

# Zinc: The Metal of Life

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**Abstract:** The importance of zinc was 1st reported for *Aspergillus niger*. It took over 75 y to realize that zinc is also an essential trace element for rats, and an additional 30 y went by before it was recognized that this was also true for humans. The adult body contains about 2 to 3 g of zinc. Zinc is found in organs, tissues, bones, fluids, and cells. It is essential for many physiological functions and plays a significant role in a number of enzyme actions in the living systems. Bioinformatics estimates report that 10% of the human proteome contains zinc-binding sites. Based on its role in such a plethora of cellular components, zinc has diverse biological functions from enzymatic catalysis to playing a crucial role in cellular neuronal systems. Thus, based on the various published studies and reports, it is pertinent to state that zinc is one of the most important essential trace metals in human nutrition and lifestyle. Its deficiency may severely affect the homeostasis of a biological system. This review compiles the role of zinc in prophylaxis/therapeutics and provides current information about its effect on living beings.

**Keywords:** zinc, antimicrobial, enzyme, food science, nutrition

## Introduction

Zinc, the 23rd most abundant element in the earth's crust, (Zinc: Human Health Fact Sheet 2005) having atomic number 30 and atomic weight 65.37, is vital in the living world. Pure zinc is a bluish-white, shiny metal, (Contaminants: Zinc 2002; Lew 2008) and is amphoteric in nature. Zinc, being colorless and diamagnetic, is invisible to most spectroscopic methods (Maret 2001). The normal concentration of zinc in human blood serum and urine (24 h) is  $800 \pm 200$ , 109 to 130, and  $<500 \mu\text{g/dL}$ , respectively (Goldfrank and Flomenbaum 2006). The mean serum zinc concentration is 1 mg/L. Red blood cells contain about 10 times higher concentration than that in the serum. Whole blood has about 5 times the serum concentration. It functions together as a structural component of numerous proteins and as a cofactor for many metalloenzymes (Noonan and others 2003). The relative concentration of free ions of zinc within the biological systems varies from  $\leq 109 \text{ M}$  in the cytoplasm of many cells to  $\leq 103 \text{ M}$  in some organelles (Fabris 1994). Most rocks and countless minerals contain zinc in varying amounts and it enters the air, water, and soil as a consequence of both natural processes and human activities. Zinc can be on the loose to the atmosphere during the production of steel and burning of coal or waste (Zinc: Human Health Fact Sheet 2005). There are approximately 55 mineralized forms of zinc. The most important zinc minerals in the world

are sphalerite ( $\text{ZnS}$ ), smithsonite ( $\text{ZnCO}_3$ ), and hemimorphite ( $\text{Zn}_4\text{Si}_2\text{O}_7(\text{OH})2\text{H}_2\text{O}$ ). Zinc appears in Group IIB of the periodic table and has 2 common oxidation states, Zn (0) and Zn (+2). Zinc forms a variety of compounds, such as zinc chloride, zinc oxide, and zinc sulfate. (ATSDR: Toxicological Profile for Zinc 2005) Powdered zinc being explosive can burst into flames if stored in a damp place. Because it is an element, zinc does not degrade nor can it be destroyed (Zinc: Human Health Fact Sheet 2005).

## Zinc: Some Conventional Studies

Zinc, a versatile element, vital for all physiological processes, is a drug, which has been used as a therapeutic agent against various diseases, since long. Ayurveda mentions the use of zinc in its calcified form (Sodhana & Marana), as zinc ore or as zinc carbonate (Kharpara), as zinc metal (Yasada), as zinc oxide (Pushpanjana) or as an alloy-brass (Pittala). These forms have been mentioned in ancient texts dating back to the 14th century, where these were used to cure various diseases. Oral zinc supplementation has been used as an immunity-boosting agent in geriatric patients (Haase and others 2006). The percentage of Zinc can be analyzed in various body fluids such as saliva, plasma, blood as well as in human excreta. Its levels can also be monitored in hair, nails, and so on. A noteworthy link of zinc and copper concentration in sera collected from pediatric population with respect to their age, height, body mass index, and nutritional habits has been acknowledged (Arvanitidou 2007; Jing and others 2007). Zinc appurtenance exhibits affirmative effect on the occurrence of diarrhea and lessens infant infections (Walker and Black 2004). On the contrary, zinc concentration in patients having osteoporosis, was not appreciably improved despite receiving calcium supplements (Morgan and others 2006). A zinc (II)-instant coffee complex, a brown amorphous compound, soluble in water was found to have the strongest

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