

**Evaluation of serum zinc levels in patients with colon cancer in Nanakali Hospital-Erbil**

Research Project

Submitted to the Department of Biology in partial fulfillment of the requirements for the degree of BSc. in Biology

***By***

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**﴿ يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا العِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ﴾**

**صدق الله العظيم**

**سورة المجادلة: الاية 11**

**SUPERVISOR CERTIFICATE**

This research project has been written under my supervision and has been submitted for the award of the degree of BSc. in Biology with my approval as a supervisor.

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**I confirm that all the requirements have been fulfilled.**

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**DEDICATION**

**This work is dedicated to:**

The sake of Allah, my Creator, and my Master, my great teacher and messenger, Mohammed (May Allah bless and grant him), who taught us the purpose of life.

My great parents, who never stop giving of themselves in countless ways, my beloved brother and sisters, to all my family, the symbol of love and giving.

***Kalthum***

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**ABSTRACT**

Malignancy of the colon is one of the commonest causes of death. The aim of this study was to carry out a comparative study to investigate the effect of zinc element on the risk of developing colon cancer; forty blood samples were used to analyze the concentration of Zinc (Zn) in colon cancer patients and healthy individuals there was a significant (p<0.05) decline in the concentration of zn in serum samples of colon patients as on comparison with the healthy individuals. Concentration of Zn of colon cancer patients was decrease in male significantly and non-significantly in female (p<0.05) on comparison with the healthy individuals. There was a significant (p<0.05) deference in the concentration of Zn in same age group between patient in male and female as compared with control group . In age group 30-40 among male and 40-50 among female with colon cancer Zn concentration was declined on comparison with the healthy individuals. Level of difference of Zn remain insignificant (p>0.05) in serum of colon cancer patients in different stages of cancer.

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1. **INTRODUCTION**

Trace elements, also known as trace minerals, are micronutrients that are needed in very small amounts through diet but are critical for the prevention of acute and chronic diseases (Mehri, 2020). They are act as a cofactors in a large number of enzymes that participate in the antioxidant defense system and are related to changes in the body’s homeostatic mechanisms, especially inflammation and oxidative stress, which are vital for optimum health(Powell, 2000). Furthermore deficiency of one of these elements can contribute to a variety of metabolic abnormalities and clinical conditions (Zoroddu et al., 2019).

Zinc (Zn) is a one of the most abundant trace element in the body. It is the most common catalytic metal ion in cell cytoplasm; its levels in healthy individuals vary from 12 to 16 µM, which corresponds to less than 1% of the whole-body zinc. (Rudolf and Rudolf, 2015). It controls the development and neutralizing of protein folding, gene expression, and more than 100 enzymes. Zn plays an important role in cell signals and cellular biology including cell divisions. Low serum zinc levels are linked diabetes; insulin resistance and apoptosis (Farooq et al., 2020).

The risk factors do not fully explain variations in the incidence of complex disorders generally in cancer and colon cancer in particular. [Epidemiological studies](https://www.sciencedirect.com/topics/engineering/epidemiological-study) have implicated perturbations in the trace elements in the etiology of a number of diseases including cancer(Wu et al., 2020).

Animal models have shown that low zinc levels may be associated with pre neoplastic lesions and colonic carcinogenesis(de Medeiros and Tavares, 2020). In intestinal epithelium, zinc regulates proliferation of crypt cells and differentiation of epithelial intestinal cells(Wan and Zhang, 2022). . Several lines of evidence suggest that zinc deficiency causes diarrhea and mucosal barrier dysfunction, while zinc supplementation improves symptoms. Thus, in the intestine, zinc is essential to maintain intestinal homeostasis and regulate intestinal disorder (Ohashi and Fukada, 2019, Zowczak et al., 2001)

**2. MATERIALS AND METHODS**

**2.1. Subjects**

The study group consisted of 40 patients with colon cancer, aged between 30–70 years, admitted to the Department of Oncology at Nanakali hospital all subjects were diagnosed with histopathologically confirmed cancer A progress of the disease was established as local or metastasized. Venous blood samples were collected into plain Tube from patients prior to chemotherapy treatment. The subjects were divided into four groups according to the site of tumor as follows: Stage II: 12 subjects (5 Men; 7 women) Stage III: 11 subjects (6 Men; 5 women) ; Stage IV: 9 subjects (4 men, 5 women) ;Prior to the blood collection 40 healthy blood donors Same age with patient (15 male and 25 female) was recruited as a control group. All studied patients had been informed of the study purpose and Gave written consent. The reported study was approved by the Ethics.

**2.2. Sample Collection**

Venous blood was obtained from all patients and donors. Off-the-clot serum samples without hemolysis were collected and stored at 20˚C until assayed.

**2.3. Statistical Analysis**

The results were expressed as mean ± SD (Graphpadprism version 9.00) software. The analytical data was subjected to one way ANOVA using the same software. The significance was set at P < 0.05.

1. **RESULTS and DISCUSSION**

The study has demonstrated decrease of the mean total serum Zn concentrations in all patient groups with colon cancer compared to the control group. The mean total serum Zn concentrations were found significantly decreased in male groups with colon cancer and compared with the male control group and Non- significant decreasing of serum Zn levels have been observed in women with colon cancer compared with healthy women. The results are shown in Table 1.

Changes in trace element levels may have prognostic significance in complex disorders including colon cancer. A number of molecular roles for the trace elements like Fe and Zn have been identified in differentiation and apoptosis(Altekin et al., 2005)

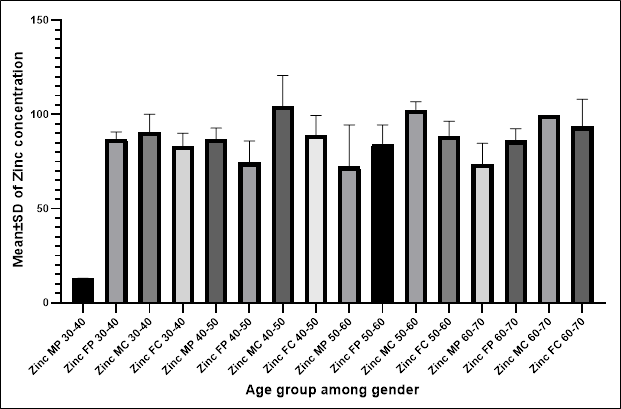
Decreased levels in serum Zn in colon cancer patients may be due to the mobilization of circulating Zn to the colon cancer tissue and its involvement in the antioxidant defense since the patients might be under higher oxidative stress. Zn is an essential cofactor in a variety of enzymes and has antioxidant-like properties. Therefore, it can stabilize macromolecules against radical induced oxidation in vitro as well as limit excess radical production (Powell, 2000).



**Figure1. Showing Zinc concentration among Colon Cancer and healthy individuals. Zinc CM (zinc control male); Zinc CF (zinc control female) Zinc MP (zinc male patient); Zinc PF (zinc patient female).**

Regard to age groups , we observed differences between individual age group there is significant difference between concentration of serum zinc in all same individual age groups between male patient with colon cancer and control healthy male; also between female patient with colon cancer and female healthy subjects.

On the other hand between age groups serum zinc concentration in only male patient age group 30-40 was deceased significantly compared with male patient of other age groups; and in female patients with age group 40-50 also decreased in compared with female patient group in other age groups. Meanwhile there is no difference showed between concentrations of other age groups of different age groups. Zn deficiency is quite common in elderly, frail people since they often avoid meats and other foods that contain this metal to avoid increasing blood cholesterol levels. In addition, they increase the consumption of refined wheat products deficient in Zn and other fiber-rich foods that contain fitates, which limit the intestinal absorption of this trace element(Huskisson et al., 2007); (Vasto et al., 2007). Other causes of deficiency of this micronutrient in the elderly include inadequate food chewing, intestinal malabsorption, psychosocial factors such as depression, pharmacologic interactions(Roohani et al., 2013)The results are shown in Table 1.and figure 2.



**Figure 2. Showing Zinc concentration in different age group among colon Cancer and healthy individuals.**

**Zinc MP (zinc male patient); Zinc FP (zinc female patient); Zinc MC(zinc male control); Zinc FC(zinc female control)**

**Table1. Showing Zinc concentration in different age group among colon Cancer and healthy individuals.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Age groups | Zinc Male Patient | Zinc Male Control | Zinc Female Patient | Zinc Female Control |
| 30-40 | 12.87±0.06455ce | 90.77±4.702ab | 87.13±1.813ad | 83.33±1.951bc |
| 40-50 | 86.97±2.373bd | 104.3±7.365ab | 74.46±6.647ce | 89.17±4.204bc |
| 50-60 | 72.35±15.65cd | 102.5±2.108ab | 84.45±3.547bd | 88.73±3.461bc |
| 60-70 | 73.79±4.44bd | 99.88±0.00ab | 86.16±2.381ad | 93.57±7.273ac |

According to stages of colon cancer and concentration of serum zinc there is no significant difference between colon cancer stages. As show in figure3. The scores of quality of life and fatigue questionnaires were not different between the groups during the chemotherapy. Showed that the intensity of fatigue is constant during the first three cycles of chemotherapy and higher in the seventh cycle. The type of antineoplastic drug and the cumulative cytotoxic effects of chemotherapeutic agents may affect fatigue intensity and quality of life. Zinc deficiency is associated with fatigue intensity in the chronic fatigue syndrome, related to inflammation markers, immune activation and oxidative stress associated with lipid membrane damage. On the other hand, zinc sulfate did not change the occurrence of grade 3 fatigue in oral cavity cancer patients who were undergoing radiation therapy(Ribeiro et al., 2017).

** Figure3. Showing Zinc concentration in deferent stages of colon Cancer.**

**Zinc M2 (zinc male stage2); Zinc F2 (zinc female stage2); Zinc M3 (zinc male stage3); Zinc F3 (zinc female stage3); Zinc M4 (zinc male stage4); Zinc F4 (zinc female stage4)**

**4. CONCLUSIONS**

On the basis of low levels of serum zinc in the cancer colon patients as compared to healthy age matched controls. We strongly suspect that the deficiency of trace elements like zinc may be playing a role as a risk factor in the development of cancer colon. However further studies on larger sample size is required to establish it.

**5. REFERENCES**

ALTEKIN, E., COKER, C., SIŞMAN, A. R., ONVURAL, B., KURALAY, F. & KIRIMLI, O. 2005. The relationship between trace elements and cardiac markers in acute coronary syndromes. *J Trace Elem Med Biol,* 18**,** 235-42.

DE MEDEIROS, K. M. G. & TAVARES, R. L. J. D. E. S. 2020. PROBIÓTICOS COMO COADJUVANTE NA PREVENÇÃO E/OU NO TRATAMENTO DO CÂNCER COLORRETAL. 1.

FAROOQ, D. M., ALAMRI, A. F., ALWHAHABI, B. K., METWALLY, A. M. & KAREEM, K. A. 2020. The status of zinc in type 2 diabetic patients and its association with glycemic control. *J Family Community Med,* 27**,** 29-36.

HUSKISSON, E., MAGGINI, S. & RUF, M. 2007. The role of vitamins and minerals in energy metabolism and well-being. *J Int Med Res,* 35**,** 277-89.

MEHRI, A. 2020. Trace elements in human nutrition (II)–an update. *International journal of preventive medicine,* 11.

OHASHI, W. & FUKADA, T. J. J. O. I. R. 2019. Contribution of zinc and zinc transporters in the pathogenesis of inflammatory bowel diseases. 2019.

POWELL, S. R. 2000. The antioxidant properties of zinc. *J Nutr,* 130**,** 1447s-54s.

RUDOLF, E. & RUDOLF, K. J. A. 2015. Low zinc environment induces stress signaling, senescence and mixed cell death modalities in colon cancer cells. 20**,** 1651-1665

ROOHANI, N., HURRELL, R., KELISHADI, R. & SCHULIN, R. 2013. Zinc and its importance for human health: An integrative review. *J Res Med Sci,* 18**,** 144-57.

RIBEIRO, S. M. D. F., BRAGA, C. B. M., PERIA, F. M., MARTINEZ, E. Z., ROCHA, J. J. R. D. & CUNHA, S. F. C. J. E. 2017. Effects of zinc supplementation on fatigue and quality of life in patients with colorectal cancer. 15**,** 24-28. Einstein (Sao Paulo), 2017

VASTO, S., MOCCHEGIANI, E., MALAVOLTA, M., CUPPARI, I., LISTÌ, F., NUZZO, D., DITTA, V., CANDORE, G. & CARUSO, C. 2007. Zinc and inflammatory/immune response in aging. *Ann N Y Acad Sci,* 1100**,** 111-22.

WAN, Y. & ZHANG, B. J. B. 2022. The impact of zinc and zinc homeostasis on the intestinal mucosal barrier and intestinal diseases. 12**,** 900.

WU, X., WU, H., LIU, L., QIANG, G. & ZHU, J. J. T. C. R. 2020. Serum zinc level and tissue ZIP4 expression are related to the prognosis of patients with stages I–III colon cancer. 9**,** 5585.

ZORODDU, M. A., AASETH, J., CRISPONI, G., MEDICI, S., PEANA, M. & NURCHI, V. M. 2019. The essential metals for humans: a brief overview. *J Inorg Biochem,* 195**,** 120-129.

ZOWCZAK, M., ISKRA, M., TORLIŃSKI, L. & COFTA, S. 2001. Analysis of serum copper and zinc concentrations in cancer patients. *Biol Trace Elem Res,* 82**,** 1-8.