Determination of Some Trace Element Levels in Iraqi Male patients with Colorectal Cancer

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Abstract

Alterations of trace element concentrations adversely affect biological processes and could promote carcinogenesis. Trace element deficiency or excess is implicated in the development or progression of some cancers like colorectal cancer. The aim of the present study was to compare the serum copper (Cu) and zinc (Zn) concentrations in patients with colorectal cancer from Iraqi male patient with those of healthy subjects. During the period of March 2015 until august 2015, a total of 25 patients with metastatic colon cancer and 20 healthy volunteers were enrolled from the Al-Kadhimia Teaching Hospital after the diagnosis using a histopathological examination for the malignant tumor; their age was between (38-60) years. Higher levels of Cu, Zn, and Cu /Zn ratio were seen in male patients with colorectal cancer compared to healthy subject's .In Conclusions: According to our findings there was a significant difference in trace elements between healthy subjects and colorectal cancer patients.

Key word: Colorectal cancer, Trace elements, Cu/Zn ratio.

Introduction

Colorectal cancer (CRC) is the third most common cancer worldwide with an estimated one million new cases and a half million deaths each year [1]. It is thought to result from complex interaction between inherited susceptibility and environmental factors, as indicated by genetics and experimental and epidemiological studies [2].

Obesity has consistently been linked with an increased risk of colorectal cancer [3]. Numerous epidemiological studies and meta-analyses have examined the relationship between body weight and CRC, mainly risk of colon cancer, and most studies have shown a positive relationship between a high BMI and risk of colorectal cancer [4, 5].

Trace elements have an important influence as a component of many enzymes on a large number of biological processes. They have some regulatory functions and they may affect immune reactions and free radical generation. The extremely low contents of these trace elements and their diversity imply that their molecular effect is very specific and that they may not be substituted for one another. The cancerous tissue directly indicates changes of trace elements that are evoked by the disease. Blood or blood constituents such as serum are considered to be the best indicators of the present exposure of an individual to many metals due to its easy sampling [6]. Therefore, imbalances in the optimum levels of trace elements may affect biological processes and have been associated with many diseases including heart autoimmune, cancer, renal failure and neurological disorders [7].

Copper (Cu) and zinc (Zn), along with other heavy metals, are involved in metabolic processes which regulate energy production. However, despite the fact that they are essential, their high levels cause a toxic effect which can ultimately lead to carcinogenesis [8].

In recent years, the analysis of trace-heavy elements in human tissues has gained great interest due to the role that these elements play in biochemical and physiological processes. It is important to note trace-heavy elements also play an important role in human health and disease. These elements are necessary in different metabolic path- ways of cells and tissues. Each of the essential and non- essential trace elements may be toxic if found in large concentrations in cells, tissues and fluids. Trace element deficiency or excess is implicated in the development or progression in some cancers [9].

The aim of our study was to compare the serum level of copper (Cu), zinc (Zn) and Cu/Zn ratio in patients with colorectal cancer and healthy group and to examine the body mass index factor (BMI) in colorectal cancer.

Materials and Methods

During the period of March 2015 until august 2015, a total of 25 patients with metastatic colon cancer and 20 healthy volunteers were enrolled. From the Al-Kadhimia Teaching Hospital after the diagnosis using a histopathological examination for the malignant tumor, their age was between (38-60) years. Venous blood samples of patients with metastatic colon cancer, and serum were separated and stored at -2 ºC until analysis.

Body mass index measurement

Body mass index categories were based on World Health Organization cut points for underweight (18.5 kg/m^2), normal weight (18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2), and obese (30 kg/m^2) [10].

Determination of Serum Trace Elements:

Determination of serum concentrations of Cu and Zn was performed by Atomic Absorption Spectrophotometer measurements [11].

Statistical analysis

The results were analyzed by Student's t-test using Statistical Package for the Social Sciences (SPSS) version 19. All data were expressed as mean ± SD. P-Value less than 0.05 was considered significant.

Results and Discussion:

The mean values for the (BMI) and age for male patients with colorectal cancer and control were presented in Table 1. As shown in Table 1, there was a statistically significant association between BMI factor and an increased risk of CRC.

The results from this study indicate that the association between obesity and risk of CRC in male. All anthropometric factors were significantly associated with an increased risk of CRC in general, which corresponds well to previous findings [12], [14]. Body weight or BMI have been the most commonly used anthropometric measurements to examine the associations of obesity and colorectal cancer risk, the majority of which have shown a positive relationship between BMI and risk of CRC in men [15] .The associations between sex hormones and risk of CRC in male is poorly understood, but its studies have supported the hypothesis that lower androgen may increase men's risk of developing CRC [16]. Lower androgen levels seem to be more frequent in obese male, and treatment with testosterone reduces insulin resistance, suggesting a role of androgens in promoting insulin sensitivity and hereby one possible mechanism in the development of CRC. Thus study is consistent with previous studies which shown stronger positive associations for BMI and colorectal cancer incidence [17, 18].

The present work was designed to determine the level of trace elements (Cu, Zn and Cu/Zn ratio) in colorectal cancer in male patients and compare these with healthy controls, table 2. There is a significant increase in the concentrations of Cu, Zn and Cu/Zn ratio in male patients with colorectal cancer when compared with control group. Changes in trace element levels may have prognostic significance in complex disorders including colon rectal cancer.

Copper is a redox-active transition metal that can participate in single electron reaction and catalyse formation of free radicals. Beside these properties, it is also an essential element for formation of hemoglobulin, myelin, collagen, and melanin. Copper has been suggested to play an important role in several disorders and normal immune function [19]. Nayak *et al*. performed a study in 20 patients affected by prostate and colon cancer; they found that Cu and ceruloplasmin levels were increased significantly in the cancer patients as compared to controls [20].

Zinc is an essential trace element that participates as cofactor in a large number of intermediary metabolism proteins, in hormone secretion pathways and in different mechanisms of immune defence. Zinc is known to be an essential component in DNA-binding Zn fingers proteins, as well as in Cu/Zn superoxidedismutase and in several proteins involved in DNA repair mechanisms. Thus, Zn plays an important role in transcription factors function and, antioxidant defence. Dietary deficiencies in Zn can contribute to single- and double-strand DNA breaks and DNA oxidative modifications that increase the risk for cancer development. It is well known that carcinogenesis is a multistep process in which genetic

sequence alterations helped by environmental factors, such as oxidative stress and antioxidant status [21].

The results of this study partly confirm the observations of other researchers who found that there was a significant difference in trace elements and heavy metals levels between healthy subjects and metastatic colon cancer patients [22].

In current study, high serums level of Zn and Cu were detected in patients with colon cancer. Thus, Zn and Cu may play different role in different types of cancers.

In recent years, the analysis of trace-heavy elements in human tissues has gained great interest due to the role that these elements play in biochemical and physiological processes. It is important to note trace-heavy elements also play an important role in human health and disease. These elements are necessary in different metabolic path- ways of cells and tissues. Each of the essential and non- essential trace elements may be toxic if found in large concentrations in cells, tissues and fluids. Trace element deficiency or excess is implicated in the development or progression in some cancers [23].

Conclusion

In conclusion, serum levels of Cu and Zn may have prognostic significance in complex disorders including colon cancer. The present findings suggest that imbalance in Cu and Zn trace element level is associated with CRC and might play an important role in cancer development among male Iraqi patients. Environmental factors have an important role in pathogenesis of cancer.

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Table (1) Demographic and anthropometric features of colorectal cancer patients and controls.

Characteristics	*Patients*	*Control*	*P-Value*
Number	**20**	**20**	**-**
Age (Years)	**48.95±5.09**	**48.50±5.18**	**0.36 NS**
BMI (Kg/m^2)	**30.1±0.30**	**25.39±3.1**	**0.001**
Family history of colorectal cancer	**75%**	**---**	**----**

Table(2) Trace element levels in colorectal cancer patients and controls

Characteristics	*Patients*	*Control*	*P-Value*
Cu (µg/dl)	152.0 ± 0.12	78.0±0.04	0.001
Zn (µg/dl)	101.0± 0.50	70.0±0.22	0.001
Cu/Zn ratio	1.50±0.24	1.11±0.18	0.05

NS: not significant

مستويات بعض العناصر النزرة(نحاس ,زنك,نسبة نحاس/زنك)عند مرضى الرجال العراقيين المصابين بسرطان القولون المستقيم.

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الخلاصة

التغيرات في تراكيز العناصر النزرة تؤثر سلبا في العمليات البيولوجية ويمكن أن تعزز زيادة او نقص عنصر في تطور بعض أنواع السرطان مثل سرطان القولون والمستقيم. ان الهدف من هذه الدراسة هو مقارنة تركيز النحاس و الزنك في مصول الذكور من المرضى العراقيين الذين يعانون من سرطان القولون والمستقيم مع تلك المجموعة من الأصحاء. مابين مارس وأغسطس 2015، تم تسجيل مجموعه تتالف من خمسة وعشرين من المرضى الذين يعانون من سرطان القولون المنتشر وعشرين متطوعا من الأصحاء. من مستشفى الكاظمية التعليمي بعد التشخيص باستعمال الفحص المجهري للورم الخبيث،وكان متوسط أعمارهم تتراوح بين (60-38). وقد شوهدت مستويات أعلى من النحاس والزنك ونسبة النحاس / الزنك في المرضى من الذكور المصابين بسرطان القولون والمستقيم بالمقارنة مع الاشخاص الاصحاء، وكانت هذه النتائج ذات دلالة إحصائية اذ وجد فرق كبير او تباين ملحوظ في العناصر النزرة الصحية والمرضى بسرطان القولون والمستقيم.

كلمات مفتاحية: سرطان القولون المستقيم, العناصر النزرة,نسبة النحاس/الزنك.