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Determining the Amount of Lead Heavy Metal in *Lavandula Angustifolia* Medicinal Plant

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ABSTRACT

The use of herbs plays an important role in improving the health of human community. Considering that, due to people's awareness of the harmful efficacy of chemical and synthetic drugs, the use of medicinal plants has increased, and considering that herbs are considered one of the most important ways of transferring heavy metals to the human food chain, therefore, one of the goals. This research is to determine the amount of lead heavy metals in lavender herbal extracts using blind atomic absorption spectrometry method. According to the obtained results, the average concentration of lead in lavender was 20.83 ppb. Which shows the results obtained with the permissible limits set by the WHO are higher than the permissible limit. According to the results, the consumption of these spirits has dangerous health consequences for consumers. Due to the wide consumption of herbal extracts and the possibility of bioaccumulation of heavy metals in the long term, continuous monitoring of heavy metals in herbal products in approved food laboratories is recommended.

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Intorduction

Medicinal plant is a plant whose one or some organs such as stem, leaf, flower, and root have medicinal properties (Noor et al., 2022). Herbal plants have always been used by humans and have been very beneficial for humans (Inoue et al. 2019). Since the beginning of history, medicinal plants were considered an integral part of human life (Inoue et al. 2019). Herbs have a special worthiness and importance in providing the health and health of societies from medicine and prevention aspets of diseases, and the general tendency of societies to use herbal medicines and treatments and natural products in general is increasing (Inoue et al. 2019). What is worth pondering about the consumption of medicinal plants and herbal products and herbal medicines is that in most cases, adverse effects and toxic substances have been observed in the case of consumption of a type of plant (Salmerón-Manzano et al., 2020). Lavender or lavender flowers, which is another name, belongs to the mint family. It is a perennial plant in the form of a small bush half a meter long. Lavender flowers have small clusters of blue or garlic-red to purple flowers (Ghavami et al., 2022).

Lavender is a plant with a sweet scent. This plant is used for hair health, blood pressure reduction, stress reduction, good sleep, flatulence, prostate, dizziness, kidney stones, epilepsy, indigestion, stomachache, colic, flatulence, vomiting, diarrhea and diabetes (Khan et al., 2023). It has many uses in traditional medicine. Considering the bad effects of chemical drugs on people and the side effects caused by long-term use in the case of rapid treatment, long-term use of chemical drugs often brings non-organ effects with them (Başaran et al., 2022).

Today, significant amounts of all kinds of pollutants, especially heavy metals, are continuously released into the environment from various sources (Novikau and Lujaniene, 2022). Some of the pollutants are transferred to agricultural soils. Considering the importance of agricultural soil in providing food and also the non-degradability and high toxicity of heavy metals on human health, the identification and allocation of the sources of this pollution have been investigated at the world level (Machate et al., 2023). Use of chemical fertilizers in agricultural fields, use of water contaminated with heavy metals and chemical pollutants, smoke from industrial factories (Fu and Xi, 2020). Heavy metals enter the soil environment naturally from the processes of soil formation during the aeration of parent materials, or through human activities (Mitra et al., 2022). Activities related to industries as well as agricultural activities have widely polluted agricultural lands. Toxic metals have adverse effects on the nervous system, liver, kidney, skin, bones and teeth. Heavy metals cause diseases by interfering with some metabolic and enzymatic processes in the body. Dealing with high amounts of pollution is not the only way of poisoning, but contact with low levels for a long time is one of the ways of poisoning (Mitra et al., 2022). The occurrence of cancer, cardiovascular disorders and liver and kidney disorders are some of the toxic effects of heavy metals on health (Alengebawy et al., 2021). The aim of this research is to investigate the amount of lead in lavender medicinal plant.

Materials and Methods

10 samples of lavender plants were collected from different regions of Ilam. The botanical characteristics of the lavender plant are known in Table 1.

Table 1. Botanical characteristics of lavender medicinal plant

Persian name	Scientific name	Plant family	English name
Ostokhodous	*Lavandula angustifolia*	Lamiaceae	Lavender

Plant Sample Conditions

The samples were transferred to the laboratory and analyzed with a GC-MS machine in selected ion mode (SIM mode) and carrier gas speed of 1 ml/min. One microliter of the extracted samples was injected split less at the temperature of the injection chamber at 250 degrees Celsius.

Preparation of Samples

For analysis, gas chromatography-mass spectrometry was performed according to standard number 17026. Digestion and measurement of the elements in the plant were done using an inductively coupled plasma device.

Method of Digestion

The digestion of plant samples was done by the procedure of Agrawal et al. (2011) and Manutsewee et al. (2007) (Manutsewee et al. 2007). After the digestion stage, the samples were cooled to the desired volume with distilled water and the amounts of metal elements were measured by ICP-OES and ICP-MS. After measuring the concentration of elements in the digested samples (mg/L), considering the initial circuit of the plant sample and the volume of the acidic mixture used, the concentration of elements in the herb sample was calculated in terms of mg/Kg (Agrawal et al., 2011).

Results

The present study is a descriptive study of measuring the concentration of lead metal in the lavender medicinal plant. Based on the data, the average concentration of lead in lavender plant was 20.83 (ppb).

Discussion

Today, people are poisoned all over the world through the consumption of medicinal plants or herbal medicines contaminated with heavy metals. Heavy metals are one of the carcinogens that are harmful to human health. Heavy metals can be found in herbal medicines. Various studies on the pollution of medicinal plants with heavy metals have been reported (Zheljazkov et al. 2006; Zheljazkov et al. 2008; Chaiyarat et al., 2011; Prasad et al., 2011). The results of a study in Isfahan (Iran) showed that the concentration of heavy metals in the medicinal plants of this city was lower than the standard limit (Azarm et al., 2012). The results of a study in Pakistan showed that the average concentration of lead in the medicinal plants of this country is 0.99 mg/kg (Rehman et al., 2013). The World Health Organization has declared the permissible limit for the use of lead in medicinal plants to be 10,000 µg/kg (Annan et al., 2010). The results of the study by Lawi et al. (2022) showed that the amount of lead in plant samples from Texas drugstores was 26.68 mg/kg (Lawi et al., 2023). The results of the study of Faruk Karahan (2022) showed that the average concentration of lead in the medicinal plants of the eastern Mediterranean region of Turkey was between 1.311 and 16.238 (Karahan, 2023).

Research have reported that the concentration of heavy metals in herbs depends on their growth environment, herb species, drying conditions, transportation and processing (Asghari, 2008). Toxic heavy metals in the environment include lead, cadmium, and mercury, and their main sources are vehicles, industrial and thermal power plants, waste incinerators, and agricultural products.

It is possible that heavy metals exist in medicinal plant materials resulting from human activities such as agriculture, industrial waste and natural resources (Liu et al., 2023; Chaplygin et al., 2022). The transfer of heavy metals and trace elements from the environment to plants is largely influenced by soil pH. At different pH levels, some heavy metals can accumulate less, while others can reach extreme levels that cause toxicity (Eskin et al., 2019). Probably, the lavender plant has a greater tendency to absorb heavy metals from the soil.

Conclusions

The widespread use of different forms of herbal medicines requires a closer monitoring and monitoring of the production and supply of herbal products regarding chemical compounds, heavy metals, and chemical pollutants, because toxic metals enter the plant in various ways and must accumulate. Monitoring should be continuous to avoid the dangers of using these natural products containing harmful metals.

Conflict of interest

There is no conflict of interest among the authors.

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Consent for publications

The authors approved the manuscript for publication.

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This study was carried out with personal funds from the authors.

Authors' contributions

UU conceived the research idea and TM, HA designed the work. MP carried out the experiment, HA and MP wrote the first draft of the manuscript, MP carried out the literature search, PM carried out the statistical analysis, and MP supervised the study. All authors read and approved the final manuscript for publication.

Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the author.

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