DOI: 10.22607/IJACS.2017.503003

Available online at
www.ijacskros.com

Indian
Journal of Advances in
Chemical Science

Indian Journal of Advances in Chemical Science 5(3) (2017) 127-136

Essential Trace Elements and Their Vital Roles in Human Body

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Received 21st April 2017; Revised 13th May 2017; Accepted: 25th May 2017

ABSTRACT

Trace elements are naturally occurring inorganic substance required in humans in amounts <100 mg/day. They are essential components of biological structures and have an important effect on and play a key role in a variety of the processes necessary for life throughout mediate vital biochemical reactions. Excessive levels, a level higher than needed for biological functions, of these elements can be toxic for the body health. Therefore, it has been found that the imbalances in the optimum levels of trace elements may adversely affect biological processes and are associated with many fatal diseases, such as cancers. Recently, efforts have been focused to attempt to advance understand of the relationship between heavy metal, trace elements, and their role in cancers. Many studies indicated the remarkable of specific elements that may be of value and may have prognostic significance in the early diagnosis, prognosis, and therapy evaluation of some diseases, especially various types of cancer.

Key words: *Trace elements, Zinc deficiency, Iron, Nickel.*

1. INTRODUCTION

The term trace elements refer to chemical elements present in a natural material at very small amounts. In analytical chemistry, a trace element is an element in a sample that has an average concentration of <100 parts per million (ppm) measured in atomic count or <100 µg/g. In biochemistry, a trace element is a dietary mineral that is needed in very minute quantities for the proper growth, development, and physiology of the organism [1].

Trace elements have several important roles in human bodies, some are essential for enzymes reactions where they attract and facilitate conversion of substrate molecules to specific end products. Moreover, some of them donate or accept electrons in redox reactions that are of primary importance in the generation and utilization of metabolic energy. Some of them have structural roles and responsible for the stability of important biological molecules. Furthermore, some trace elements have important actions throughout biological processes, for example, ıron (Fe) which can bind, transport, and release oxygen in the body [2,3]. In fact, although the trace elements are essential components of biological activities, the excessive levels of these elements can be toxic for the body health and may lead to many fatal diseases, such as cancers. In this review article, we will describe the properties and biological important of a variety of trace elements.

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1.1. Zinc (Zn)

Zn is a chemical element with symbol Zn and atomic number 30. It is the first element of group 12 of the periodic table. This element was discovered by German chemist Andreas Sigismund Marggraf in 1746 at Germany [4]. It has an atomic weight of 65.4. Zn is the second metal present in the human body (about 2.5 g), after Fe (about 4 g) but before copper (Cu) (about 0.2 g). It is found throughout the entire body system, with half in the muscle tissue [5]. The established recommended daily amount (RDA) for Zn is 8 mg/day for women and 11 mg/day for men [6]. In fact, Zn is found in wheat, brown rice, oats, lentils, soybeans, dried peas, black-eyed peas, lima beans, walnuts, peanuts, cashews, brazil nuts, many cheeses, any kind of liver, and animal flesh such as beef, lamb, chicken, turkey, and various fish and seafood. It is also found in most vitamin mineral supplements as sulfate, citrate, or oxide and these are inexpensive and bioavailable sources [6-8].

Zn is an essential trace element that functions as a cofactor for certain enzymes involved in metabolism and cell growth, it is found in nearly 300 specific enzymes [9-11]. As a component of many enzymes, Zn is involved in the metabolism of proteins, carbohydrates, lipids, and energy. Zn is vital for the healthy working of many of the body's systems; it plays an essential role in numerous biochemical pathways. It is particularly important for healthy skin and is

essential for a healthy immune system and resistance to infection. Zn plays a crucial role in growth and cell division where it is required for protein and DNA synthesis, in insulin activity, in the metabolism of the ovaries and testes, and in liver function [9,12].

Zn deficiency may occur due to insufficient dietary intake. It was reported that nearly two billion people in the developing world are deficient in Zn [10]. Zn deficiency is a serious problem in many developing countries. Zn deficiency is ranked as the 5th leading risk factor in causing disease, especially diarrhea and pneumonia in children, which can lead to high mortality rates in these underdeveloped regions. Other severe deficiency symptoms include stunted growth and impaired development of infants, children, and adolescents. Early Zn deficiency also leads to impaired cognitive function, impaired immune function, behavioral problems, memory impairment, and problems with spatial learning and neuronal atrophy. Public health programs involving Zn supplementation and food fortification could help overcome these problems [13,14]. In more severe cases, Zn deficiency causes hair loss, delayed sexual maturation, impotence, hypogonadism in males, and eye and skin lesions, weight loss, delayed healing of wounds, taste abnormalities, and mental lethargy can also occur [15-17].

The World Health Organization (WHO) advocates Zn supplementation for severe malnutrition and diarrhea. Zn supplements help prevent disease and reduce mortality, especially among children with low birth weight or stunted growth [18].

1.2. Copper (Cu)

Cu is a chemical element with symbol Cu and atomic number 29. It is in the top of group 11, of the periodic table, above silver and gold. It has an atomic weight of 63.5. Cu is a reddish metal with a face-centered cubic crystalline structure. It reflects red and orange light and absorbs other frequencies in the visible spectrum. It is malleable, ductile, and an extremely good conductor of both heat and electricity (second only to silver in electrical conductivity) [19,20]. The discovery of Cu dates from pre-historic times, where it was known to some of the oldest civilizations on record. It has a history of use that is at least 10,000 years old, a Cu pendant was found in northern Iraq that dates to 8700 BC [21].

Cu is an essential trace element in plants and animals. The human body only contains about 150 mg of this vital mineral. The established RDA for Cu in normal healthy adults is 2 mg/day [22]. Cu is absorbed in the gut and then transported to the liver bound to albumin. After processing in the liver, Cu is distributed to other tissues in a second phase. Cu transport in liver involves the protein ceruloplasmin, which carries the majority of Cu in blood. Ceruloplasmin also carries Cu that is excreted in milk and is particularly well absorbed as a Cu source [23-25]. The best dietary sources of Cu to human body include wheat, barley, sunflower seeds, almonds, pecans, walnuts, peanuts, cashews, prunes, raisins apricots, various dried beans, mushrooms, chicken, and most fish [26].

Cu is an essential constituent of several enzymes such as cytochrome oxidase, monoamine oxidase, catalase, peroxidase, ascorbic acid oxidase, lactase, tyrosinase, and superoxide dismutase (SOD). Moreover, due to its presence in a wide variety of enzymes, Cu is involved in many metabolic reactions. For example, the presence of Cu in the SOD helps in the conversion of superoxide to oxygen and hydrogen peroxide [27,28]. Cu is an essential micronutrient necessary for the hematologic and neurologic systems. It is necessary for the growth and formation of bone, formation of myelin sheaths in the nervous systems, helps in the incorporation of Fe in hemoglobin, assists in the absorption of Fe from the gastrointestinal tract, and in the transfer of Fe from tissues to the plasma [29].

Cu deficiency is rare among healthy people, but it may occur among infants. The most common symptoms of Cu deficiency include fatigue, anemia, and a decreased number of white blood cells. Sometimes, osteoporosis develops or nerves are damaged. Nerve damage can cause tingling and loss of sensation in the feet and hands. Muscles may feel weak. Some people become confused, irritable, and mildly depressed. It has been found that the most common cause of Cu deficiency is the remote gastrointestinal surgery, such as gastric bypass surgery, due to malabsorption of Cu. On the other hand, Menkes disease is a genetic disorder of Cu deficiency involving a wide variety of symptoms that is often fatal [30,31]. Acquired Cu deficiency is mainly attributable to nutritional deficiency and may be seen in malnourished low-birth weight infants, newborns, and small infants. Cu deficiency has also been reported to develop after intractable diarrhea and prolonged parenteral or enteral nutrition. However, since Cu supplementation of intravenous and enteral nutritional formulas was made mandatory, the incidence of Cu deficiency has decreased dramatically [32-34].

1.3. Iron (Fe)

Fe is a chemical element with symbol Fe and atomic number 26 and has been known since the beginning of time. It is by mass the most common element on Earth, forming much of Earth's outer and inner core. It is the fourth most abundant elements after oxygen, silicon, and aluminum, respectively. It has an atomic weight of 55.8. Fe is the most abundant metal in the human body. Body Fe content is approximately 3-4 g, which almost corresponds to a concentration of 40-50 mg of Fe per kilogram of body weight [35]. The established RDA for Fe in normal healthy adults is 8 mg/day for

men and post-menopausal women and 18 mg/day for menstruating women [36] (this is due to lose a lot of blood during their monthly period).

The rich sources of dietary Fe include red meat, liver, lentils, beans, peas, nuts, seeds, poultry, fish, seafood, leaf vegetables, watercress, tofu, chickpeas, black-eyed peas, blackstrap molasses, fortified bread, and fortified breakfast cereals. It is also found in low amounts in molasses, teff, and farina. It has been found that Fe in meat is more easily absorbed than Fe in vegetables [26].

The majority of Fe in the body is contained within hemoglobin, an erythrocyte protein that transfers oxygen from the lungs to the tissues. The Fe contained in hemoglobin is also responsible for the red color of blood [33]. Fe is an essential component of myoglobin, a protein that provides oxygen to muscles [37]. Fe is also necessary for growth, development, normal cellular functioning, and synthesis of some hormones and connective tissue [37,38].

In the case that the body supply of available Fe is too low, this lead to a condition known as Fe deficiency. Fe deficiency is the most common nutritional deficiency in the world. People with Fe deficiency cannot produce an adequate amount of hemoglobin to meet their body's oxygen transport needs. When the deficiency becomes severe, the condition is diagnosed as Fe-deficiency anemia [39,40]. The WHO estimates that approximately half of the 1.62 billion cases of anemia worldwide are due to Fe deficiency [41]. The most common symptoms of Fe-deficiency anemia are tiredness and weakness due to the inadequate oxygen supply to the body's cells and paleness in the hands and eyelids due to the decreased levels of oxygenated hemoglobin. The other symptoms include fatigue, dizziness, hair loss, twitches, irritability, brittle or grooved nails, impaired immune function, pagophagia, and restless legs syndrome [39,42,43]. It has been observed that the deficiency in Fe level usually associated with increase possibility of exposure to toxoplasmosis in women [44]. Fe-deficiency anemia can be treated using Fe supplements [39]. Most of vitamin/mineral supplements have Fe in them as common sulfates, fumarates, and gluconates.

1.4. Magnesium (Mg)

Mg is a chemical element with symbol Mg and atomic number 12 and has an atomic weight of only 24.3. This element was first discovered in 1618 by a farmer at Epsom in England while he attempted to give his cows water from a well, but metal itself was first produced by Sir Humphry Davy in England in 1808 [45]. It is the ninth most abundant element in the universe [46]. Mg is the eighth most abundant mineral on earth and the third most abundant in sea water, after sodium and chlorine. More importantly, it is the fourth most abundant mineral in the human body and it is necessary in over 300 reactions within the body, the human body contains approximately 25 g Mg [26].

Mg is used in so many biological functions, where it is function as a cofactor in more than 300 enzyme systems that regulate diverse biochemical reactions in the body, including protein synthesis, muscle and nerve function, blood glucose control, and blood pressure regulation [47-49]. Mg is needed for energy production, oxidative phosphorylation, and glycolysis. It contributes to the structural development of bone and is required for the synthesis of DNA, RNA, and the antioxidant glutathione [50]. It protects mitochondria, which is the storehouse of energy, from the dangerous oxidants [51]. It is found that this mineral also plays a role in the active transport of calcium and potassium ions across cell membranes, a process that is important to nerve impulse conduction, muscle contraction, and normal heart rhythm [49].

Mg is one of the ten essential minerals with an RDA of 400 mg/day for healthy adult males and 320 mg/day for healthy adult females [47]. It has been reported that the best sources of dietary Mg include spinach, legumes, nuts, seeds, and whole grains. Furthermore, it is also found that spices, nuts, cereals, cocoa, and vegetables are rich sources of Mg [52].

Despite that Mg deficiency is uncommon, it can occur primarily due to low dietary intake or in people who abuse alcohol [49,52]. Mg deficiency also may occur as a result of using certain medications (such as diuretic use) [53]. The early and moderate symptoms of Mg deficiency include loss of appetite, nausea, vomiting, fatigue, tingling or numbness, rapid heartbeat, delirium, hallucinations, retention of sodium, low circulating levels of parathyroid hormone, and weakness [47,48,54].

Studies have indicated that inadequate Mg intake frequently causes muscle spasms and has been associated with cardiovascular disease, diabetes, high blood pressure, anxiety disorders, migraines, osteoporosis, and cerebral infarction [50,55-58]. Moreover, it has found that severe Mg deficiency can result in hypocalcemia or hypokalemia (low serum calcium or potassium levels, respectively) [48,54].

1.5. Manganese (Mn)

Mn is a chemical element with symbol Mn and atomic number 25 and has an atomic weight of 54.9. Mn is the 12th most abundant element in the Earth's crust, with an average concentration of 0.1%. Mn is a metal that mainly used with alloys, particularly in stainless steels. It was first recognized and isolated as a separate chemical element in 1774 by the Swedish chemist Johan Gottlieb Gahn [59].

Mn is a trace mineral that is present in tiny amounts in the body. It is one of the most important nutrients for human health. The average human body contains about 12 mg of Mn. About 43% of it is found in the skeletal system, with the rest occurring in soft tissues including liver, pancreas, kidneys, brain, and central nervous system [26,45]. Mn helps the body to form connective tissue, bones, blood-clotting factors, and sex hormones [60,61]. It also plays a role in fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation [62,63]. Mn is also necessary for normal brain and nerve function. In addition, Mn is a key component of enzyme systems, including oxygen-handling enzymes. It is a component of the antioxidant SOD, which helps fight free radicals [64,65].

The RDA for Mn is 2.3 mg/day for adult males and 1.8 mg/day for adult females [36]. It is established that the rich dietary sources of Mn include various dried beans and peas, nuts and seeds, wheat germ, and whole grains (such as buckwheat, bulgur wheat, rye, oats, brown rice, and corn), legumes, pineapples, tea, parsley, leafy greens, root vegetables (such as sweet potatoes and beets), and sea vegetables [26,66,67].

Although Mn is necessary for humans to survive, health problems will also occur when the uptake exceeds the normal level. It has been shown that the abnormal concentrations of Mn in the brain, especially in the basal ganglia, are associated with neurological disorders similar to Parkinson's disease [68]. The National Academy of Sciences established a tolerable upper intake level of 11 mg for total daily Mn intake for human adults [36].

On the other hand, it has been found that the low levels of Mn in the body (deficiency of Mn) can causes hypercholesterolemia, impaired glucose tolerance, dermatitis, changes in hair color, skeletal abnormalities, infertility, deafness, and impaired synthesis of vitamin K-dependent clotting factors [68-70]. In fact, Mn is available in a wide variety of forms, including Mn salts (sulfate and gluconate) and Mn chelates (aspartate, picolinate, fumarate, malate, succinate, citrate, and amino acid chelate). Mn supplements can be taken as tablets or capsules, usually along with other vitamins and minerals in the form of a multivitamin [26].

1.6. Nickel (Ni)

Ni is a chemical element with symbol Ni and atomic number 28. Ni is a silvery-white metal, hard, malleable, and ductile metal. It is of the Fe group and it is a fairly good conductor of heat and electricity. It has an atomic weight of 58.7. Ni is a naturally occurring element that is present in soil, water, air, and biological materials. It is a natural component of earth's crust and is present in igneous rocks [71]. Natural sources of nickel include dusts from volcanic emissions and the weathering of rocks and soils [72]. Inorganic fertilizers particularly phosphate fertilizers have variable levels of nickel [73]. Ni was discovered by the Swedish chemist Axel Fredrik Cronstedt in the mineral niccolite, in 1751 [74]. Today, it is known that the most important use of nickel is in making alloys, especially in stainless steel.

It is well accepted that nickel is as essential ultra-trace nutrient in plants, animals, and humans. It has been reported that the nickel is essential for the active synthesis of urease in plant cells. In several species of higher plants such as jack beans, soybeans, rice, and tobacco, it is required for effective urea metabolism and urease synthesis [75-76]. Although the biological function of nickel is still somewhat unclear in human body, however, nickel is found in the body in highest concentrations in the nucleic acids, particularly RNA, and is thought to be somehow involved in protein structure or function. It has been speculated that nickel may play a role, as a cofactor, in the activation of certain enzymes related to the breakdown or utilization of glucose. Ni may aid in prolactin production and thus be involved in human breast milk production [77-80]. More research is needed to reveal the properties of this interesting mineral in the human body.

There is no RDA has been established for nickel. Nevertheless, it has been reported that the estimated daily intake of nickel from food and water worldwide is 80-130 μg/day [26]. Ni is contained in many foods such as, beans, chocolate, soybeans, lentils, split, green peas, oats, buckwheat, barley, and corn. Nuts, such as walnuts and hazelnuts, are the best sources of nickel. Many vegetables and some fruits, such as bananas and pears, have moderate amounts of nickel [81].

It has been found that humans may be exposed to nickel during breathing air, eating food, or smoking cigarettes. Skin contact with nickel-contaminated soil or water may also result in nickel exposure. In fact, small quantities of nickel are essential for the body, but when the uptake is too high it can be a danger to human health. Studies have shown that acute exposure of human body to nickel may cause several health problems such as liver, kidney, spleen, brain and tissue damage, vesicular eczema, lung, and nasal cancer [79,82].

It has been observed that the exposure to nickel (especially, nickel in jewelry) may result in the development of a dermatitis known as "nickel allergy" in sensitized individuals. The first symptom is usually itching, before skin eruption occurs. Ni is an important cause of contact allergy, partly due to its use in jewelry intended for pierced ears [83,84]. Furthermore, it has been demonstrated that acute exposure to nickel carbonyl, a carcinogenic gas that results from the reaction of nickel with heated carbon monoxide, can

cause symptoms such as frontal headaches, nausea, vomiting, or vertigo. Long-term nickel inhalation may cause serious health problems, including cancer [85].

Ni deficiency has not been shown to be a concern in humans, despite this it may cause biochemical changes, such as reduced Fe resorption that leads to anemia. It can disturb the incorporation of calcium into skeleton and lead to parakeratosis-like damage, which finds expression in disturbed Zn metabolism. It has found that nickel deficiency particularly affects carbohydrate metabolism [78]. More researches are required to see the benefits of, and what effects nickel deficiency can cause on the human body.

1.7. Chromium (Cr)

Cr is a chemical element with symbol Cr and atomic number 24. It is a steely-gray, lustrous, hard, and brittle metal [86]. It has an atomic weight of 52.0. In 1797, chromium oxide was discovered by the French pharmacist and chemist Louis Nicolas Vauquelin. In the following year 1798, Vauquelin discovered that he could isolate metallic chromium by heating the oxide in a charcoal oven, which making him the discoverer of the element [87].

Cr is a trace element that humans require in trace amounts. It is found primarily in two forms: Trivalent (chromium III), which is biologically active and found in food and hexavalent (chromium VI), a toxic form that results from industrial pollution [88]. In 2001, Dietary Reference Intakes for chromium were established. Adequate intakes of chromium is 35 mg/day for adult males and 25 mg/day for adult females [36]. Cr is widely distributed in the food supply, but most foods provide only small amounts of it. It is found in egg yolks, whole-grain products, high-bran breakfast cereals, coffee, nuts, green beans, broccoli, meat, and brewer's yeast [89,90].

Cr levels in biological matter have been studied extensively. It has been found that chromium produces significant increases in enzyme activity and serves an important function in carbohydrate metabolism, stimulation of fatty acid and cholesterol synthesis from acetate in the liver, and improved sugar metabolism through the activation of insulin. In addition, it has been found that chromium renders the body's tissues more sensitive to insulin. It is a critical cofactor in the action of insulin [91-93]. In fact, the actual chromium deficiency in humans is rare. Despite that, some studies reported that chromium deficiency is associated with glucose intolerance and insulin resistance in patients on long-term parenteral nutrition [94,95]. Furthermore, it has been reported that chromium deficiency may be the reason to an increase in hematological parameters (hemoglobin, hematocrit, erythrocytes, leukocytes, and mean erythrocyte volume) [96].

1.8. Cobalt (Co)

Co is a chemical element with symbol Co and atomic number 27. It has an atomic weight of 58.9. Co was first discovered in 1739 by the chemist Georg Brandt of Swedish. Co is hard, shiny, crisp, bluish-gray metal. It is a very stable metal that is not affected by air or water. Co is one of the three magnetic minerals (in addition to Fe and nickel) that is often used in magnet alloys. It has considerable industrial applications. It is used in paints and dyes, where it has been used since the middle ages in the production of a blue colored glass (smalt) [97]. The radioactive counterpart Co-60 is a powerful gamma ray source that used in medical applications, such as radiotherapy trace and cancer fighter. It is also used for sterilization of medical supplies and medical waste [98].

Co is an essential trace element for the human body, where it is a key constituent of cobalamin (the scientific name of vitamin B12). It also has a substantial role in the formation of amino acids and neurotransmitters. Human body can get Co ions through several pathways: With food, by the respiratory system, by the skin, and as a component of biomaterials. The cobalt ions enter the body through any of the above routes and bind with proteins within the bloodstream and get transported with blood to be deposited in tissues and cells [45,46]. The largest source of exposure to cobalt for the general population is the food supply. The estimated intake from food is 5-40 µg/day, most of which is inorganic cobalt. Green vegetables and fresh cereals are the richest sources of cobalt, whereas dairy products, refined cereals, and sugar contain the least cobalt. Inorganic forms of cobalt are toxic to the human body, and the longer they stay in the body, the more the detrimental effects they cause in cells [99].

It has been found that the cobalt deficiency is associated with disturbances in vitamin B12 synthesis. It might cause anemia and hypothyroidism, as well as increase the risk of developmental abnormalities and failure in infants [100]. The excess level of this metal in the human body might cause hypothyroidism and overproduction of erythrocytes, fibrosis in lungs and asthma [101].

1.9. Lead (Pb)

Pb is a chemical element with atomic number 82 and symbol Pb and has an atomic weight of 207.2. Pb is a soft, malleable, and heavy metal. It is a bluish-white metal but on exposure to air it tarnishes to a dull gray metal. Pb is a relatively unreactive metal and has a weak metallic character with amphoteric nature, where lead and its oxides react with both acids and bases [102]. Pb has several useful mechanical properties to use it in industrial applications including high density, low melting point, ductility, and resistance to corrosion. One disadvantage of using lead is its high toxicity [103]. In fact, lead has been

used for bullets since their invention in the middle ages. Its high density and resistance to corrosion have been exploited in a number of related applications. It is used as ballast in sailboat keels and also used as a protective sheath for submarine cables in seabed [104,105].

Pb is an extremely common metal in our life. Water, paint, electric storage batteries, insecticides, and gasoline are considering some common sources of lead. It is rapidly absorbed into the bloodstream of human body through inhalation, ingestion, or by skin contact. Through the bloodstream, lead is distributed among three main compartments: Blood, soft tissue that includes kidney, bone marrow, liver, brain, and mineralized tissue that includes bones and teeth [106].

In fact, there are no any known health benefits or biological role of lead for the human body. On the contrary, lead has adverse effects that deleterious the human body. It can affect almost every organ and system in the human body. To a great extent, it can cause damage to the brain, kidneys, nervous system, reproductive system, and can cause high blood pressure. From these dysfunctions, it has found that the nervous system is the most sensitive to lead poisoning. Pb is especially affect fetuses and young children causing them serious disorders [107,108]. Although there is no safe level of exposure to lead has been found, chronic toxicity of it is much more common and occurs at blood levels of about 40-60 μg/dL [106].

1.10. Selenium (Se)

Se is a chemical element with symbol Se and atomic number 34 and has an atomic weight of 78.97. It was discovered by Swedish chemist Jöns Jacob Berzelius in 1817. It is of the group 16 of the periodic table with properties that are intermediate between the sulfur and tellurium elements. Se is an essential micronutrient for animals and plants. The selenium content in the human body is about 13-20 mg. It is a vital mineral with an established RDA approximately 70 μg/day. The best food sources for selenium are seafood, meats, whole grains, and some vegetables. It has been found that the raw foods contained considerably more selenium than cooked and processed foods [26,109].

Se is a vital trace element for human body health, where it is found at the active site of a wide range of selenoproteins as selenocysteine. It is an important component of the antioxidant enzymes such as glutathione peroxides and thioredoxin reductase [47]. Although selenium deficiency is rare in healthy human, it is a very toxic if taken in excess amounts. It has been established that dietary selenium is important for a healthy immune system, where it enhances T-lymphocyte immune responses. It has been found that there is a relationship between low blood levels of Se and increased cardiovascular disease mortality. Furthermore, it has been reported that the lack of selenium is the main reason of Keshan disease. On other hand, there is strong evidence that Se has a protective effect against some forms of cancer such as colon, prostate, and breast [26,110,111].

2. CONCLUSION

Essential trace elements play an important role as a cofactor for certain enzymes involved in metabolism and cell growth, most of them involved in the metabolism of proteins, carbohydrates, lipids, and energy. They are also necessary for growth, development, muscle and nerve function, normal cellular functioning, and synthesis of some hormones and connective tissue.

The role of trace elements in biological processing may provide vital clue for understanding the etiology of some diseases such as cancer. The ability of trace elements to function as substantial affecter in a variety of the processes necessary for life, such as regulating homeostasis and prevention of free radical damage, can provide an answer to the definite correlation between content of trace elements and many common diseases. In the past ten years, studies have focused extensively on determine the levels of trace elements in cancers patients, as an attempt to understand the nature of relationships between cancer and trace elements. Thus, the expected role of trace elements will enable to understand the etiopathogenesis of cancer and provide a rapid diagnostic facility and also create effective treatment modalities.

3. ACKNOWLEDGMENTS

The authors would like to thank Mustansiriyah University (www.uomustansiriyah.edu.iq). Baghdad, Iraq, for its support in the present work.

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