Trace elements are important constituents required for normal physiological functioning. Iron, Zinc, Manganese, Copper; Fluoride, Molybdenum, Chromium and selenium and Iodine are some of the trace elements required for body in very minute quantity and generally its need is fulfilled from intake of balanced diet. However the increased tendency in recent times towards unbalanced food intake, excessive purification of crops, and dietary practiced widely to reduce body weight, deficiencies of a trace elements are relatively frequent. To encounter this deficiency generally supplementation of multi mineral drugs are given. Rasau Shadhis (Herbomineral preparations) could be the answer to this especially metallic Bhasma (Incinerated minerals) as it contains various trace elements along with basic elements. Hence present paper aimed to review analytical studies conducted on Dhatu bhasma (metallic incinerated powders prepared by Ayurvedic methods) to find out important trace elements in them. For this purpose analytical studies on Saptadhatu bhasmas (Seven metallic Bhasmas) namely Swarna (Gold), Rajat (Silver), Tambra (Copper), Louha (Iron), Vanga (Tin), Naga (Lead) and Yashada (Zinc) bhasma was reviewed. It is observed that these Bhasma preparation contain significant number important trace elements such as Iron, Manganese, Copper, Calcium etc. Also due to immune modulator and rejuvenating properties of these Bhasma preparations, Bhasma can be a possible source of trace elements. However there is need of further research on both experimental and clinical ground to find out role of administration of trace elements in the form of Bhasma in treating deficiency disorders of trace elements.

Keywords: Trace elements, Rasau Shadhis, Saptadhatu bhasma.

Introduction

Trace elements are the micronutrients required by the body in very minute quantity. These elements have preventive and curative role in human body for various diseases. Iron, Zinc, Manganese, copper; Fluoride, Molybdenum Chromium and selenium Iodine are some of the trace elements required for proper growth and development. Although need of these trace elements is fulfilled by diet. Now a day the stress has been given for its supplement as its deficiency lead to various disorders. Because of the tendency in recent times towards unbalanced food intake, excessive purification of crops, and dietary practiced widely to reduce body weight, deficiencies of a trace element are encountered relatively frequently.[1]

Even though biological effect of metals are well known, very little is known about their biological activity in terms of elemental properties. Metals and their actions play a critical role of acting as Catalysts or a structural components of large molecule with specific function and thereby indispensable for life. Biological active elements are required for maintenance of biological fluids, structure and function of cell membranes, synthesis of protein, conduction of nerve impulses and construction of muscles. Trace elements are selected for specific tasks in biological systems such as several enzymatic activities. [2]

Rasau Shadhis (Herbomineral Preparations) especially metallic Bhasma (Incinerated metal) are known to improve immunity and stability in the body. [3] As these Bhasma acts as Rasayana (Rejuvenation) and Yogvahi (Targeted drug delivery). Use of these Bhasma for therapeutic purpose is not merely to cure the respective ailment but also can complete the need of trace elements required for various enzymatic activities in the body. Pharmaceutical processing of Bhasma preparation by classical Ayurvedic methods, herbal drugs are use for Bhasna (trituration), Shodhan (purification) and Maran (Incineration) purpose. They act as chelating agents and form multiple bonds with single metallic ions. [4] As plants are good source of trace elements, processing with these plants material may be the origin of trace elements in metallic Bhasma.

It is important to understand the structure and composition of various constituents present in the Bhasma which suppresses its toxic effects and inserting therapeutic effects to the metal. It has been hypothesized that repeated incineration of metal with suitable raw material change the inherent quality of the metal, which render them non-toxic and suitable for the treatment of chronic ailments.[5] Analytical study of various metallic preparation shows remarkable numbers of trace elements which ultimately proves that Dhatu Bhasma (Incinerated metals) are good source of trace elements. Now various technologies are available which are helpful in finding total elemental content of Bhasma sample. The most widely techniques to analyze trace and heavy metals are atomic absorption spectrometry (AAS), inductively coupled plasma mass...
spectrometry (ICP-MS), inductively coupled plasma atomic emission spectrometry (ICP-AES), and X-ray fluorescence spectroscopy (XFS). With the help of these technologies various analytical studies are carried out which gives complete profile of trace element present in various metallic Bhasma. Present paper has taken brief review of these papers to point out trace elements in various Bhasma preparations.

**TRACE ELEMENTS IN BHASMA**

**Swarna bhasma**

Swarna bhasma (Incinerated gold) is Madhur (Sweet), Hrudya (Heart tonic), improves intellectual power, Rasayana (rejuvenator), alleviates increased Doshas and Anti Toxic effect. [7] Brown et al (2007) in their study evaluated the physico-chemical characterization of Swarna Bhasma by using atomic absorption spectrometer, FT infrared spectroscopy, transmission electron microscopy, Atomic force microscopy and x-ray diffraction analysis. Atomic absorption spectroscopy revealed that Swarna Bhasma contain 92 % gold. Pharmacological review of Swarna Bhasma reveals that it possesses immune modulator, free radical scavenging activity, analgesic activity and anti stress activity.[8] In elemental analysis of Swarna Bhasma by EDAX it is observed that As and Nb in trace amount.[9] However presence of other trace element is not observed.

**Rajat bhasma**

Rajat Bhasma (incinerated silver) is Kashaya (Pungent) Ruchikarak (Improve taste) and Uttam medhavardhak (Good brain tonic). It is Vayasthapano (Anti aging).[10] In elemental analysis of Rajat Bhasma various trace elements found were iron, copper, lead, cadmium apart from silver (73.59%/w/w) and sulphur (17.24%/w/w) with the help of Atomic Emission Spectroscopy with Inductively Coupled Plasma (AESICP).[11]

**Tambra Bhasma**

Tambra Bhasma (Incinerated Copper) is Deepan (Appetizer), Udakrminashak (Anti-helminthic) and Kushtaroganashak (Relieves skin diseases). It is Ayuvardhak (Decrease Ageing process).[12] Sudheendra Honwad et.al (2014) noted in elemental analysis by ICP-AES of Somnathi Tambra Bhasma shows elements such as Cu, Fe, Al, S, As and Hg in trace forms.[13]

**Louha bhasma**

Louha Bhasma (Incinerated iron) is Deepan (Appetizer), Kshayaroganashak (Anti-tuberculosis), Udakrminashak and Uttam panduroganashak (Anaemia).[14] In the body, Iron has major role in carrying oxygen in the body hence must required elements by all living being. Louha Bhasma in the form of iron oxide completes the need of iron. Louha bhasma contains iron as major element along with potassium (K), Copper (cu), Zinc (Zn), Manganese (Mn) and Magnesium (Mg) as a trace element estimated by ASS and EDAX study.[15] Sekar et al. reported the presence in elemental analysis of Louha Bhasma indicates the major elements to be iron (>60%) and oxygen (>30%). Other elements like Ca, K, Na, Cl from the herbal ingredients are present at >0.1% may be involved in pharmacological activities of the Bhasma.[16]

**Vanga bhasma**

Vanga Bhasma (Incinerated Tin) acts on Bahumutrata (Excessive Urination), Shukrameha (Excessive semen discharge), Swetpradara (white discharge in females) etc. It also acts as nerve tonic for urogenital system.[17] Saraswathy A et al noted in study on chemical analysis of Vanga Bhasma that along with presence of tin oxide, trace elements such as calcium, arsenic, iron, silicone, phosphorus, aluminum and chloride.[18]

**Naga Bhasma**

Naga Bhasma (Incinerated Naga) Deepan, Antragativardhak (Increases peristaltic movements) and Framehanashak (Diabetes).[19] Manoj Dash et al identified elements such as calcium, tin, molybdenum and potassium in pharmaceutical and Identification study of Naga Bhasma. [20] Lagad C.E et al noted percentage of the elements like Ca, Fe, Mg, K, Mn, n etc was increased with the process of Marana.[21]

**Yashad bhasma**

Yashad Bhasma (Incinerated Zinc) act on Neteraroga (Eye disorders), Panduroga (Anaemia), Rajyakshma (Tuberculosis) and Ratriswed (Excessive Sweating at Night).[22] Santhosh et al. noted in Analytical study of Yashad Bhasma ICPAES (Inductively coupled plasma atomic emission spectroscopy) showed the presence of Zinc in major portion (95.08ppm) and other elements like Sn (0.27), Pb (0.14), Fe (1.69), Ca (1.82), Mg (1.00), Cu, Co and Mn < 0.5 ppm in the final product.[23]

| Table 1: Trace elements in Sapta Dhatu Bhasmas |
|-----------------|-----------------|
| S.No. | Bhasmas | Trace elements |
| 1 | Suwarna Bhasma | As, Nb |
| 2 | Rajat Bhasma | Fe, Cu, Pb,Cd,S |
| 3 | Tambra Bhasma | Cu, Fe, Al, S, As,Hg |
| 4 | Louha Bhasma | K, Cu, Zn, Mn, Mg, Ca,Na,Cl |
| 5 | Vanga Bhasma | Ca, As, Fe, Si, P, Al, Cl |
| 6 | Naga Bhasma | Ca, Sn, Mo, K, Mn, Fe,Mg |
| 7 | Yashad Bhasma | Sn, Pb, Fe, Ca, Mg,Cu,Co,Mn |

**Discussion**

With the principles of Ras shashtra, Lohasidhibhi (conversion of low quality metals into precious metals) and Dehasiddhi (To achieve healthy body and long life by using Rasoushadi) metallic Bhasmas has own importance due to its curative and preventive role. In Rasashastra, pharmacology of Bhasma is followed properly which gives ultimate therapeutic benefit of these Bhasma and the authenticity of these Bhasma was judged by its therapeutic value only. Now with the development of newer technology such as atomic absorption spectrometry (AAS), inductively coupled plasma mass spectrometry (ICP-MS), inductively coupled plasma atomic emission spectrometry (ICP-AES), and X-ray fluorescence spectroscopy (XFS), it is possible to estimate purity of metallic Bhasma along with its elemental analysis and particle size. From the above review it is observed that most of the Bhasma contain very essential trace elements such as Ca, Cu, Fe, Mg which are very important in physiology (table1). Metals and trace Elements are essential components of metabolism however due to complicated metabolism process of trace
elements it is quite difficult to access exact deficiency of single trace element. Modern medicine is using these trace elements in supplementation in respective deficiency of that elements. Unfortunately, in recent years the avalanche of uncontrolled supplementation with TE (Trace elements) has put some TE on the border of toxicity in several populations. Thus, it is a crucial priority to define the requirements for TE, based on essentiality and health promotion, and the limits for toxicity. Due to complex metabolism process and interdependent metabolism it is quite difficult to decide toxic level of these elements.

Although concept of trace element deficiency is not mentioned in Ayurveda but it is interesting to study the role of these Bhasma preparation in trace elements deficiency disorder by animal study or clinical trials.

Since Ayurvedic Bhasma preparations are ultimate Rasayana drugs, as metallic Bhasma rejuvenate body, increases intellectual capacity, anti aging capacity, improves appetite, restores reproductive functions, use of these Bhasma as Rasayana can not only fulfill the need of essential elements such as Iron, copper, Zinc etc but also can be able to complete need of trace elements such as manganese, phosphorus, Aluminum etc required by the body in trace amount. Presence of trace elements in Bhasma preparations may improve its assimilation by taking parts in various enzymatic processes at micro level.

CONCLUSION

Bhasma preparation contains significant number of trace elements in bio accessible form, but exact physiological and clinical basis is yet to prove. If it is studied in deficiency disorders by various clinical trials for its therapeutics value for trace elements. Then it could be a good option for deficiency disorders of trace elements.

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