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# Multidimensional Uses and Functions of Extracted Bioactive Compounds from *Zataria multiflora* medicinal plant: A Review

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## Abstract

*The major purpose of the Author's review is mainly based on the exploration of the major extracted components present in regional*

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*and localized medicinal plants i.e. from Zataria multiflora belonging to Family Lamiaceae and to study their multi-dimensional uses and versatile functions such as its medicinal and pain reliving uses in the field of pharmacology, its pesticidal, insecticidal, miticidal, acaricidal and herbicidal uses in the field of agriculture and agroforestry, its antioxidant, antibacterial and antifungal uses in the field of Microbiology, the significance and effectiveness of Zataria multiflora extracted compounds on other living species.*

**Keywords**: Zataria multiflora, Composition, Pesticide and acaricide, Clinical use, Multidimensional functions.

## INTRODUCTION:

Plants are the main source of traditional and synthetic medicines[1] due to the presence of plenty of Bioactive volatile and nonvolatile compounds. Most of these medicinal plants belong to the Family Lamiaceae also known as Labiate family[2] or commonly known as the Mint family which has approximately 2500 to 6000 species and 200 to 236 genera[3,4]. Being medicinal family, it is observed that throughout the world 70,000 medicinal plant species have been used Ethnomedically and WHO has also reported that about 78 to 80 percent of the world population is still based on herbal medicines for the treatment of different diseases[5]. These plant-based medicines are not only much more effective having prominent efficacy in the cure of disease but also have very few side effects. Due to high efficacy and significant results, the ancient and folk people were mostly dependent on herbal medicines6. As it is observed that the synthetic medicines have mostly adverse side effects due to the presence of several threatening chemical compounds, the modern Civilization leads their concern towards herbal medicines7. Among these medicinal plants, *Zataria multiflora* belonging to Family Lamiaceae is well known for its versatile multidimensional uses and functions. Word *Zataria* is of Arabic origin Za'ataar meaning as a generic name for some medicinal plants such as Thyme, Savory etc.[8,9,10]. It is observed that thyme is among the many of the medicinal aromatic plants such as the *Thymus*

*vulgaris*[11] of Labiate family, being the relative of thyme aromatic herbs, *Zataria multiflora* is also known as the Shirazi-thyme or Avishan-e-Shirazi in Persian language[12]. It is an aromatic medicinal plant of family Lamiaceae found in the warm central and south regions of Pakistan, Iran and Afghanistan. It has different localized names such as Avishan-e-Shirazi in Persian language[12] and Balochi people called it Izghand in Balochistan. It is present mostly in shrub form on the inclined planes of a mountain where the rain water is running down. In Balochistan, it is present in nearby mountains of Hazarganji Chiltan park in District Mastung nearby Lackpass tunnel and also in Neechara in District Kalat. It is a perennial medicinal plant mostly ranging from 45-80cm in height and have Pubescent, Orbiculated grey-green leaves[8]. Its flowers are unbranched, yellowish-white in colour and are mostly male sterile[8,13].

## Composition and Screening of *Zataria multiflora* Extractions of different locations:

*Zataria multiflora* is a medicinal plant abound with several phytochemical compounds. The best tool used for the predictions of the chemical constituent present in this medicinal plants can be carried out by using GC-MS, GC-FID and GC-NIR. By using these analytical techniques, the results obtained after analysis has revealed that the chemical constituents of *Zataria multiflora* are mostly dependent on the soil texture, Temperature and Geographical locations. The growth of *Zataria multiflora* was mostly observed in those areas where the soil was rich in $Ca, Fe, K$ *and* $Al$ with a temperature of 14 to 29℃ and with average rain fall of 40 to 303mm per year. Near-Infrared spectroscopy has revealed the presence of Carvacrol, Thymol, Linalool and $\rho$ −cymene as major compounds of the plant[14]. The essential oil obtained from Bariji Essence Pharmaceutical Company of Iran and after its screening via GC-MS studies has revealed that the volatile part of *Zataria multiflora* was containing Carvacrol with 34%, $\gamma$-terpinene with 5.88%, Thymol with 35%, $\rho$ −cymene with 9.89% and $\alpha$ −pinene with 4.22% [15]. The *Zataria multiflora* areal parts on collection from Feroozabad; Fars province, Iran and on applying Hydrodistillation methodology via Clevenger apparatus and the analysis of essential oil via GC-MS, about 25

compounds were identified among which Thymol was the major component of oil with 33.65%, $\gamma$-terpinene with 3.88%, $\beta$-caryophyllene with 2.06% and $\rho-$cymene with 7.72%. $\beta-$caryophyllene and sesquiterpenes with 2.06% were predominant among the Hydrocarbons. 73% of Phenyl-propanoid derivatives were also identified. Along with the above components, monoterpenes with 19.08% was also indicated which consist of Linalool with 1.75%, 4-Terpineol with 1.14%, $\alpha-$Terpineol with 1.28%, $\gamma-$Terpinene with 3.88%, and 1,8-Cineol with 0.98%[16]. Another sample of 100g of areal part of dried *Zataria multiflora* was obtained from Barij Essence Research Farm Kashan, Iran and by using Clevenger apparatus when the essential oil was obtained. After its screening about 42 compounds were identified among which Thymol with 38.7% was the major component of oil along with Carvacrol with 15.3%, $\alpha-$Pinene with 4.6 %, $\gamma-$Terpinene with 9.8%, Trans caryophyllene with 3.1% and that of $\rho-$Cymene with 13.5%[17]. The screening of another sample of *Zataria multiflora* essential oil was carried out by using GC-MS and the compounds were found to be $\rho-$Cymene with 15%, Dodecane with 9% and Carvacrol with 37% as a major component of oil and it was also observed that major component of oil i.e. Carvacrol was responsible for the antibacterial activity of *Zataria*[18]. The screening of the upper areal part of *Zataria* multiflora collected from the region of Kohpayeh situated in the Karman district of Iran was also carried out. The chemical screening via GC-MS has shown that about 25 compounds were present in that sample out of which the major compounds of essential oil were Thymol with 41.81%, $\rho-$Cymene with 8.36% and Carvacrol with 28.85% respectively[19]. The upper areal part screening of *Zataria multiflora* collected from two different regions of Fars province, Iran i.e. Lamerd and Zarghan regions indicated that 31 of total compounds were present in the essential oils of samples out of which 77.4% Carvacrol and 90.6% Linalool were the main components of essential oils[20]. The detailed screening of essential oil extracted from the flower and Buds of *Zataria multiflora* collected from the region of Iran i.e. Kolahghaz the region in the vicinity of Isfahan was carried out via using GC-MS, FT-IR, $^{13}$C-NMR and $^{1}$H. The analysis of essential oil extracted from Bud depicted that it was containing the oxygenated Monoterpenes with 84.81% and Sesquiterpenes

hydrocarbon with 11.88%. The extracted oil of the flowering part was containing the sesquiterpenes with 6.96%, monoterpenes with 81.78%. The major compound of essential oils in both samples as was Linalool, Linalyl acetate and $\beta$ −Caryophyllene[21].

**Insecticidal and Acaricidal efficacy of *Zataria multiflora*:**

Phytotoxic effect of *Zataria multiflora* was observed against the seed germination and growth of four different weed species i.e. *H. spontaneum* Koch, *A. retroflexus L., S.sereale L.* and *C. dactylon L.* with concentration of 0, 80, 160, 320 and 640 $\mu L/L$. Very effective Phytotoxic effect was observed at concentration 320 and 640 $\mu L/L$ and the germination rate of weed seeds were reduced to great a extent[20]. *Apis mellifera* (Honeybee) although produces Honey for mankind but such Bees are facing a severe threat from *Varroa destructor*; a pest feeding on Bees, which has also adopted resistance against many synthetic acaricides thus producing immense economic lose in Bee farming industries. For Bee protection and killing of pests, the area infected by *Varroa destructor* was sprayed with *Zataria multiflora* and *Lepidium latifolium* methanolic extracts with a concentration of 100, 200, 400 and 500ppm in comparison with Aspirant chemical strips. The acaricidal efficacy of *Zataria multiflora* was observed at 86.26% while that of *Lepidium latifolium* was observed 100% [22].

**Antimicrobial activity of *Zataria multiflora*:**

Antifungal activity of *Zataria multiflora* essence was carried out against fungi specie i.e. *C. albicans*. A very significant result was obtained in the thorough removal of fungi colonies especially that of *C. albicans* in the dentures just like 100% of results obtained in Nystatin (gold) 100000 IU. They observed that when Candida cells are treated with *Zataria multiflora* essence at a different concentration ranging from 50mg/ml to 3.125mg/ml, the essence with higher concentration has removed 100% of all Candida cells while that with lower concentration has cleaned the solution 88 to 44.7% from Acryl resin contaminated plates[23]. Another microbial agent in the form of Fungi which effects the crops after post -harvesting cause huge damage to fruits and vegetables. To control the effect of pathogenic fungi *Zataria multiflora* essential oil in eight concentrations on Potato

Dextrose agar in vitro was applied on different species of fungi i.e. *Aspergillus niger, Aspergillus ochraceus, Rhizopus stolonifer, Aspergillus flavus, Alternaria solani and Rhizoctonia solani* for determination of their inhibitory growth. The results obtained has depicted immense fungicidal effect against all of the postharvest fungi species at a minimum and highest inhibition[15]. Another antifungal activity of essential oil of medicinal plants i.e. *Zataria multiflora, Eucalyptus camaldolensis* and *Geranium herbarium* were carried out against *Saprolegnia parasitica* infecting the eggs of Trout fish species i.e. *Oncorhynchus mykiss* at a concentration of 1, 5, 10, 25, 50 and 100ppm with tree interval daily till the eyed larval stage of Trout fish. Out of 150 infected eggs, most of the hatching was observed in that eggs which were treated with essential oils and the observed hatching rates were 11% with *Zataria multiflora,* 7% with *Eucalyptus camaldolensis* and 3% with *Geranium herbarium*. The most significant results were obtained at 25, 50 and 100ppm concentrations of *Zataria multiflora*[24].

**Uses of *Zataria multiflora* extractions in the Culinary field:**

Bakery products are the major component of our festivals especially cake. For a long time, these products cannot be stored or preserved due to oxidation of edible chemicals and oils used in these products as well as by the attack of pathogens on these oils and products. To preserve these food stuffs, *Zataria multiflora* and *Cinnamon zeylanicum* essential oils as food preservatives were used in the cake preparation with three different concentrations i.e. 500, 1000 and 1500ppm and were compared with control group containing synthetic food preservatives i.e. Butylated hydroxyl anisole and Butylated hydroxyl toluene and were kept under observation for 60 days. The cake with essential oils of *Zataria multiflora* and *Cinnamon zeylanicum* has depicted very effective antioxidative as well as antimicrobial results in comparison with the cake containing synthetic preservatives[25]. Another problematic phenomenon with the preservation of food-stuff nowadays is the contamination of preserved food-stuffs by certain Gram-positive and Gram-negative Bacteria including *S. Xexneri, S. typhi, S. aureus, E. coli, P. vulgaris, and B. cereus*. For halting the contamination of food-stuffs, Hydroalcoholic

extract of *Zataria multiflora* and *Rhus coriaria* was carried out at different concentrations ranging from 0.05-1.6% (w/v). The antibacterial efficacy of *Rhus coriaria* was much more than *Zataria multiflora*. The result obtained has depicted that both plants can be used as effective astringent agents against food spoiling bacteria species[26]. In terms of food packing Scientific researchers are now diverting their attention from plastic packing material to biodegradable edible film coating materials in food industries which are not only safe but also friendly to the environment and human beings. In this scenario, the antimicrobial study was carried out for preserving the food-stuffs by using starch films containing essential oils of *Zataria multiflora* and *Benium persicum* in a concentration ranging from 1mg/ml to 20mg/ml against four species of bacteria which was causing spoilage of food-stuffs i.e. *Listeria monocytogenes, staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli* by using Plate Count Assay and Disk Diffusion method. Very satisfactory antimicrobial results of *Zataria* and *Benium persicum* were obtained against these food spoiling pathogens and the essential oil of these two plants can be used as safe compounds and also as an antimicrobial agent in food packing industries[27]. The food spoilage was also observed by growing fungus in preserved food-stuffs. For this purpose, the antifungal effect of *Zataria multiflora* in vitro was carried against different colonies of fungi species i.e. *Trichophytone mentagrophytes, E. floccosum, T. rubrum, A. flavus* and *A. fumigatus*. The effect of *Zataria multiflora* as an antifungal agent was found very effective at a concentration range of >8% mg/ml against *Trichophytone mentagrophytes, E. floccosum, T. rubrum* while against *A. flavus* and *A. fumigatus* was observed at a concentration range of >10% mg/ml. the results also depicted that *Zataria multiflora* essence can be used as the best antifungal agent in food industries as a food preservative[28].

**Clinical and Medicinal uses of *Zataria multiflora* extractions:**

Infection causing microbial agents are one of the main concerns by gaining resistance against many drugs. *S. aureus* is one of the pathogens causing immense threat to patients in hospitals and communities and gaining resistance against many disease treating

drugs especially Vancomycin. The current study was carried out in the clinical field to observe the synergic antistaphylococcal activity of *Zataria multiflora* essential oil in combination with Vancomycin. The results so obtained has depicted that the *Zataria multiflora* essential oil has enhanced the antistaphylococcal activity of Vancomycin to a significant level against clinically isolated *S. aureus*[17]. The reoccurrence of Hydatid cyst is another problem after surgery. For prevention of this problem, groups of Mice have been injected with protoscoleces intraperitoneally and were divided in-to three groups i.e. preventive and therapeutic and one group was the control group. The preventive group was further divided in to three replicates in which one replicate was treated with 4g/liters in drinking water of *Zataria multiflora* extract for 8 months, the second replica with Albendazole (150mg/kg) and the third replicated was untreated group (control group). After 8 months the infected mice were divided further into three replicates again called the therapeutic group in which one replica was allowed to treat with 8g/liters of *Zataria* for 30 days and a second replica with Albendazole (300mg/kg) along with the third untreated control group. After treatment the hydatid cyst was removed, weight and size were compared with the untreated group cyst. A significant decrease was observed in hydatid cysts of preventive and therapeutic groups as compared with control group cysts. Thus *Zataria multiflora* extract can be used to prevent the reoccurrence of hydatid cyst[29]. Another problem observed in hospitals is during the chemotherapy process. As in chemotherapy, Cyclophosphamide is used as Alkylating agent in suppressing the immune system but it also has some adverse effects on Liver cells by infecting the antioxidative enzymes and produce oxidative stress in liver cells. For the protection of liver cells, Mice was pretreated with *Zataria multiflora* extract at a concentration of 50 to 400mg/kg for seven days along with the control group. These mice were then exposed to a single intraperitoneal injection with a dose of 400mg/kg and after the passage of 24 hours, the samples of blood and liver were collected. An elevation was observed in the hepatic marker serum levels of control group animals while the Mice treated with *Zataria multiflora* dose were observed protected from hepatic cell damage due to very effective inhibition of the antioxidative enzymatic defensive

system which has protected the hepatic cells from damage when Cyclophosphamide dose was given to mice[30].

## CONCLUSION:

In this study, some of the multidimensional functions and uses of extracted compounds of *Zataria multiflora* are reviewed from different aspects such as in terms of composition and screening of samples of *Zataria multiflora* collected from different regions by using certain analytical techniques. The insecticidal and acaricidal efficacy of extracted compounds, its use as an antimicrobial agent against several pathogens, as food preservative compounds in certain cooking items and its clinical and medicinal use and functions are also reviewed.

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