ISSN NO: 2770-0003
Date of Publication: 04-11-2022

Recent statistical studies of zinc and its effect on the human body

Hiba Yousef Saleh , Ameer Kamil Hamzah
Medical Technical Institute, Al- Mansour, Middle Technical University, Iraq
Hiba.yousif.saleh@mtu.edu.iq ; ameeralkk@mtu.edu.iq

Abstract: Compared with many other metal ions with similar chemical properties, zinc is relatively harmless. Except when exposed to high doses, it has toxic effects, making it severe Intoxication; Long-term high doses of zinc also interfere with copper absorption. Hence it causes copper deficiency. Since zinc has a prominent role in brain cell death, cytotoxicity as a result of this includes ischemia or shock accumulation of free zinc. Rather than being a toxic metal (ion), zinc is an essential element. While overexposure poisoning is rare, zinc deficiency is widespread and has a detrimental effect on neuronal growth and immunity, and in severe cases its consequences are fatal. Deficiency caused by poor diet and foods with low bioavailability, aging, disease, or unregulated homeostasis is a more common hazard to human health. This study includes a statistical explanation of the natural ratios found in the human body, as well as statistical studies on the protocol used to take zinc in the quantities that must be taken to avoid infection with viruses, especially the Corona virus.

Keyword: Zinc, toxic effects, human health, Corona virus

Introduction

In the periodic table of the elements, zinc can be found in group IIb, with two toxic metals cadmium and mercury. However, zinc is considered relatively non-toxic to humans [1]. and according to Toxnet Database of the US National Library of Medicine, the oral LD50 of zinc is close to 3 g/kg body weight, more than 10 times that of cadmium and 50 times higher than that of mercury [2]. An important factor is zinc balance, allowing effective oral administration of excess zinc intake, [3]. Zinc is an essential element not only for humans, but for all living things. It is made up of more than 300 enzymes and more than the number of other proteins, which confirms its indispensable role for human health. [4].In this article, we will present a brief summary of zinc, followed by a description of the effects of acute zinc poisoning and the consequences of long-term exposure to high amounts of zinc, which has a prominent role in neuronal death. Finally, we will also briefly discuss the adverse effects of zinc deficiency, because unless they are exposed to zinc in the workplace or by chance, healthy individuals are at a much greater risk of zinc-related adverse effects[5].

The human body contains 2-3 grams of zinc, of which approximately 90% is found in muscles, bones and other organs. Estimated concentrations of zinc include the prostate, liver, digestive system and kidneys, in addition to the skin, lungs and brain, as well as the heart and pancreas. Oral zinc absorption leads to absorption throughout the body and then the small intestine and distribution through the plasma, which contains many proteins such as albumin, α-microglobulin, and transferrin, The physiological role of zinc is the formation of mineral enzymes such as alcohol dehydrogenase, Cu-Zn, metalloenzymes superoxide dismutase, DNA and RNA polymerase . Zinc deficiency leads to a disorder in a number of body functions, especially a disorder in male reproductive function [6], Legumes and grains are the main sources of zinc in food in addition to meat zinc poisoning occurs from irregular consumption for rich nutritional supplement for zinc occupational exposure to zinc is through inhalation of smoke or oxide dust zinc from some industrial processes causes metal smoke fever inhalation of smoke containing zinc usually originates from industrial processes that primarily affect manufacturing workers. In addition, military smoke bombs contain zinc oxide or zinc chloride, which makes for many cases of inhalation[7]. There is some research related to smoke bomb accidents that have similar effects on the respiratory system. However, in none of the incidents was there conclusive evidence that zinc was the main cause of respiratory symptoms. Not only was information about concentrations available, but the inhaled smoke contained several other ingredients besides zinc chloride. Additionally, zinc chloride is generally caustic, so the effects could be heightened from the specific properties of the compound, rather than a direct zinc toxicity effect. In the event of acute

ISSN NO: 2770-0003
Date of Publication: 04-11-2022

poisoning resulting from ingestion of a large amount of zinc, it appears on the poisoner has gastrointestinal symptoms including vomiting, diarrhea, abdominal cramps, and burning in the throat and pharynx. Chronic exposure to zinc also leads to blood changes; Long-term use of zinc-containing nutritional supplements causes anemia [8].

The most well-known effect of inhaling smoke containing zinc is the so-called metal smoke fever (MFF), caused by inhalation of zinc oxide. This acute syndrome is most often caused by inhalation of fresh metal fumes with particle size of less than 1 micrometer per square meter where some jobs and professions such as zinc smelting or welding. Symptoms of this syndrome generally begin a few hours after acute exposure such as fever, muscle soreness, nausea, fatigue and effects on the respiratory system such as chest pain, cough and shortness of breath [9]. It is a symptom of the respiratory system it appears that there is an increase in the number of white blood cells. In the event of ingestion of a large amount of zinc, it is recommended to eat large quantities of milk and cheese because it contains high levels of phosphorous and calcium reduces the absorption of zinc in the digestive system. After zinc absorption, chelating agents are treated with chelating agents, including -CaNa2 and EDTA. Dimercopal can also be used [10].

Conclusions and discussion

It is rare for people to consume a lot of zinc. Usually, excess zinc is caused by the consumption of acidic foods or beverages packed in zinc-coated cans. In certain industries, inhaling zinc oxide fumes can lead to an increase in zinc, causing nausea, vomiting, and diarrhea in sufferers, as mentioned previously. Inhaling zinc oxide fumes can cause rapid breathing, sweating, fever, and a metallic taste in the mouth, a disorder called metal fume fever [11]. The level of zinc in blood and urine samples is measured, but these tests may not accurately determine zinc status.

American researchers from the (Fred Hutchinson Cancer Research Center) presented their study on the effect of zinc in stimulating the body's immunity. The study indicated that in conditions of zinc deficiency, widespread immune effects can be seen, including disruption of B cell growth and disruption of T cell function. They are key pillars of the body's immune system strength ,in another study at the(Zucker Medical Center) in Newyork; researchers noted the role of zinc in cardiovascular disease in individuals with chronic kidney disease and type 2 diabetes, groups that are uniquely at risk of cardiovascular disease and death [12]. It has been found that zinc deficiency increases the inflammatory response resulting from increased oxidative stress in blood vessels, especially in patients with type 2 diabetes.

However, how zinc affects the heart and blood vessels still needs to be better understood in order to use it as a preventative and treatment for cardiovascular disease. It should be noted that some medications for heart failure or blood pressure, such as types of diuretics, may increase the amount of zinc lost in urine [13].

Table No. (1) The normal values of zinc in the human body using statistical standards

age	male	range	Mean	min	max	Female	range	mean	min	max
1-12 month	2_3mg	1mg	2.5mg	2mg	3mg	2_3mg	1mg	2.5mg	2mg	3mg
1_8 years	3_5mg	2mg	4mg	3mg	5mg	3_5mg	2mg	4mg	3mg	5mg
9_18years	7_11mg	4mg	9mg	7mg	11mg	8_9mg	1mg	8.5mg	8mg	9mg
19_30 years	11_20 mg	9mg	10.5mg	11mg	20mg	13_20mg	7mg	11.5mg	13mg	20mg
30+ years	12_25 mg	13mg	18.5mg	12mg	25mg	13_30mg	17mg	16.5mg	13mg	30mg

Mean: It is the average of the observations values, meaning it is the sum of the values divided by their number

Minimum: it is the smallest value seen within the given values

Maximum: it is the value of the largest observed within the given values

ISSN NO: 2770-0003
Date of Publication: 04-11-2022

Range: it is the difference between the largest and smallest value

It is noted from the above table that as the age of the person increases, the normal percentage of zinc needed in the human body increases, taking into consideration by reading the above table that the natural need for zinc in women increases from its value in men as the age increases, as the highest natural value was recorded in women (30 mg), while the highest value for men was (25 mg), noting that the difference increases in women more than the difference in men after the age of thirty years, where it was recorded in women (17 mg) and in men it was recorded as (13 mg).The normal level of zinc in the blood ranges from 13.8-22.9 µmol/L (90-150 µg/dL). In recent studies, it was shown that the symptoms of zinc deficiency appear when zinc concentrations in the blood plasma drop to less than 9.9 µmol/L (65 µg/dL). A study evaluating zinc levels in the blood serum and their relationship to changes in diabetic and aging lens the results of statistics for FBS levels showed a mean of 212.6±14.95 mg/dL for diabetic patients with cataract and moderate 69.9 ± 10.9 mg/dL for individuals with cataracts and statistics for average zinc levels showed 68.6 ± 8.49 mcg/dL for diabetic patients with cataracts and mean 96.07 ± 12.41 mcg/dL for aging individuals [14].

Another study showed that people with cancer may appear to have a zinc increase of 100 mcg/dL and have an increased risk of death than healthy people [15]. Studies showed the relationship of zinc level with the work of the kidneys in the human body, where the results showed that the high level of zinc is not toxic to the kidneys [16].in the other hand, studies indicated the detection of zinc concentration in the blood and indicators of immune system functions in Symptomatic Venous Thromboembolism Patients with symptoms and investigating the relationship between them, as it was proven that there is a defect in the immune system at the cellular and genetic levels in VTE patients [17].

After the Covid-19 pandemic, many studies have proven that taking zinc in quantities according to medically recommended decrease the risk of developing the virus, contributes to strengthening the immune system, and has a major role in recovering from the virus [18].

Table No. (2) shows the recommended daily dose of zinc after the Corona pandemic to reduce the incidence of the disease using statistical criteria

age	male	min	max	mean	Female	min	Max	mean
9_18years	10_15mg	10mg	15mg	12.5mg	9_14mg	9mg	14mg	11.5mg
19_30 years	20_25 mg	20mg	25mg	22.5mg	15_20mg	15mg	20mg	17.5mg
30+ years	25_50 mg	25mg	50mg	37.5mg	25_50mg	25mg	50mg	37.5mg

From the results of the above table, the zinc dose shows us 50 mg as an appropriate dose to reduce infection with viral diseases, especially the Corona virus. Recent studies have indicated that the use of zinc as a preventive measure with a dose of less than 25 milligrams may not be good for elderly women and men (over thirty years) to avoid infection with the virus.

References

1- Bastola, Mrigendra M., et al. "Selenium, copper, zinc and hypertension: An analysis of the National Health and Nutrition Examination Survey (2011–2016)." BMC Cardiovascular Disorders 20.1 (2020): 1-8.
2- Chrastinová, Ľ., et al. "Effect of dietary zinc supplementatiоn on nutrients digestibility and fermentation characteristics of caecal content in physiological experiment with young rabbits." Slovak Journal of Animal Science 49.1 (2016): 23-31.
3- NESSRIN, S. – ABDEL – KHALEK, A. M. – GAD, S. M. 2012. Effect of supplemental zinc, magnesium or iron on performance and some physiological traits of growing rabbits. Asian Journal of Poultry Science, vol. 6 (1), 2012, p. 23–30.

ISSN NO: 2770-0003
Date of Publication: 04-11-2022

4- MEMIŠI, N. – LEVIĆ, J. – ILIĆ, N. 2014. The influence of presence of zinc in diet on production traits of goats. In: Proc. XVI Int. Symposium “Feed Technology” 28-30 October, 2014, Novi Sad, Serbia, p. 78-87, ISBN 978-86-7994-044-5
5- POSPÍŠILOVÁ, D. – PARKÁNYI, V. 2011. Vplyv humínových látok a probiotík na rast a produkčné ukazovatele brojlerových králikov. In: Nové směry v intenzivních a zájmových chovech králíků - XI. Celostátní seminář, 16. 11. 2011, Praha, Česká republika, s. 35–39. ISBN 978-80-7403-083-3
6- Gibson, Rosalind S., and E. L. Ferguson. "Assessment of dietary zinc in a population." The American journal of clinical nutrition 68.2 (1998): 430S-434S.
7- Dutra, Rosilene L., Geny A. Cantos, and Eduardo Carasek. "Analysis of zinc in biological samples by flame atomic absorption spectrometry." Biological trace element research 111.1 (2006): 265-279.
8- Beyersmann, Detmar, and Andrea Hartwig. "Carcinogenic metal compounds: recent insight into molecular and cellular mechanisms." Archives of toxicology 82.8 (2008): 493-512.
9- Honscheid, Andrea, Lothar Rink, and Hajo Haase. "T-lymphocytes: a target for stimulatory and inhibitory effects of zinc ions." Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders) 9.2 (2009): 132-144.
10- Carausu, Elena Mihaela, et al. "Study of serum and saliva biochemical levels for copper, zinc and cooper-zinc imbalance in patients with oral cancer and oral potentially malignant disorders and their prostetical and dsss (disfunctional syndrome of stomatognathic system) treatment." Revista de Chimie 67.9 (2016): 1832-1836.
11- Damianaki, Katerina, et al. "Renal handling of zinc in chronic kidney disease patients and the role of circulating zinc levels in renal function decline." Nephrology Dialysis Transplantation 35.7 (2020): 1163-1170.
12- Sonmez, Rana, and Sahabettin Selek. "Determination of the Reference Range of Zinc and Copper Trace Elements in Turkish Society." Bezmialem Science 9 (2021): S36-S36.
13- Tudor, R., P. D. Zalewski, and R. N. Ratnaike. "Zinc in health and chronic disease." The journal of nutrition, health & aging 9.1 (2005): 45-51.
14- Rahim, Amena, and Khadija Iqbal. "To assess the levels of zinc in serum and changes in the lens of diabetic and senile cataract patients." JPMA-Journal of the Pakistan Medical Association 61.9 (2011): 853.
15- 15 - Wu, Tiejian, et al. "Serum iron, copper and zinc concentrations and risk of cancer mortality in US adults." Annals of epidemiology 14.3 (2004): 195-201.
16- sadat Mirsadeghi, Saghi. "Pbi-131 investigate the effects of zinc on renal function in rats."
17- Wen, Siwan, Fan Yang, and Lemin Wang . "GW26-e0499 Comparison Study of Serum Zinc Concentration and Immune System Functions in Symptomatic Venous Thromboembolism Patients." Journal of the American College of Cardiology 66.16S (2015): C238-C238.
18- Ramos, Eliza Miranda, et al. "Vitamin D, Zinc and Iron in Adult Patients with Covid-19 and Their Action in The Immune Response as Biomarkers: A Case Report." (2021).