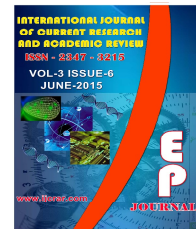




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### Trace elements analysis of edible freshwater molluscs in Manipur

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#### KEYWORDS

Edible freshwater molluscs, trace elements, Manipur, GF-AAS.

#### A B S T R A C T

Freshwater molluscs are consumed in every part of the world. In Manipur, some of the freshwater molluscs are consumed in delicious manner as curry by cooking. These molluscs are one of the important bioresources of the wetlands of Manipur and also have economic potential. In the present study, six different species of edible molluscs are analysed for the presence of seven various trace elements. Trace elements have a definite role in metabolism, growth and development. They also have their nutritive role as well as antioxidant activity. The elements analysed in the samples are Fe, Zn, Cu, Mo, Cr, V and Mn. These elements are found to present in considerable concentrations. Out of these elements Cu and Cr are present in high concentration i.e. Cu 1.4 ppb to 2.07 ppb and Cr 7.2 to 15.07 ppb. The concentration of iron and manganese is highest in *Lamellidens marginalis*  $2.79 \pm 0.01$  ppb and  $2.39 \pm 0.03$  ppb respectively. The analysis of the elements was done with the help of Graphite Furnace- Atomic Absorption Spectrometer (GF-AAS), Model: Analytik Jena Vario-6.

### Introduction

Manipur is one of the states in North-Eastern India, with Imphal as its capital city. Total area covered by the state is 22,347 km<sup>2</sup> (8,628 sq.km) and have its own unique flora and fauna. The state belongs to Indo-Burma hot spots region of the world and falls in the core zone of Indo Myanmar. Further, it falls in the bio-geographic tri- junction of

three distinctive bio-geographic regions - extensions of Himalaya region, Oriental region of India and the Malayan Archipelago, indicating an active centre for transformation of gene pools leading to speciation and evolution of new and novel gene pools.

The state is blessed with several wetlands including rivers. Loktak Lake, a Ramsar site 1990 is the biggest freshwater lake in Northeast India, a lake of International importance under Ramsar Convention. It covers an area of 287 sq km and is situated 48 km in the South of Imphal. It is the lifeline of Manipur with a variety of edible molluscs, one of the important bio resources of the wetlands of Manipur.

In Manipur, varieties of snails i.e. molluscs are available from the pre-historic periods. Many of the gastropods and bivalves are served as food by many people of Manipur, in some case attaining the level of delicacy. Edible molluscs are regularly sold in different markets of Manipur and are used as the staple food by the local people.

Bithyniidae, Pilidae, Viviparidae, Thiaridae, Amblemididae and Pisidiidae are the families that the mollusc belongs to *Bellamya crassispinalis* has been consumed mainly as food by the people of Manipur. Molluscs also serve as food for many people in many areas, in some cases attaining the level of delicacy.

### **Materials and Methods**

Different samples of freshwater molluscs were collected from various local markets. All the samples collected were preserved and transferred to laboratory for further study. In the laboratory the shells were brushed properly and washed thoroughly with double distilled water so as to remove the mud and algae.

They were then soaked in distilled water for observation and identification by following the procedure described by Zoological Survey of India (ZSI), Calcutta and Subha Rao, 1989 handbook "Freshwater Molluscs of India". Trace elements analysis was done by the following method.

### **Drying and grinding of soft tissues and shells**

The soft tissues were removed from the shell removing the operculum. Then they were softly washed with deionised water, air dried, spread on aluminium foil. Later dried in the oven, the tissues and shell separated at 60°C. The dried tissues were ground well into fine powder using mortar and pestle. The powdered mollusc material was then stored in air-tight bottles and stored at room temperature after labelling properly.

### **Sample preparation**

For the acid digestion of mollusc sample, 1g sample was digested for 3hr at 85°C with conc. HNO<sub>3</sub> : HCl (3:1) mixture. Then concHClO<sub>4</sub> (1ml) was added. The solution was filtered and diluted to 50ml with distilled water. The blank solution was taken as the same procedure.

Following the above method, all samples for concentration of trace elements Fe, Zn, Cu, Mo, Cr, V and Mn (in ppb) were determined by Graphite Furnace Atomic Absorption Spectrometer (GF-AAS) Model: Analytik Jena Vario-6.

### **Result and Discussion**

The concentration of trace elements in the soft tissue of various six edible freshwater mollusc and shell of one mollusc are shown in table no.01

Trace elements are essential in the maturation, activation and functions of host defence mechanism. Cu, Fe, Zn and Mn are integral part of enzymatic anti oxidants (Arinola *et al.*, 2008). Trace elements are known to play important roles in the catalytic activities of major antioxidant enzymes (Arinola *et al.*, 2008). The concentration of iron and manganese is

highest in with *Lamellidens marginalis* 2.79±0.01 and 2.39±0.03 ppb respectively. *Cipangopaludina lecythis* have the highest concentration of chromium and vanadium with 15.07±0.27 and 2.637±0.11 ppb respectively. While the concentration of molybdenum is somewhat similar between *Pila theobaldi* and *Bellamya crassispinalis* i.e. 0.017±0.008 and 0.017±0.009 ppb respectively. The species *Bellamya crassispinalis* contains the highest zinc concentration 0.4731±0.045 ppb. *Pila theobaldi* contains 2.200±0.08ppb of copper concentration as maximum value with comparison to other species. The shell of species *Bellamya crassispinalis* was found to have iron concentration of 3.48±0.50ppb.

These trace elements have a definite role in metabolism, growth and development. They also have their nutritive role as well as antioxidant activity.

Iron is essential for human body in the production of haemoglobin, in the production of haemoglobin, in the oxygenation of red blood cells. It is needed for a healthy immune system and for the production of energy. Iron functions as an important component of the proteins that helps to carry oxygen throughout an organism. It is also essential for cell replacement and immune system response according to the Massachusetts Institute of Technology website. Iron is carefully stored and regulated in the body. Additional iron added to the diet will restore an animal to good health. It has the longest and best described history among all the micronutrients. It is a key element in the metabolism of almost all living organisms. Iron deficiency is the most common nutrient deficiency in the U.S. and the world.

Manganese is a mineral element that is both nutritionally essential and potentially toxic.

It plays an important role in a number of physiologic as a constituent of multiple enzymes and an activator of other enzymes. It is a part of enzymes involved in urea formation, pyruvate metabolism and the galactotransferase of connective tissue biosynthesis (Chandra, 1990). It helps to neutralize free radicals as well as being of assistance in preventing diabetes and needed for normal nerve function.

Chromium is an essential element for animals and humans (Frieden, 1984). Chromium is essential, functioning as a glucose tolerance factor. It is also used for insulin signalling for biological role, and thus sugar metabolism and diabetes (Chen, 1993). It could play a role in maintaining the configuration of the RNA molecule, having shown to be particularly effective as a cross-linking agent for collagen (Eastmond et al 2008). Chromium deficiencies may exist particularly in children suffering from protein calorie malnutrition (Mertz, 1974).

Vanadium is a ubiquitous metal. Its compound has been demonstrated to have effects on glucose metabolism in vitro (Frieden, 1984) and also in lipid metabolism (Hopkins and Mohr, 1974). Vanadium has been shown to be nutritionally essential for both the chick and the rat (Hopkins and Mohr, 1971, 1974). It also has been shown to inhibit markedly the growth of humans' tumour colony formation (Mukherjee et al., 2004).

Molybdenum is an essential trace element for virtually all life forms. It functions as a co-factor for a number of enzymes that catalyze important chemical transformation in the global carbon, nitrogen and sulphur cycles. Plants in nitrogen fixation use molybdenum as nitrogenase and nitrate reductase enzymes.

**Table.1** Concentration of Trace Element in six species of soft tissue in edible molluscs including one shell sample by Graphite Furnace-Atomic Absorption Spectrometer (GF-AAS), Model Analytical Jena Vario – 6

| Molluscs  | Trace elements |                |              |               |              |               |               |
|---|----------------|----------------|--------------|---------------|--------------|---------------|---------------|
|   | Fe             | Zn             | Cu           | Mo            | Cr           | V             | Mn            |
| <i>Cipangopaludina lecythis</i> (Benson)            | 1.07 ± 0.008   | 0.2387 ± 0.001 | 1.42 ± 0.001 | 0.012 ± 0.002 | 15.07 ± 0.27 | 2.637 ± 0.11  | 0.013 ± 0.001 |
| <i>Brotia (Antimelania) costula</i>                 | 1.01 ± 0.001   | 0.446 ± 0.043  | 1.96 ± 0.04  | 0.014 ± 0.003 | 14.34 ± 1.11 | 1.555 ± 0.905 | 0.017 ± 0.007 |
| <i>Lamellidens marginalis</i> (Lamarck)             | 2.79 ± 0.01    | 0.27 ± 0.01    | ND           | ND            | 0.50 ± 0.08  | ND            | 2.39 ± 0.03   |
| <i>Pila theobaldi</i> (Hanley)                      | 0.99 ± 0.056   | 0.3835 ± 0.075 | 2.20 ± 0.08  | 0.017 ± 0.008 | 7.238 ± 0.11 | 0.460 ± 0.009 | 0.014 ± 0.004 |
| <i>Angulyagra oxytropis</i> (Benson)                | 0.98 ± 0.005   | 0.3356 ± 0.004 | 1.95 ± 0.02  | 0.016 ± 0.002 | 8.294 ± 0.08 | ND            | 0.016 ± 0.007 |
| <i>Bellamya crassispinalis</i> (Annandale) (tissue) | 1.01 ± 0.011   | 0.4731 ± 0.045 | 2.07 ± 0.03  | 0.017 ± 0.009 | 9.34 ± 0.10  | 0.329 ± 0.044 | 0.018 ± 0.005 |
| <i>Bellamya crassispinalis</i> (Annandale) (shell)  | 3.48 ± 0.50    | ND             | ND           | ND            | 1.20 ± 0.10  | ND            | 2.08 ± 0.20   |

All concentrations are in ppb; ND - Not Detectable

Zinc is essential for all organisms and it is an important trace element having a definite role in the metabolism, growth and development. It is an essential component of over 200 enzymes viz. cytosolic superoxide dismutase, having both catalytic and structural roles. Especially important during pregnancy, for the growing foetus whose cells are rapidly dividing. It also helps to avoid congenital abnormalities and pre-term delivery. Zinc is vital for fertility, immune system, taste, smell, appetite, skin, hair and nails. Zinc is also required for normal testicular development (Merck, 1986) and for the function of taste buds. It is needed for tissue repairment and wound healing, plays a vital role in protein synthesis and digestion, and it is necessary for optimum insulin action as zinc is an integral constituent of insulin. It is an important constituent of plasma (Malhotra, 1998, Murray *et al.*, 2000).

Copper is an essential micro nutrient necessary for the haemetologic and neurologic system (Tan *et al.*, 2006). It is involved in the oxidation of Fe<sup>2+</sup> to Fe<sup>3+</sup> and in the process of erythropoiesis, erythrocyte function and regulates erythrocyte survival. And, it is an important catalyst for iron

absorption. Copper is an essential co-factor in several reactions concerning iron use, collagen synthesis and suppression of free radicals. It serves in the expression of genes for several enzymes. It stimulates the production of the neurotransmitters epinephrine, nor- epinephrine and dopamine. Copper is critical for energy production in the cells. It is also involved in nerve conduction, connective tissue, the cardiovascular system and the immune system.

### Conclusion

Trace elements, also known as micronutrients, are vital for human body and essential in the maturation, activation and functions of host defence mechanism. They also balance toxicity levels. Copper, manganese, iron and zinc are integral parts of enzymatic anti-oxidants (Arinola *et al.*, 2008b). Neurological disorders and trace elements are closely related (Arinola *et al.*, 2008c). Moreover, essential trace elements like iron, zinc, copper, manganese and chromium, having nutritive value, are also present in the mollusc tissue such that some of the elements possess anti-oxidant property at some extent. It is important to

regularly obtain up-to-date information on the minerals content of edible freshwater molluscs used for human and animal foods and feed respectively. The main objective of this study showed that the selected Mollusca species were suitable for human consumption.

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