

Physiological effects of iron as a trace element

1 Ali A.Khaled

2.Naimah Hussein Mansour

1chemistry department faculty of education/university of tobruk, libya

2 biology department faculty of education/ university of tobruk, libya

Abstract :

Recently, trace metals have been identified that are present in large quantities in living tissues and cells (chromium (cr) , cobalt (co), iron (fe), iodine (i), copper (cu), manganese (mn), molybdenum (mo), selenium (se), zinc (zn), fluorine (f), silicon (si)). It is necessary for reasons of interest in biological physiology, and is therefore considered an essential components for growth. Trace elements have basic physiological functions. Iron (fe) binds increased oxygen, while manganese, molybdenum, and zinc (zn, mo, mn) carry out metabolic stimulation, in addition to selenium and iodine (se , i) , which are responsible for hormonal influences . Trace elements are found in small compositions, but it is essential for growth and physiological functions metabolic processes occurring within trophozoite tissues, such as enzymes structure and function, bone and blood maintenance, immune responses or transmission of impulses also depend on trace elements.

It must have a strong weight system applied to obtain the series of elements necessary to perform the functions of its biochemistry. Through this paper we will study the matrix of trace elements and their causes of invisibility in cells, and discuss the symptoms of apparent trace definition of shortcomings in the elements and development of the general concept.

Aim of this study is to identify trace elements in the field of biochemistry and pharmaceutical applications.

There is only industrial, organic, pharmaceutical, mineral compounds which used as anti-cancer treatments, inflammation, antidiuretic medication or antimicrobial agent. To prevent these studies from understanding the main effects of elements on companions and their links to organ functions.

keywords : trace elements , human health , metal-based drugs , nutrition.

1. Introduction:

Minerals are inorganic substances found in tissues and fluids. They are divided into two types. They may be large (major) minerals, and they are called large because the body consumes them in large quantities , they are (Ca, Mg, K, Na, Cl, P, S), The second type is secondary microminerals, which the body consumes small quantities such as (I, Zn, Si, Fe, Mn, Cu, Co, Mo, F, Cr) , [1, 2, 3] , Trace elements are found in disturbed nature in small quantities, it plays a vital role in various physiological processes and metabolism within living tissues. It also strengthens bones and contributes to the transmission of nerve impulses during enzymatic structure. As for iron, it is the most abundant element in human serum, followed by zinc and copper, while cobalt, iodine and selenium, Boron, molybdenum and chromium are ultra-trace elements and are found in the smallest quantities measured in ppb, parts per billion (abbreviated as ppb from parts per billion) is an expression used to indicate trace concentrations in the chemical composition of substances, and mathematically corresponds to the expression 10^{-9} [5]. A wide variety of minerals are associated with different vital functions, and some of them affect in similar ways, as for micro-minerals (Cu, Fe, Mn, Se, Zn) are necessary for the formation of the structural part of enzymes. And red blood cells. For example, manganese plays an important role in combating free radicals because it is part of one of the enzymes responsible for that. It is also one of

the components of other metabolic enzymes that contribute to the digestion and breakdown of proteins, carbohydrates, and cholesterol, in addition to its role in promoting cell division and maintaining coagulation level blood. On the other hand, the elements (co, i, and fe) contribute to regulating the levels of glucose activation. For oxidation, the element (mo) affects the formation of anti-oxidant enzymes, and may participate with copper, selenium and zinc in various immune processes [2].

Since minerals are not produced by the body but have an essential role in performing vital functions, and therefore a specific diet must be followed to obtain them [6,7], the availability of macro- and micro-minerals will depend on following a diverse and balanced diet. Vegetables, fruits, and meat are sources of a series of minerals. Of the elements [2, 3], but it does not reflect the total amount available for absorption by the body, because the bioavailability of the mineral is the part that is absorbed and used in physiological functions, therefore, it depends on the process of digestion, and its release from the food matrix. The rate of absorption by intestinal cells of the target element in biochemical and quantitative processes. And its transfer to cells [1, 2].

In general, minerals are absorbed in different parts of the body, such as the digestive system (the duodenum, jejunum, and ileum: which is the last part of the small intestine), and the absorbed minerals are transported through the intestinal epithelial cells into the cytosol and pass through Membrane into the blood by active transport mechanism, if the metal is not transported through the membrane, it will remain in the intestinal cell attached to the proteins. For example, iron ions bind to ferritin and zinc to metallothionein, minerals that are not absorbed. It is usually excreted to the outside, which is a mechanism that protects the body of the toxicity that can be caused by

excessive absorption of minerals [1, 2], and if minerals are not available in sufficient quantities, deficiencies arise, and may appear Certain symptoms, as the percentage of decline in any essential element cannot be corrected without completing its biological presence. For minerals to become bioavailable, they must be absorbable[7], and recently, there are many Pharmaceutical industries and pharmaceutical products are used to supplement these minerals [8, 9, 10, 11]. For example, lactoferrin is a multivitamin and protein.

This nutritional supplement contains iron, which is a medical supplement rich in iron. Thus, nutritional supplements are rich in trace minerals (iron, zinc, manganese, etc.), and they have an important role in physiological functions and biological processes [12, 13].

It is possible to delve into mineral-based medicines, which are inorganic compounds used in medicinal chemistry and are considered among the... Long-acting therapeutic agents, applied as mineral complexes in Anti-cancer, anti-inflammatory, and diabetes medications, used as antimicrobial agents, and anti-huntington's disease agents, Atherosclerosis and wilson's disease [14, 15, 16]. Using metal drugs and active pharmaceutical preparations, it has been proven that it is possible to control the cytotoxicity of metal ions by The appropriate choice of ligands [14], as the redox metabolism in cancer cells is not comparable to healthy tissues and its levels are different, Because oxygen molecules are reactive inside cells (ros) or cancer cells With cellular redox balance, which opens the way for cancer treatment [17]. The presence of these cells is essential in the diagnosis of hodgkin lymphoma, and the absence of reed-sternberg cells has a high negative predictive value. In fact, antioxidants work to resist free radicals and protect healthy cells. And prevents the formation of tumors,however,

what the researchers found in the case of melanoma skin cancer - for example - was different. It was found that antioxidants double the risk of the spread and development of melanoma skin cancer. It enhanced the ability of cancer cells to divide.

2. Methodology and discussion:

According to the procedural method and discussion of previous studies, in this study, we will follow The inductive method, which is the research method in biochemistry, biology, medical sciences, and pharmaceutical pharmacology. Our goal is to reveal the regularity of phenomena associated with trace elements and their folding under certain biological and physiological laws. We will clarify the difference between induction and deduction through this research, which transforms many observations to serve as general rules, unlike deduction, which depends on dividing the general rule into many parts. From the results, however, we collect previous studies to form a general rule again, and the reason for this is that the manufacture of mineral complexes has proven successful as an anti-cancer substance (including copper and manganese) in order to balance cellular oxidation and reduction, as the change in oxidation works to change Oxidative stress conditions and its molecular effects on malignant tumors, and this in itself is a general rule.

Therefore, they have been considered as therapeutics for tumors as well as guidelines in the development of redox-active metal drugs [11, 17].

Opinions vary about the role and impact of trace elements on human physiology and biological processes, and there is a lot of research information, in the field of trace minerals such as iron, Zinc, copper,

manganese, and fluoride and their relationship to the state of the physiological and biological situation.

It was found that iron is an essential element for all living organisms because it participates in metabolic processes, oxygen transport, and the synthesis of deoxyribonucleic acid. (dna) And the transfer of electrons.

It has an important role during infections and achieves The immune response to infection, and it also forms free radicals, Therefore, its concentration must be carefully within the permissible values, because its excess causes serious damage to tissues. Iron metabolism disorders are among the most common health problems and cause diseases with diverse clinical manifestations.

As a result of iron deficiency or excess, including neurodegenerative diseases [9, 18, 19]. We find that Red meat, cabbage, various grains, nuts and shellfish are sources of iron. Men need about 8 mg of iron, while women need about 18 mg [20, 21].

Iron absorbed from food travels into the bloodstream toward the small intestine Intestinal disorders, such as refractory disease, often affect the intestine's ability to absorb essential nutrients and iron In biological processes. Generally, it happens, Iron absorption is mainly in the duodenum and upper part Fasting, as for inhibitors, they include phytates and polyphenols (tannins, phenolic acids and flavonoids), as well as Dietary fiber, protein, calcium, and iron absorption can be facilitated by Ascorbic acid, citric acid, and amino acids [9, 18, 22]. As for dietary iron, it has two forms.

Chemists, found that iron in hemoglobin, (heme), Myoglobin, (non-heme), enzymes, is bioavailable, and mainly iron present In plant foods, some

animal sources, as well as enzymes And ferritin [1, 23]. Iron concentrations in plasma and also in tissues are constant.

Absorption and maintenance of iron stores in the body are regulated, and thus systemic iron balance is controlled by a variety of proteins, with hepcidin being the main protein , Which is regulated through its association with ferroportin [1], and iron deficiency leads to anemia.

In this case, the red blood cells are smaller, and thus the blood count decreases Hemoglobin [1, 9] and iron deficiency anemia are common diseases. Factors for blood deficiency in women include heavy blood loss during the menstrual cycle, bleeding resulting from injury, or chronic blood loss, and it is considered anemia.

Cause of stomach ulcers, hemorrhoids, varicose veins, the spread of parasites, ulcerative colitis or Malignant diseases of the uterus and colon, Low intake of bioavailable iron, in a vegetarian who does not consume enough heme iron, and insufficient absorption, which leads to Diarrhea and intestinal disorders such as digestive disorders, atrophic gastritis, Or partial or total gastrectomy, or intervention with various medications, and the reason may be the presence of inhibitors in the stomach Diet such as grains and vegetables, and there may be iron deficiency, It may occur during childhood, adolescence, pregnancy, and lactation when it is not taken in quantities necessary for blood volume growth, and failure to release iron from plasma reserves due to Inflammation or chronic disease [1, 9, 24].

Anemia can be corrected by taking iron supplements, which are iron (ii) salts, in relatively high doses, including ferrous sulfate or ferrous gluconate, which are the most common.

It is characterized by low cost and high bioavailability. To prevent iron deficiency, One should eat foods that contain an appropriate amount of iron [24].

On the other hand, medical tests are performed to detect hemochromatosis, since it is a hereditary condition resulting from an increase in the percentage of iron in the blood.

It leads to gradual lesions in the liver, pancreas, heart and organs, and causes an absorption process Iron is three times greater than normal, and is considered a men's most susceptible to this disease is the physiological mechanisms.

It is not restricted by time periods, unlike women who have time restrictions, such as in the menstrual cycle, pregnancy, and breastfeeding [1].

Nanocatalysts of single iron atoms Sequestered in nitrogen-doped carbon can catalyze the peroxidase-like reaction, thus producing hydroxyl radical to kill gram-positive bacteria (staphylococcus aureus) And gram-negative (escherichia coli) in the presence of H_2O_2 . In the living body, this is one atom of iron It has also been observed that nanocatalysts are able to eliminate bacterial infections spread in wounds by escherichia coli and staphylococcus aureus, which have been identified as one of the Pathogens [25], and it has Two iron (iii) compounds carrying the compound tri-aminobisphenolate were manufactured, and it was found that they are toxic compounds for breast cells and are among the causes of Adenocarcinoma and cervical cancer, in addition to being a good antibacterial It works to stop tuberculosis activity [26].

Recently, mixed iron (iii) complexes containing amino acids isonitrosoacetophenone [27] and have been shown to be powerful anti-

cancer compounds It is among the factors that can be developed as anti-cancer drugs, in addition to antimicrobial activity Fe(iii) complexes were also screened against both gram-positive and gram-negative bacteria (staphylococcus, bacillus subtilis, escherichia coli, pseudomonas aeruginosa) and fungus candida albicans showed that iron compounds were more active against gram Positive bacteria, which has proven that the complexes have antifungal activity and inhibit the growth of candida albicans, and this is what has been proven.

In recent studies of the anti-cancer effect and the pharmacological mechanism of the disease The effectiveness of the compound phenanthroline fe (ii) [28], and by selectively transferring this compound to Esophageal squamous cell carcinoma, gave promising results for transferrin 1 (tfr1) Through cellular analysis by tfr1, it was shown to be dose-dependently anti-cancer The effect of the fe(ii) complex stops the cell cycle in the g0/g1 phase by preventing... Cdk4/6-cyclin d1 complex and mitochondria-mediated apoptosis, and from establishment fe(ii) complex results in an excessive accumulation of reactive oxygen species.

It is what activates thioredoxin reductase and double-strand dna breakage, which in turn produces chk1/2 and p53. It was also found that fe(ii) combination treatment with cisplatin It has a synergistic effect in escc cells, suggesting the use of this compound As a chemotherapy for esophageal squamous cell carcinoma, especially for patients with tfr1 Overexpression, It is a nanomedicine that can release tumor-specific chemotherapy drugs and reactive oxygen species (ros), and by developing generation using encapsulated iron oxide nanoparticles and β -lapachone in Nanostructure assembled by a h2o2-responsive multidrug polymer [29], and succeeded in the anti-tumor effect, The drug was approved and thus generated ros in vitro

combination chemotherapy for cancer known as chemodynamic compound was demonstrated and invented Two isothiocyanate iron (iii) compounds containing 2,2'-[2,6-pyridinediylbis(ethylidyne-1-)Hydrazinyl-2-ylidene)]bis[n,n,n-trimethyl-2-oxoethanaminium] Dichloride (H_2LCl_2), and It was synthesized and studied [30] and resulted in testing for cytotoxic activity and new as (iii) complexes.

It compared to five lines of cancer cells and one line of normal cells, to get the same results compared with Obtained complexes of Co(II) , Ni(II) , Mn(II) , Zn(II) , and Cd(II) that have the same composition as another Previously made [31, 32, 33, 34], where the cytotoxic activities of the complexes were lower For all malignant cell lines of cisplatin activity, and from another point of view, it is found that Fe(III) , Co(II) , and Cd(II) complexes was observed. And iron (iii) complexes as well It has a more effective antimicrobial activity than the compounds H_2LCl_2 and $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$, but they represent minimum inhibitory concentration (MIC) values higher than standard values Because antimicrobial agents demonstrate activity against gram-positive bacteria Gram-negative bacterial strains [30], Thus, Fe(II) complex with the basic schiff bond derived from 2-amino-3-hydroxypyridine and 3- The success in preparing methoxysalicylaldehyde [35] was decisive, which demonstrated that the schiff base of the Fe(II) compound It allows the corresponding metal oxide nanoparticles to be tested for in vitro biological activities as both gram-negative bacteria (*Escherichia coli* and *Serratia marcescens*) and gram-positive bacteria.

Bacteria (*Micrococcus luteus*) and three strains of fungi (*Aspergillus flavus*, *Getrichm*) *Candida* and *Fusarium oxysporum*). It was revealed that there are more iron complexes Of the antimicrobial activity of free base schiff, but nano-sized metal oxide has Highest activity, meaning that the Fe(II) complex

also interacts with dna through the intercalary binding mode It shows toxic activity on colon and liver cancer cells.

3. Conclusion :

In conclusion, it can be said that the trace elements, or minerals, are naturally occurring chemical components In precise proportions and concentrations, it is necessary for optimal development, growth, metabolic performance, metabolism in cells, effective immune function, and reproduction.

The balance of trace elements varies in living organisms. Their concentrations are relatively constant, and these minerals have negative or positive charges that are absorbed by the digestive system. They are necessary for the body from a structural and functional standpoint. There are approximately (26) small or large mineral elements from which the body originates, and these chemical supplements , not to be shortchanged , they are not broken down into smaller compounds, and these elements are absorbed into the body in the form of ions in the presence of hydrochloric acid in the stomach. It is necessary to have a careful balance To concentrate iron to ensure health Through this paper, we studied iron as one of the trace elements, and by discussing previous studies, we find that iron is an essential mineral that the body needs to produce hemoglobin and myoglobin, which are proteins that transport oxygen around the body. Excessive iron causes cancer in organisms. As we indicated in this study, the presence of large amounts of heme iron may increase the risk of colon cancer. Iron can be found naturally in food sources, and in the case of iron deficiency, ferritin protein can be taken, which may help restore iron storage in the blood, and compensate for the decline in iron.

If iron level is below the normal range, which may cause a malfunction in the body's functions and the occurrence of many diseases. Therefore, iron deficiency is compensated for using a group of medications and nutritional supplements, under medical supervision.

Through this research paper, we present proposals for farther investigations , to contribute and intensifying the development of physiological, medical, biochemical and biological concepts related to trace elements, given their great impact on major living organisms.

It begins with the quantitative and qualitative analysis of trace elements, and the main concepts of compounds and pharmaceutical preparations that contain trace element salts, and thus studies the techniques and methods of their analysis, developments in analysis technology in various fields, and conducts research on the environment of those elements, and the necessities of medical analyzes including it is compatible with emerging scientific ambitions and innovations.

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