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A Review on Trace Elements and Petroleum Pollution

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Abstract

A trace element is a dietary element that is needed in very minute quantities for the proper growth, development, and physiology of the organism. It is also chemical element required in minute quantities by an organism to maintain proper physical functioning. Zinc is an essential mineral perceived by the public today as being of "exceptional biologic and public health importance", especially increasingly by regarding prenatal and postnatal development. Zinc deficiency effect about two billion people in the developing world and is associated with many diseases. Copper is involved in the formation of red blood cells, the absorption and utilization of iron, lead emitted from petrol pollutants affects the red blood cell formation by making copper level lower to form red blood cells. Petrol pollutants which causes breathing and respiratory system, damage to lungs and tissue causes cancer. In elderly and children to people causes chronic lung disease, influenza and asthma, causes anemia, kidney disease, reproductive disorders, seizures behavioural disorders, hypertension, heart failure, inflammation, reduce fertility in males. Balancing copper and zinc, through vitally important may not be as easy as expected. Exposure to metal like lead can push zinc out. Iron, particularly from supplements, may inhibit intestinal absorption of both zinc and copper through competition for transport molecules located in the gut. Wilson's disease the inability to metabolize copper out of the body require zinc therapy and dietary change that precludes mushroom, nuts, chocolate.

Keywords: trace element is, Zinc deficiency, Copper, hypertension, heart failure, inflammation,

Introduction

TRACE ELEMENT

According to Bowen, 1996 in biochemistry, a trace element is a dietary element that is needed in very minute quantities for the proper growth, development, and physiology of the organism. A chemical element required in minute quantities by an organism to maintain proper physical functioning (American Heritage Dictionary).

ZINC METAL

Zinc is an essential mineral perceived by the public today as being of "exceptional biologic and public health importance", especially increasingly by regarding prenatal and postnatal development (Hambidge and Krebs, 2007). Zinc deficiency effect

about two billion people in the developing world and is associated with many diseases.

Zinc metal was not produced on a large scale until the 12th century in India and was unknown to Europe until the end of the 16th century (Cradlock, 1998). To date, the oldest evidence of pure zinc comes from Zawar, in Rajasthan, as early as the 9th century AD when a distillation process was employed to make zinc.

Alchemists burned zinc in air to form what they called "philosopher's wool or white snow" the element was probably named by the alchemist Paracelsus after the German word *zinke*. Corrosion resistant zinc plating of iron (hot-dip galvanizing) is the major application for zinc. Other applications are in batteries, small non-structural castings, and alloys, such as brass. A variety of zinc compounds are commonly used, such as zinc carbonate and zinc gluconate (as dietary

supplement, zinc chloride (in deodorants) zinc pyrithione (antidandruff shampoos), and zinc methyl (or zinc diethyl) in the organic laboratory (Kharakwal and Gurjar, 2006).

SOURCES OF ZINC

The most well-known fact about zinc in foods is almost certainly that oysters are rich in zinc. Shrimp is the 10th best world Health food source of zinc (Foster *et al.*, 2013). Red meat, poultry, grass-fed beef, pasture-raised chicken, fish including scallops and shrimps, are animal sources of zinc (lamb), nuts and seeds, cashews are all good sources of zinc.

Zinc is present in a range of everyday foods. Oysters have more zinc than any other food. They include oysters, toasted wheat germ, veal liver, roast beef, crab, pork loin, baked beans, lobster, beef patty, dark chocolate, lamb, peanuts, crab. Zinc supplements are available in form of capsules and tablets. (Wolfgang and Harold, 2006).

DIETARY DEFICIENCY OF ZINC

Zinc deficiency in a healthy adult world occurs in a person who consumed few animal foods and whose diet was largely based on processed foods, with no routine intake of nuts, seeds, fresh vegetables or whole grains (Solomons, 1998).

According to Taylor *et al.* (1992), ready to eat processed cereals have become an important source of zinc in kids' diets thereby making kids lack in nutrients that are naturally present along side of zinc in whole foods. It also leaves kids with imbalanced intake of zinc in relationship to other nutrients (like copper).

Other circumstance that might contribute to deficiency of zinc is in case of poor dietary supply, increased need for zinc (beyond our typical everyday needs) can also contribute to a relative deficiency of this nutrient. Infections, trauma, stress, and steroid medications are some of the examples of situation where body tissues take up extra zinc from the blood, creating a relative deficiency (Mocchegiani *et al.*, 2013). Loss of appetite, anaemia, slow wound healing, abnormal taste, depressed growth, altered cognition, diarrhea, hair loss.

Excessive zinc intake can be harmful as it suppresses copper absorption, according to a study published in biological trace element research they include nausea, vomiting, loss of appetite, stomach pains, head aches, diarrhea (Wapair and Balkman, 1991).

ZINC AND HEALTH

According to the European Journal of Immunology (2010) the human body needs zinc to activate

T lymphocytes (T cells). T cells help the body in two ways, controlling and regulating immune responses, attacking infected or cancerous cells.

Zinc may help protect the skin and mucosal membrane. A Swedish study that analyzed zinc in wound healing, concluded that topical zinc may stimulate leg ulcer healing by enhancing re-epithelialization, decreasing inflammation and bacterial growth. When zinc is applied on wounds it not only corrects a local zinc deficit but also acts pharmacologically (Argen, 2013). Zinc prevents cellular damage in the retina, which helps in delaying the progression of AMD and vision loss. Zinc is also possibly effective for the treatment of Acne, osteoporosis, preventing and treating pneumonia (Gerd *et al.*, 2013).

COPPER METAL

The metals and its alloys have been used for thousands of years. In the Roman era, copper was principally mined on Cyprus, hence the origin of the name of the metal as cuprium (metal of Cyprus), later shortened to cuprum.

Its compounds are commonly encountered as copper(II) salt, which often impart blue or green colours to minerals such as azurite and turquoise and have been widely used historically as pigment. Copper compounds are used as bacteriostatic substances, fungicides and wood preservatives (Johnson and Lary, 2005).

Copper in human blood is principally distributed between the erythrocytes and the plasma. In erythrocytes most copper (60%) occurs as the copper-zinc metalloenzyme superoxide dismutase, the remaining 40% being loosely bound to other proteins and amino acids.

Total erythrocyte copper in normal humans is around 0.9- 1.0 µg/ml of packed red cell (Manson, 1979; Underwood, 1977).

According to Manson, 1979 plasma or serum copper in normal humans is in the range 0.8-1.2 µg/ml and is not significantly influenced by cyclical rhythms or by feeding. The mean value for females is about 10% higher, than that for males and is elevated by a factor of up to 3 in late pregnancy and in women taking estrogen based oral contraceptives.

DIETARY SOURCES OF COPPER

Copper is an essential trace mineral that cannot be formed by the human body. It must be ingested from dietary sources. Food contributes virtually all of the copper consumed by humans (Georgopoulos *et al.*, 2001).

The best dietary sources include sea food (especially shellfish), organ meats (e.g liver), whole grains, legumes (e.g beans and lentils) and chocolate. Nuts, including peanuts and pecans, are especially rich in copper, as are grains such as wheat and rye, and several fruits including lemons and raisins (Sadhra *et al.*, 2007).

According to W.H.O, other food sources that contain copper include cereals, potatoes, peas, red meat, mushrooms, fruits (coconuts, papaya and apples), tea, rice and chicken are relatively low in copper, but can provide a reasonable amount of copper when they are consumed in significant amount.

COPPER DEFICIENCY

High intakes of zinc can significantly decrease copper absorption. The deficiency in copper can cause many hematological manifestations, such as myelodysplasia, anemia, leukopenia (low count of neutrophils). A type of white blood cells that often caused the first line of defense for the immune system (Halfon *et al.*, 2008).

Increased consumption of zinc is another cause of copper deficiency (Kumar, 2006)

According to Kodama & Fujisawa, 2006, Menkes disease is a hereditary condition caused by a defective gene involved with the metabolism of copper in the body. Menkes disease involves a wide variety of symptoms including floppy muscle tone, seizures, abnormally low temperatures, and a peculiar steel colour hair that feels very rough.

Another rarer cause of copper deficiency is coeliac disease, probably due to malabsorption in the intestines. It is rarely suggested that excess iron supplementation causes copper deficiency myelopathy (Jaiser & Winston, 2010)

COPPER METAL AND HEALTH

Copper is a mineral that is found throughout the body. It helps our body make red blood cells and keeps nerve cells and your immune system healthy (Araya *et al.*, 2006).

It also helps form collagen, a key part of bones and connective tissue. Copper may also act as an antioxidant, getting rid of free radicals that can damage cells and D.N.A. Copper helps the body absorb iron and your body needs copper to make energy (Bugel *et al.*, 2005).

Too much copper can cause nausea, vomiting, stomach pain, headache, dizziness, weakness, diarrhea, and a metallic taste in the mouth. Copper

toxicity is rare but can cause heart problems, jaundice, coma and even death. Do not use copper supplements if diarrhea is present (Tamura and Turnlund, 2004).

According to Tamura and Turnlund 2004 water containing copper concentration greater than 6mg/l may cause stomach problems such as nausea and vomiting if you have well water, you may want to get the water tested for mineral content.

SELENIUM

Selenium (selene) meaning Moon was discovered in 1817 by Jons J. B. and Johan G. G. (Berzelius, 1818). Selenium came to medical notice later because of its toxicity to human beings working in industries. Selenium was also recognized as an important veterinary toxin, which is seen in animals that have eaten high selenium plants in 1954, the first hints of specific biological functions of selenium were discovered in microorganisms (Stadtman, 2002).

In living systems, selenium is found in the amino acids selenomethionine, selenocysteine, and methylselenocysteine. In these compounds, selenium plays a role analogous to that of sulfur.

Another naturally occurring organic selenium compound is dimethyl selenide (Wessjohann *et al.*, 2007)

Selenium is a catalyst in some chemical reactions but it is not widely used because of issues with toxicity. In x-ray crystallography incorporation of one or more selenium atoms in place of sulfur helps with multi-wavelength anomalous dispersion and single wavelength anomalous dispersion phasing (Kasap *et al.*, 2009).

Selenium is used in the toning of photographic prints, and it is sold as a toner by numerous photographic manufacturers. Its use intensifies, and extends the total range of black and white photographic images and improves the permanence of prints (Penichon 2003).

SOURCE OF SELENIUM

Selenium is an essential mineral and micro nutrient. It is found in meat, seafood (hence, selenium levels are high in populations with high intake of seafood like the Inuit population) (Hansen *et al.*, 2004), grain cereals, egg yolk, milk, Brazil nuts, mushrooms and garlic (Brown and Arthur, 2001).

Dietary selenium comes from nuts, cereals, meat, mushrooms, fish, eggs. Brazil nuts are the richest ordinary dietary source (though this is soil-dependent) in descending order of concentration, high levels are

also found in kidney, tuna, crab and lobster (Barclay *et al.*, 2002).

The human body's content of selenium is believed to be in the 13-20 milligram range (Zane, 2008).

DEFICIENCY OF SELENIUM

According to Rayman(1997) in general, selenium is though to be important in a number of varied aspect of health (for a healthy immune system, for a protective effect against some forms of cancer, to maintain and enhance male fertility, for a reduction in cardiovascular mortality and to regulate inflammatory markers in asthma).

Selenium deficiency is associated with Keshan disease and Kashin-Bek disease (Zhang *et al.*, 2001), deficiency in trauma and burns patients (Berger, 2006). Selenium deficiency may help to precipitate hypothyroidism and autoimmune-thyroid disease and supplementation may contribute to prevention of these diseases.

People that at risk of selenium deficiency are associated with risk factors like poor dietary intake, smoking(smokers have lower levels of selenium compared with non-smokers) at socio-economic status (lower educational attainment), the elderly living in residential or nursing homes had lower levels of selenium (Batas *et al.*, 2002).

Patients on total parental nutrition, vegetarians in countries with low selenium status(Ishidah *et al.*, 2003). Areas with a low selenium soil environment are associated with deficiency.(Dodig and Cepelak, 2004).

SELENIUM AND HEALTH

In humans, selenium is a trace element nutrient that functions as cofactor for reduction of antioxidant enzymes, such as glutathione peroxidases selenium plays a role in the functioning of the thyroid gland and in every cell that uses thyroid hormone selenium may inhibit Hashimoto's disease in which the body's own thyroid cells are attacked as alien (Mazokopakis *et al.*, 2007).

Selenium as a constituent of seleno proteins, is needed for the proper functioning of the immune system and appears to be key nutrient in counteracting the development of virulence and inhibiting HIV progression to AIDS. It is required for sperm motility. An elevated selenium intake may be associated with reduced cancer risk (Rayman, 2001).

PETROLEUM

Petroleum meaning rock is a naturally occurring yellow-to-black liquid found geological formations beneath the

Earth's surface, which is commonly refined into various types of fuels. (Concise Oxford English Dictionary, 2011).

It is refined and separated, most easily by distillation into a large number of consumer products, from gasoline(petrol)and kerosene to asphalt and chemical reagents used to make plastics and pharmaceuticals. In its strictest sense, petroleum includes only crude oil, but in common usage it includes all liquids, gaseous solid hydrocarbon. Under surface pressure and temperature conditions, lighter hydrocarbons methane, ethane, propane and butane occur as gases while pentane and heavier ones are in the form of liquids or solids. The hydrocarbons in crude oil are mostly alkanes, cycloalkanes and various aromatic hydrocarbons contain Nitrogen, oxygen and sulfur and trace amounts of metals such as iron, nickel, copper and vanadium (Ollivier and Magot, 2005).

Petroleum and crude oil cause birth defects and it is known to cause leukaemia in humans (Kirkeleit, 2010). The compound is also known to lower the white blood cell count in humans, which would leave people exposed to it more susceptible to infections.

COMPOSITION OF PETROLEUM

It consists of hydrocarbons of various molecular weights and other organic compounds.

HYDROCARBONS

1. Alkanes: Alkanes are saturated hydrogen and carbon (hydrocarbon). They are the main commercial source of petroleum (Arora, 2006) emission of gaseous and volatile alkanes has also been documented at low levels, though they are not generally considered to be a major component of biogenic air pollution (Kesselmeier and Staudt, 1999). The higher liquid alkanes are highly flammable, although this risk decreases with the length of the carbon chain. Pentane, hexane, heptane and octane are classed as dangerous for environment and harmful (Morrison and Boyd, 1992).
2. Unsaturated hydrocarbons alkenes.
3. Cycloalkanes.
4. Aromatic hydrocarbons: The simplest possible aromatic hydrocarbon is benzene. Benzene increases the risk of cancer and other illnesses. Benzene is a notorious cause of bone marrow failure (Kasper *et al.*, 2004). The specific hematologic malignancies that benzene is associated with includes. Acute myeloid leukemia (AMLs), aplastic anemia, myelodysplastic syndrome (MDS), acute lymphoblastic leukemia (ALL), and chronic myeloid leukemia (CML)(Smith and Marlyn, 2010).

Some woman who inhaled high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. Men exposed to high levels of benzene are more likely to have an abnormal amount of chromosomes in their sperm, which impact fertility and fetal development. (Environmental Health News).

ORGANIC COMPOUNDS

An organic compound is any member of a large class of gaseous, liquid or solid chemical compounds whose molecules contain carbon (Spencer and Michael, 2004).

POLLUTANTS

A pollutant is a substance or energy introduced into the environment that has undesired effects or adversely affects the usefulness of a resource. A pollutant may cause long or short term damage by changing the growth rate of plant or animal species or by interfering with human amenities, comfort, health or properly valve (Tietenbery, 2006).

PETROLEUM POLLUTANT AND HEALTH

> CARBON MONOXIDE

It is the most common type of fatal air poisoning in many countries (Omaye, 2002). The most common type symptoms of carbon monoxide poisoning include headache, nausea, vomiting, dizziness, fatigue and feeling of weakness (Blumenthal, 2001).

> SULPHUR DIOXIDE (SO₂)

Sulfur dioxide is a major air pollutant and has significant impact upon human health. In addition, the concentration of sulfur dioxide in the atmosphere can influence the habitat suitability for plant communities, as well as animals life (Hogan and Micharel 2010).

> BENZENE

Long-term exposure to excessive levels of benzene in the air causes leukaemia, a potentially fatal cancer of the blood-forming organs. (W.H.O). Because benzene is ubiquitous in gasoline and hydrocarbon fuels are in use everywhere, human exposure to benzene is a global health problem. Benzene targets liver, kidney, lung, health and brain (Huff, 2007, Rana and Verma 2005)

> NITROGEN OXIDE

Nitrogen oxide are family of gases that can cause a number of serious health effects. It is unhealthy to breathe, especially for children, the elderly asthmatics

and people with chronic obstructive pulmonary disease (Stockholm Environment Institute, S.E.I, 2012).

PETROL POLLUTANTS AND TRACE ELEMENT

Zinc is necessary for optimal physical performance. Energy levels and body composition but when the body is exposed to petrol pollutant e.g benzene, when inhaled causes drowsiness, dizziness, rapid or irregular heartbeat, unconsciousness even death. (Chasapis *et al.*, 2011).

According to W.H.O benzene causes cancer, in human zinc level is decreased in the body by petrol pollutant the body is exposed to effect of cancer. Which is caused by benzene.

Zinc plays a biological role in immunity, can be inactive by inhaling pollutants from petrol affecting the immune system, increasing the chance of infection (Wong and Ho, 2012).

However copper which is incorporated into a variety of proteins and metalloenzymes which perform essential metabolic functions (Scheiber *et al.*, 2013). Copper is necessary for the proper growth, development and maintenance of bone, connective tissue, brain, heart and many body organs. When exposed to petroleum pollutants affects respiratory organs and cause heart problems making the copper level low and exposing the body to several respiratory and heart conditions along with cancer (Smith and Marylyn, 2010).

Copper is involved in the formation of red blood cells, the absorption and utilization of iron, lead emitted from petrol pollutants affects the red blood cell formation by making copper level lower to form red blood cells (Lead in Air) (Scheiber *et al.*, 2013).

Furthermore petroleum pollutants like sulfur dioxide which is associated with increased respiratory symptoms and diseases, difficulty in breathing and causes preterm birth (Shah and Balkhair 2011) affects the effect of trace element in the body to produce immunity against diseases making the selenium level low (Ralston and Raymond 2010).

Conclusively petrol pollutants which causes breathing and respiratory system, damage to lungs and tissue causes cancer. In elderly and children to people causes chronic lung disease, influenza and asthma, causes anemia, kidney disease, reproductive disorders, seizures behavioural disorders, hypertension, heart failure, inflammation (Prockop and Schickova 2007), reduce fertility in males (Golub and Mar, 2005).

Affects the cardiovascular system, kidneys and immune system (Bergeson, 2008) reduces, the level of

the trace element in the body of an petroleum attendant exposed to petroleum pollutants making the functions of the trace element reduces and giving room for problems and diseases.

ZINC-COPPER

Zinc copper is an alloy of zinc and copper that is employed as a reagent in organic synthesis (Howard and Ronald, 1959).

Zinc overdose, might be a legitimate cause of copper deprivation. Concerns arise when you take several supplements that each contains zinc. The tolerable upper limit, exists and affect copper .

Balancing copper and zinc, through vitally important may not be as easy as expected. Exposure to metal like lead can push zinc out. Iron, particularly from supplements, may inhibit intestinal absorption of both zinc and copper through competition for transport molecules located in the gut. Wilson's disease the inability to metabolize copper out of the body require zinc therapy and dietary change that precludes mushroom, nuts, chocolate (Chasapis, 2011) .

Copper and zinc are regarded as neurotransmitters and are in high concentrations in brain lipocampus. As a result elevated copper and depressed zinc have been associated with copper hyperactivity, attention deficit disorders behaviour disorders and depression (Jeremy, 2015).

Copper and zinc work together to support metabolism. Both minerals help to activate the enzyme copper zinc superoxide dismutase, also called CuZnSOD. This enzyme serves as an antioxidant, which means that it protects your cells from harmful reactive oxygen species. (Sylvie , 2012).

ZINC-SELENIUM

Selenium and zinc play a role in reproduction. Both zinc and selenium are required for healthy immune function, which makes these nutrients vital for keeping the body free of disease and common illness (Polofka *et al.*, 2012).

Zinc plays roles on immune function, protein synthesis, cell division and wound healing in addition, zinc is important for normal growth and development during childhood and pregnancy selenium is important for reproduction, thyroid function, DHA synthesis and protecting the body from oxidative damage and infection.

Severe zinc deficiency and selenium deficiency is associated with several types of cancer including skin cancer.

Inherited disorder of impaired zinc absorption characterized by erosive dermatitis, diarrhea and alopecia selenium imbalance, both deficiency and excess causes skin abnormalities. Moderate zinc deficiency causes pigmentation changes, decreased hair and nail growth and skin lesions on body sites exposed to repeated pressure and friction (Kumar *et al.*, 2012, Rostan *et al.*, 2002).

Conclusion

A trace element is a dietary element that is needed in very minute quantities for the proper growth, development, and physiology of the organism. Zinc is an essential mineral perceived by the public today as being of "exceptional biologic and public health importance", especially increasingly by regarding prenatal and postnatal development. Zinc deficiency affects about two billion people in the developing world and is associated with many diseases. Copper is involved in the formation of red blood cells, the absorption and utilization of iron, lead emitted from petrol pollutants affects the red blood cell formation by making copper level lower to form red blood cells. Petrol pollutants which causes breathing and respiratory system, damage to lungs and tissue causes cancer. Balancing copper and zinc, through vitally important may not be as easy as expected. Exposure to metal like lead can push zinc out. Wilson's disease the inability to metabolize copper out of the body require zinc therapy and dietary change that precludes mushroom, nuts, chocolate.

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