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Heavy metal content in an ayurvedic formulation *Triphala* prepared by different manufacturers

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ABSTRACT

Triphala is an age old commonly used Ayurvedic powdered preparation in Indian systems of medicine. This well known formulation is made by combining *Phyllanthus emblica* Linn. (amalaki), *Terminalia bellirica* (Gaertn.) Roxb. (bibhitaki) and *Terminalia chebula* (haritaki), in equal proportions as mentioned in Ayurvedic Formulary of India (AFI). The formulation is prescribed in the first line treatment of many ailments and is used as laxative, detoxifying agent and rejuvenator. *Triphala* is used for curing diseases of eyes, mouth, ulcer (inflammation), promotes health and immunity, detoxifies the whole body and acts as cardio-tonic. It is also used in treatment of jaundice and pthisis due to vata dosa and slesma dosa. *Triphala* is manufactured by several manufacturers in India. The preparation is a poly herbal formulation containing three medicinal plants amalaki, bibhitaki and haritaki. *Triphala* itself is used as an ingredient in other formulations like Pancaguna Taila, *Triphala* guggul etc. Different manufacturers collect fruits from different habitats. High concentration of heavy metals in formulation may be due to collection of fruits from different habitats like farmlands where there is excess use of fertilizers or from the plants growing near the highways where the plants are exposed to automobile pollutants. Five heavy metals Cu, Zn, Pb, Ni, and Hg which are contributed through various sources from the atmosphere and automobiles were analysed in *Triphala* of different manufacturers and from *Triphala* in-house (prepared in laboratory) by Optical Emission Spectroscopy which uses the technique of Inductively coupled plasma. ICP-OES is one of the analysis techniques of trace elements. Out of the *Triphala* samples analysed of different manufacturers, total heavy metal concentration was found to be maximum in Manufacturer No.3 (M3) and minimum in *Triphala* in-house.

KEYWORDS

Triphala;
ICP-OES;
Heavy metals.

INTRODUCTION

Triphala is an age old commonly used Ayurvedic powdered preparation in Indian systems of medicine. This well-known formulation is made by combining *Phyllanthus emblica* Linn. (amalaki), *Terminalia bellirica* (Gaertn.) Roxb. (bibhitaki) and *Terminalia chebula* (haritaki), in equal proportions[7]. It is com-

monly prescribed by most health care practitioners in India. According to the traditional Indian medicinal system (Ayurveda), *Triphala* strengthens the different tissues of the body, prevents ageing, promotes health and immunity. It corrects constipation, cleanses and tonifies the gastrointestinal tract and also detoxifies the whole body, improves digestion and assimilation. *Triphala* and its constituents act as cardio-tonic, control blood pressure, improve blood circulation and reduce cholesterol levels[6].

Because of such wide use of this formulation it is necessary to analyze atleast common heavy metals from the formulation.

Heavy metals are a matter of concern in herbal drugs; especially as certain plants have the tendency of accumulating heavy metals from soils, polluted water and atmosphere[7]. In all there are 38 heavy metals[5]. They all play a variety of roles in biological systems, ranging from regulations of biological process, to being important structural component in proteins[3].

The main sources of metal contaminants in soils are from metalliferous mining and smelting activities, other industrial emissions, and effluent, urban development, vehicle emissions, dumped waste materials, contaminated dusts and rainfall; fertilizers and pesticides[8]. A trace element is considered as essential for both man and animals. At the same time, when it crosses the limits it becomes toxic and degenerates the system.

In the current investigation *Triphala* of different Manufacturer and *Triphala* in-house were analyzed for five heavy metals. *Triphala* in-house is considered as a reference standard. Five common heavy metals Pb, Zn, Cu, Ni and Hg were analysed by Optical Emission Spectroscopy which uses the technique of Inductively Coupled Plasma. ICP-OES is one of the analysis techniques of trace elements.

MATERIALS AND METHODS

Fruits of *Phyllanthus emblica* Linn., *Terminalia bellirica* (Gaertn.) Roxb. and *Terminalia chebula* Retz was collected from Karjat and fruits were authenticated from Agharkar Research Institute (Pune). The voucher specimen numbers for *Phyllanthus emblica* Linn., *Terminalia bellirica* (Gaertn.) Roxb. and *Terminalia chebula* Retz. are Auth 08-65, Auth 08-67and Auth 08-66 respectively.

Fruits of *Phyllanthus emblica* Linn., *Terminalia bellirica* (Gaertn.) Roxb. and *Terminalia chebula* Retz were separately washed, dried, deseeded. The seeded fruits were powdered using electrical mixer grinder and sieved through 85- mesh (BSS) sieve. The fine powder was stored in an airtight Pearl Pet containers.

Powders of three fruits were mixed in the ratio of 1:1:1 (w/w/w) and stored in commercially available airtight Pearl Pet containers labelled with details such as date of preparation and weight of powder, at 28 ± 2^0C. This powdered mixture of plant material was used as standard *Triphala* (in-house *Triphala*) and *Triphala* of various manufacturers were analysed for its heavy metal content by Optical Emission Spectroscopy. ICP-OES is a reproducible and very accurate analysis technique, suitable for all types of watery and solid samples (the latter if they are first brought into solution) standard.

The ICP-OES detection limits vary from 1-100 ppb, these values are similar to the frame-AAS detection limits. ICP-OES usually shows linear calibration curves for over 5 decades, thus making it possible to determine both high and (very) low concentration.

RESULT

The range of concentrations of five heavy metals namely Zn, Cu, Ni, Hg and Pb in normal plants have been presented in TABLE 1[9], The results of these heavy metal analysis using ICP- OES technique have been presented in TABLE 2;

Copper (Cu) - The concentration of Cu was minimum (<1ppm) in *Triphala* prepared by Manufacturer no.1 (M1), while maximum (14.42ppm) in *Triphala* prepared by Manufacturer no.3 (M3).

Zinc (Zn) - The concentration of Zn was lowest (11.22ppm) in *Triphala* in-house and highest (43.48ppm) in M3.

Nickel (Ni) - In the case of Ni the concentration was minimum (4.83ppm) in Maharastra and maximum in M3 (15.97ppm).

Lead (Pb) - The concentration of Pb was minimum (6.15ppm) in *Triphala* prepared by Manufacturer no.2 (M2), while maximum (11.28ppm) in M1.

The concentration of mercury was minimum in all

Triphala sample (<1ppm).

CONCLUSION

Amongst the five metals analysed, Zn was found to be in maximum concentration but it was within the safe limits and Hg in the least concentration in *Triphala* of different manufactures.

There was significant variation in the total metal concentration between *Triphala* in-house *Triphala* and *Triphala* prepared by different manufacturers.

The total heavy metal content was found to be maximum in M3 as compared to *Triphala* prepared by other manufacturers. In the five samples analyzed lead was found to be in excess in M1 sample. The effects of lead are the same whether it enters the body through breathing or swallowing. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults to lead at work has resulted in decreased performance in some tests that measure functions of the nervous system. Lead exposure may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people. Lead exposure may also cause anemia. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production[4]. The concentration of Ni was found to be high in M3 sample as compared to other *Triphala* samples. The larger part of all nickel compounds that are released to the environment will adsorb to sediment or soil particles and become immobile as a result. For animals nickel is an essential foodstuff in small amounts. In small quantities nickel is essential, but when the uptake is too high it can be a danger to human health. This can cause various kinds of cancer on different sites within the bodies of animals, mainly of those that live near refineries. The increasing concentration of Ni detected in *Triphala* can be attributed to the high concentration of Ni present in the soil coming from various environmental factors, especially through fungicides from cultivated lands nearby. Humans may be exposed to nickel by breathing air, drinking water, eating food or smoking cigarettes. In the current evaluation total heavy metal content was found to be maximum in *Triphala* manufactured by M3 and minimum in *Triphala* in-house. The high metal content may be due to the quality of raw materials, soil where plant is grown, manufacturing process, stability etc. Therefore analysis of different parts of the tree and soils needs to be done to check the source of the heavy metals. These results require further investigation, especially to correlate with the environmental levels of the heavy metals.

Note: The source of readings-Normal range Alloway (1968) and Bowen (1979) Concentration in contaminated plants-Kabata-Pendias and Pendias

TABLE 1: Typical concentration of some metals in plants

Metal	Normal range in plant material μgg^{-1} fresh weight	Concentration in contaminated plant μgg^{-1}
Copper	4-15	20-100
Zinc	3-100	100-400
Lead	0.1-10	30-300
Nickle	0.02-5	10-100
Mercury	0.015	-

Note: The source of readings-Normal range Alloway (1968) and Bowen (1979) Concentration in contaminated plants-Kabata-Pendias and Pendias (1984) (Alloway, 1990; Ross, 1994)

TABLE 2: Metal concentrations (ppm) in *Triphala* of different manufacturers

Metal	Standard *Triphala* in-house	Manufacturer Nno.1 (M1)	Manufacturer no.2 (M2)	Manufacturer no.3 (M3)
Copper	7.03	<1	11.91	14.42
Zinc	11.22	23.45	18.74	43.48
Lead	8.84	11.28	6.15	9.27
Nickel	4.83	5.33	5.68	15.97
Mercury	<1.0	<1.0	<1	<1.0
Total metal	31.92	40.06	42.48	83.14

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