of methoxylated psoralens, bergapten and xanthotoxin compounds as the final product of furanocoumarin biosynthesis, and the amount of accumulation of these substances in the plant depends on factors such as the plant's growth environment (18).

Eight coumarins including emperine, bergapten, oxypeucednin, pabuienol, marmesin, xanthoxin, isopempiniline and heraclinin were isolated by phytochemical study on the fruit of Amy magus plant (19). Two chemicals 6-hydroxy-7-methoxy-4-methyl coumarin and 6-hydroxy-7-methoxy coumarin have been extracted from the aerobic part of this plant (16).

Medicinal effects

Many studies have been conducted on the therapeutic effect of Ami Magus plant on leukoderma (7, 11), psoriasis, vitiligo, and tinea vesicular (5, 9, 11, 20-22). After 5 months of using the Ami Magus plant in patients with this disease, it was observed that the people under investigation started to re-pigment, although the skin of the face started to produce pigmentation faster than other parts of the body of the patients (23).

Of course, in all the people under investigation, the appropriate treatment response was not seen, and there is a possibility of creating a skin lesion due to the use of ultraviolet light in the treatment protocol of these people, which requires more studies in this field (24).

The furanocoumarins present in this plant have antibacterial, anti-fungal, anti-insect, anti-larro (12) effects. The anti-viral effect of Ami Magus plant has been evaluated against two viruses such as HSV-1 and VSV. In this study, the titrated extract extracted from this plant was evaluated for its inhibitory effect on viral cytopathogenic effects, and the result was that the furanocoumarin of this plant It has antiviral effect against VSV (vesicular stomatitis virus) but has no effect on HSV-1 virus (25).

In another study, the administration of furanocoumarin with a specific dose of 400 mg/kg along with petroleum with a dose of 15 mg/kg extracted from this plant for six days in patients with Schistosoma mansoni caused a 40-70% reduction of this cream in these patients (26, 27).

Ammi majus seed extract has the highest antibacterial activity against streptococcal species and the strongest antibiophilic activity on staphylococcal species (28).

According to the studies conducted, this plant can destroy the larvae of Culex pipiens (29). This plant contains 8-methoxypsoralen (8-Mop), which is an active furanocoumarin in Ami Magus and is used in the treatment of many diseases such as lek and pis psoriasis. .. is effective. And it is used as an anticancer drug in the treatment of Tcell lymphoma (30). The experiments they conducted on this compound concluded that mop-8 reduces the phosphorylation of Akt, a protein kinase b that is involved in glucose metabolism, cell growth, and apoptosis, and is overexpressed in lung and breast cancers and causes the production of becomes too much tumor (31, 32) and decreasing the expression of bcl2, which increases in cancer and causes a decrease in apoptosis (33) and increases the activity of caspase, thus decreasing the growth of neuroblastoma and colon cancer (34-36).

Since many years in Palestine, Ammi majus and Ammi visnaga (which are from the same family) have been used as traditional and herbal medicine in the treatment of urinary tract infection (37). As it was mentioned earlier, the seeds of Emi Magus contain a substance called xanthotoxin, which reduces the number of osteoclast cells and thus increases bone strength, especially in women who have had their ovaries removed (38).

The fruits of Ami Magus contain bioactive compounds, such as furanocarins and flavonoids with important biological activities. The endophytic fungus isolated from the fruit of the plant was investigated in terms of its microscopic and morphological characteristics and the antimicrobial activity of Ami Majus ethanol fruit extract (AME) and mushroom ethyl acetyl extract (FEA). In the photochemical investigation of FEA extract; The composition of benzaldehyde derivatives is named: (1) dihydroevoglaucin (2) tetrahydrouroglucin (3) benzaldehyde compounds (4) isotetrahydrouvoglaucin and (5) flavoglaucin. Compound (1) has high antimicrobial activity against Escherichia coli with minimum inhibitory concentration (MIC) = 1.95 µg/ml, Streptococcus mutans (MIC = 1.95 µg/ml) and Staphylococcus aureus (MIC = 3.9 µg/ml). High antibiophilic activity with minimum biofilm inhibitory concentration (MBIC) = 7.81 µg/ml against Staphylococcus aureus and Escherichia coli biofilium and MBIC = 15.63 µg/ml against Streptococcus mutas and Candida albicans and moderate activity (MBIC = 31.25 showed micrograms/ml).

Dihydroovagulosin, a perylated benzaldehyde derivative, has broad-spectrum antimicrobial activity. As a result, the MICs of FEA are much lower than those of AME against all susceptible species, and the antimicrobial activity of Ame Majus was confirmed. It may be due to the ability of its endophytic fungi to produce secondary metabolites (2).

Investigation of the aerial parts of the medicinal plant Amy Magus led to the isolation of a new coumarin, 6-hydroxy-7-methoxy-4-methylcoumarin and 6-hydroxy-7-methyoxycoumarin. The structure of coumarin compounds was determined by interpreting the spectroscopic data that this plant has anti-inflammatory and antiviral properties (9).

Two furoquinoline alkaloids were isolated from Emi Majus, namely 4-hydro 7-hydroxy 8-methoxy furoquinoline and 4-hydro 7-hydroxy 8-prenyloxyfuroquinoline. The cytotoxic activity of the isolated compounds (1 and 2) was evaluated against HepG-2, PC-3, A-549 and MCF-7 and the results of selective antiproliferative effects and cytotoxicity, with IC50 = 230.2 and 326.5 µM (µM) against HepG2 and MCF-7, respectively, for compound (1) and for compound (2) IC50 = 234.2 µM against MCF-7 7 showed (39).

Ammi majus has long been used as a herbal medicine in many countries for skin disorders, menstrual regulation and conditions where diuresis is mentioned. evaluation of antioxidant, antimicrobial and cytotoxic activities of crude seed extract; The highest antioxidant activity is in the crude extract of chloroform and the lowest amount is related to the crude extract of methanol. All crude extracts of Emi magus have moderate antimicrobial activity against one Gram-positive bacterium, Staphylococcus aureus (S. aureus) and three Gram-negative bacteria, namely Escherichia coli (E. coli), Haemophilus influenzae (H. influenzae) and Proteus spp. (Proteus spp) showed a growth inhibition zone of 0-15 mm. . However, regarding the overall cytotoxicity effect, chloroform crude extract showed the highest activity in a decreasing order by hexane, methanol, ethyl acetate, butanol and water crude extract. In this way, the highest mortality rate was observed with the crude extract of chloroform, whose lethal concentration (LC50) was 16.49 µg/ml, while the lowest lethal concentration was observed with the crude extract of water, where the LC50 was 38 was 652/mcg/ml). The present study shows that all crude extracts of Emi magus seeds have significant antioxidant, antimicrobial and cytotoxic effects (40).

Contraindications and side effects

This plant is contraindicated for patients who are sensitive to light, as well as people with cataracts and people suffering from aggressive squamous cell cancer and people sensitive to xanthotoxin. Also, the fruit of this plant is contraindicated for pregnant women and people with tuberculosis and patients with liver and kidney problems. It is contraindicated for people with HIV and other autoimmune diseases (41).

Cases of allergic rhinitis and skin inflammations after exposure to light have been reported due to the consumption of Ami Magus fruit (42). Some patients who were treated with the fruit of this plant developed phototoxic dermatitis. In a study, the cause of phototoxic dermatitis in these patients was attributed to the presence of furanocoumarin in Ami Magus, which is activated by ultraviolet light and causes skin complications such as erythema and bulla after 24 to 72 hours after consumption (32).

There are reports of the toxicity of furanocoumarins in many animals. For example, ducklings that were fed by this plant have eye spots (43) or sheep that were fed by it developed skin problems (44).

Anti-inflammatory effects

The anti-inflammatory effects of three coumarin compounds of this plant were evaluated by an experiment, and in this experiment, the anti-inflammatory effects of Ammi majus injection were investigated on rats, and finally, after three hours of injection, a significant difference was observed with the control group, and from this The test can conclude that these substances extracted from Amy Magus have acceptable anti-inflammatory properties (45).

In another study, the anti-inflammatory, anti-infection, anti-pain and anti-hyperlipidemia properties of Ammi majus blood were found. In this experiment, 50 and 100 mg of furanocoumarin extracted from Ammi majus seeds were administered per kilogram of the rats' weight, and they observed that after 2 months, the amount of triglycerides and cholesterol in the blood decreased, and the same about the anti-infective properties. From 1 hour after the administration of furanocoumarin extracted from Ammi majus seeds, they saw a decrease in the temperature of the infection site. Also, with an increase in the therapeutic dose, more effects on the temperature decrease were seen (46).

Antimicrobial effects

In ancient Egypt, Ammi majus was used for disinfection. During a research, the antimicrobial effects of this plant were evaluated. The extract of this plant inhibited the growth of Staphylococcus aureus, Haemophilus influenzae, Escherichia coli, and Proteus sp bacteria (47-49).

During a study after obtaining the methanolic extract of this plant with concentrations of 0.5, 1, 2% through disc diffusion tests, they showed that these concentrations had an antibacterial effect on Staphylococcus aureus bacteria, but different concentrations of this extract on Escherichia coli bacteria did not cause any non-growth aura (50).

Discussion and Conclusion

This study showed that Ammi Majus has antioxidant, antimicrobial, and anti-inflammatory effects and is used in the treatment of various diseases. Of course, one should also pay attention to the contraindications and side effects of consuming this plant.

Based on the data collected from a variety of laboratory studies, animal models and clinical trials that investigated the therapeutic effects of Ami Magus on skin diseases, there are promising positive effects in the treatment of psoriasis, vitiligo, leukoderma, and tinea versicolor. It was also observed that this plant, in addition to clear anti-inflammatory effects, had significant antibacterial and cytotoxic effects in studies, but due to the lack of laboratory studies, animal models, and human experiments in the field of Ami Magus plant, it is still not possible to He suggested stopping the use of this plant in traditional and modern medicine in the treatment of these diseases, and more studies and experiments are needed in the future on the therapeutic effects of this plant.

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Author's contribution:

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Consent for publication

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Conflict of interest

The authors declare that they have no competing interests.

References

1. Sonkar N, Shukla PK, Misra P. Plant Hairy Roots as Biofactory for the Production of Industrial Metabolites. Plants as Bioreactors for Industrial Molecules. 2023:273-97.

2. Fathallah N, Raafat MM, Issa MY, Abdel-Aziz MM, Bishr M, Abdelkawy MA, et al. Bio-guided fractionation of prenylated benzaldehyde derivatives as potent antimicrobial and antibiofilm from Ammi majus L. fruits-associated Aspergillus amstelodami. Molecules. 2019;24(22):4118.

3. Kaboodi PS, Moghadamnia A, Bakhshi D, Sefidgar A. A study of phytochemical properties of various extracts of Ammi majus fruit using GC-MS technique. Ecology, Environment and Conservation. 2016;23(1):150-5.

4. Gurib-Fakim A. Medicinal plants: traditions of yesterday and drugs of tomorrow. Molecular aspects of Medicine. 2006;27(1):1-93.

5. Babashpour-Asl M, Baleghi M, Sajadi P, Golalipour M. Different aspects and results of modern studies of Urtica dioica: a review. J Babol Univ Med Sci. 2014;16(S1):47-54.

6. Erkan N, Ayranci G, Ayranci E. Antioxidant activities of rosemary (Rosmarinus Officinalis L.) extract, blackseed (Nigella sativa L.) essential oil, carnosic acid, rosmarinic acid and sesamol. Food chemistry. 2008;110(1):76-82.

7. Usmani QI, Jahan N, Aleem M, Hasan SA. Aatrilal (Ammi majus L.), an important drug of Unani system of medicine: A review. Journal of Ethnopharmacology. 2021;276:114144.

8. Wu B, Shi S, Zhang H, Lu B, Nan P, Yun A. Anabolic metabolism of autotoxic substance coumarins in plants. PeerJ. 2023;11:e16508.

9. Selim YA, Ouf NH. Anti-inflammatory new coumarin from the Ammi majus L. Organic and medicinal chemistry letters. 2012;2(1):1-4.

10. Sajadi Kabodi P, Bakhshi D, Moghadamnia A, Sefidgar A. The antibacterial effects of methanol extract of Ammi majus on Staphylococcus aureus and Escherichia coli. Journal of Babol University of Medical Sciences. 2017;19(1):36-42.

11. Balkrishna A, Arya V, Sharma IP. Anti-Cancer and Anti-Inflammatory Potential of Furanocoumarins from Ammi majus L. Anti-Cancer Agents in Medicinal Chemistry (Formerly Current Medicinal Chemistry-Anti-Cancer Agents). 2022;22(6):1030-6.

12. El-Sharkawy E, Selim Y. Three new coumarin types from aerial parts of Ammi majus L. and their cytotoxic activity. Zeitschrift für Naturforschung C. 2018;73(1-2):1-7.

13. Issa MY, Elshal MF, Fathallah N, Abdelkawy MA, Bishr M, Salama O, et al. Potential anticancer activity of the furanocoumarin derivative xanthotoxin isolated from Ammi majus L. fruits: In vitro and in silico studies. Molecules. 2022;27(3):943.

14. Bhaskar R, Xavier LSE, Udayakumaran G, Kumar DS, Venkatesh R, Nagella P. Biotic elicitors: A boon for the in-vitro production of plant secondary metabolites. Plant Cell, Tissue and Organ Culture (PCTOC). 2022;149(1-2):7-24.

15. Wu M, Su X, Wu Y, Luo Y, Guo Y, Xue Y. Glycosylated Coumarins, Flavonoids, Lignans and Phenylpropanoids from Wikstroemia nutans and Their Biological Activities. Beilstein Archives. 2021;2021(1):87.

16. Sagyndykova M, Imanbayeva A, Suleimen YM, Ishmuratova MY. Chemical composition and properties of essential oil of Ferula foetida (Bunge) Regel growing on Mangyshlak peninsula. Bull Karaganda Univ. 2019;4:25-34.

17. Hussain I, Khan S, Khan M, Rehman IU, Ahmed M. Investigation of fatty acid composition of ammi majus seed oil by gas chromatography mass spectrometry. Journal of the Chinese Chemical Society. 2012;59(5):655-8.

18. Hehmann M, Lukačin R, Ekiert H, Matern U. Furanocoumarin biosynthesis in Ammi majus L. Cloning of bergaptol O-methyltransferase. European journal of biochemistry. 2004;271(5):932-40.

19. Zhang J, Li X. A theoretical study on the molecular structure and chemical reactivity of

traditional Chinese medicine extract isopimpinellin. 亚洲传统医药. 2020;15(1):32-40.

20. Castillo E, González-Rosende ME, Martínez-Solís I. The use of herbal medicine in the treatment of vitiligo: an updated review. Planta Medica. 2023;89(05):468-83.

21. Ramadhan AA, Mutlag SH. Modulated effect of Ammi majus L. on Psoriasis-Like Skin Inflammation Caused by Imiquimod in Vivo. Science. 2021;9(12):9-13.

22. Younis ZT, Mutlag SH. Possible Anti-Asthmatic Effect of Iraqi Ammi Majus Seeds Extract Against Asthma Induced by Ovalbumin in Mice. Iraqi Journal of Pharmaceutical Sciences (P-ISSN 1683-3597 E-ISSN 2521-3512). 2023;32(Suppl.):1-7.

23. Narayanaswamy R, Ismail IS. Role of herbal medicines in vitiligo treatment-current status and future perspectives. Asian J Pharm Clin Res. 2018;11:19-23.

24. Janjić V. Plant-Caused Skin Disorders: Cambridge Scholars Publishing; 2021.

25. Nolkemper S, Reichling J, Stintzing FC, Carle R, Schnitzler P. Antiviral effect of aqueous extracts from species of the Lamiaceae family against Herpes simplex virus type 1 and type 2 in vitro. Planta medica. 2006;72(15):1378-82.

26. El-Seedi HR, Khalifa SA, Mohamed AH, Yosri N, Zhao C, El-Wakeil N, et al. Plant extracts and compounds for combating schistosomiasis. Phytochemistry Reviews. 2022:1-116.

27. Abdulla W, Kadry H, Mahran S, El-Raziky E, El-Nakib S. Preliminary studies on the anti-schistosomal effect of Ammi majus L. Egyptian Journal of Bilharziasis. 1978;4(1):19-26.

28. Adham AN, Abdulah ZA. Antibacterial and antibiofilm activity of Ammi majus seed against Gram-positive bacteria. Zanco Journal of Medical Sciences (Zanco J Med Sci). 2017;21(1):1664-72.

29. Al-Khazraji A, Mustafa M. Effect of some plant extracts on the Culex pipiens molestus. 2008.

30. Yu Z, Wolf P. How it works: the immunology underlying phototherapy. Dermatologic Clinics. 2020;38(1):37-53.

31. BHATIA BK, LIM HW, HAMZAVI IH. Psoralen plus ultraviolet A photochemotherapy and other phototherapy modalities. Comprehensive Dermatologic Drug Therapy. 2019:263.

32. YAFOUT M, BENNIS S, EL-OTMANI IS, SAID AAH. A discussion of the therapeutic benefit of the medicinal plants used for the traditional treatment of vitiligo in Morocco. safety. 2021;8:9.

33. Revathidevi S, Munirajan AK, editors. Akt in cancer: Mediator and more. Seminars in cancer biology; 2019: Elsevier.

34. Nitulescu GM, Van De Venter M, Nitulescu G, Ungurianu A, Juzenas P, Peng Q, et al. The Akt pathway in oncology therapy and beyond. International journal of oncology. 2018;53(6):2319-31.

35. Zheng C, Liu T, Liu H, Wang J. Role of BCL-2 family proteins in apoptosis and its regulation by nutrients. Current Protein and Peptide Science. 2020;21(8):799-806.

36. Bartnik M, Sławińska-Brych A, Żurek A, Kandefer-Szerszeń M, Zdzisińska B. 8-methoxypsoralen reduces AKT phosphorylation, induces intrinsic and extrinsic apoptotic pathways, and suppresses cell growth of SK-N-AS neuroblastoma and SW620 metastatic colon cancer cells. Journal of ethnopharmacology. 2017;207:19-29.

37. Jaradat NA, Zaid AN, Al-Ramahi R, Alqub MA, Hussein F, Hamdan Z, et al. Ethnopharmacological survey of medicinal plants practiced by traditional healers and herbalists for treatment of some urological diseases in the West Bank/Palestine. BMC Complementary and Alternative Medicine. 2017;17:1-18.

38. Dou C, Chen Y, Ding N, Li N, Jiang H, Zhao C, et al. Xanthotoxin prevents bone loss in ovariectomized mice through the inhibition of RANKL-induced osteoclastogenesis. Osteoporosis International. 2016;27:2335-44.

39. Mohammed MM, El-Sharkawy ER. Cytotoxic new furoquinoline alkaloid isolated from Ammi majus L. growing in Egypt. Natural product research. 2017;31(6):645-52.

40. Al-Hadhrami RMS, Hossain MA. Evaluation of antioxidant, antimicrobial and cytotoxic activities of seed crude extracts of Ammi majus grown in Oman. Egyptian journal of basic and applied sciences. 2016;3(4):329-34.

41. Lacy CF. Drug information handbook: a comprehensive resource for all clinicians and helthcare professionals. (No Title). 2006.

42. Jhorar P, Andrasik WJ. Plant-Induced Urticaria. Dermatological Manual of Outdoor Hazards: Springer; 2020. p. 13-28.

43. Lang L. Eye disorders in lesser white-fronted geese (Anser erythropus) in captivity. 2023.

44. Stegelmeier BL, Davis TZ, Clayton MJ. Plant-induced photosensitivity and dermatitis in livestock. Veterinary Clinics of North America: Food Animal Practice. 2020;36(3):725-33.

45. Otman E-G, Drioua S, Ameggouz M, Salhi N, Sayah K, Zengin G, et al. Antioxidant activity, analgesic activity, and phytochemical analysis of Ammi majus (L.) extracts. International Journal of Secondary Metabolite. 2023;10(1):23-37.

46. Koriem KM, Asaad GF, Megahed HA, Zahran H, Arbid MS. Evaluation of the antihyperlipidemic, anti-inflammatory, analgesic, and antipyretic activities of ethanolic extract of Ammi majus seeds in albino rats and mice. International Journal of Toxicology. 2012;31(3):294-300.

47. Al-Hadhrami RMS, Al Muniri RMS, Hossain MA. Evaluation of antimicrobial and cytotoxic activities of polar solvent extracts from leaves of Ammi majus used by the omanis. Pacific science review A: natural science and engineering. 2016;18(1):62-5.

48. Al Akeel R, Al-Sheikh Y, Mateen A, Syed R, Janardhan K, Gupta V. Evaluation of antibacterial activity of crude protein extracts from seeds of six different medical plants against standard bacterial strains. Saudi journal of biological sciences. 2014;21(2):147-51.

49. Aldulaimi O. Screening of fruits of seven plants indicated for medicinal use in Iraq. Pharmacognosy Magazine. 2017;13(Suppl 2):S189.

50. Moghadamnia A. The Antibacterial Effects of Methanol Extract of Ammi majus on Staphylococcus aureus and Escherichia coli.