SHORT ARTICLE / INVESTIGACIÓN

Evaluation of serum Selenium level as a risk factor for Colorectal cancer

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Abstract: Selenium, an antioxidant enzyme component, has been shown to protect against colorectal cancer risk. A diet is the primary source of these antioxidants, and selenium level is inversely related to colorectal cancer risk and may be responsible for around 50% of colorectal cancer risk. The study aims to evaluate selenium levels as a marker for colorectal cancer risk. The participants in this study were 180 individuals, comprising patients and healthy people, separated into two distinct groups: The first comprised 90 cases, 47 of them were men, and 43 were female patients. The second group had 90 healthy individuals, including 60 men and 30 women. All individuals were subjected to blood sampling to determine serum selenium by using Flame Atomic Absorption Spectrometer. The mean serum selenium concentration in the colorectal cancer group was significantly lower (P< 0.01) than in healthy control people. The result shows a strong association between low levels of selenium and the risk of colorectal cancer.

Key words: Selenium, Colorectal cancer.

Introduction

Cancer is a disease characterized by the unregulated proliferation of aberrant cells. When this kind of tumor arises in the colon or rectum, it is termed colorectal cancer or bowel cancer. It's a malignant tumor in the colon or rectum, accounting for around two-thirds and one-third of all diagnosed individuals, respectively. About 95% of them are adenocarcinomas of the glandular epithelium[1,2]. Selenium (Se) is a trace element essential for human health. Diet is the primary source of Se, and intake is determined by the concentration of dietary sources and the quantity ingested. The daily-recommended requirement for selenium is 55 mg for females and 70 mg for males[3].

Selenium is a constituent of selenoproteins, one of which is an antioxidant. The human genome has 25 selenoprotein genes. Glutathione peroxidases (GPx) are selenoprotein enzymes that help protect cells from reactive oxygen species[4,5]. Selenium is present in animals as selenocysteine and selenomethionine. The amount of selenium in the diet varies depending on where plants grow, and animals thrive. The primary source of selenium is inorganic selenates found in blackcurrant, onion, common walnut, and pistachio, which are then transformed into organic forms[6]. Most of the selenium compounds we eat are absorbed from the duodenum, with a smaller amount in the jejunum and ileum[7].

Human health is linked to excess and deficit selenium intake[8]. Low selenium levels in the soil in the affected region likely resulted in low selenium levels in local wheat crops. Selenium insufficiency has been proposed as a probable cause of Keshan's illness, cardiovascular disease, infertility, degenerative disorders, and cognitive decline[5]. According to the studies, there is a strong relationship between low selenium levels and the risk of colorectal cancer, and it may protect against CRC progression through anti-oxidative actions[9,10]. Human selenium poisoning (selenosis) has been recorded in areas with high selenium in the soil. Chronic intoxication causes emaciation, hair and hoof loss, joint erosion, heart atrophy, cirrhosis, and anemia[11]. A more significant selenium (Se) level is linked to a decreased risk of CRC, especially in areas with low Se concentration in soils[12]. Several studies have shown that Se status affects gene and protein expression in the antioxidant reactions, immunological role, inflammatory pathways, cell growth and death, and cellular mobility[13]. In addition, selenoproteins contribute to better CRC survival by regulating programmed cell death and inhibiting angiogenesis. As a result of these features, it has been suggested that Se compounds may be helpful in cancer therapy[14]. The study aims to evaluate selenium levels as a marker for colorectal cancer risk.

Materials and methods

This study was conducted at Tumors Oncology/ Al-Habooby Teaching Hospital and Department Surgery/ Al-Hussein Teaching Hospital in Thi-Qar province, south of Iraq. One hundred eighty participants in a case-control study, comprising patients and healthy people, were separated into two groups: the first group included 90 patients comprising 47 males and 43 females. The second group involved 90 healthy individuals, 60 of whom were men and 30 were women. A blood sample (5 milliliters) was taken from the subjects, where it was allowed to clot before being centrifuged at 3000 revolutions per minute for 10 minutes. All tube samples were kept at (-20°C) deep-freezing until they were analyzed. Serum Selenium levels were measured by Flame Atomic Absorption Spectrometer (FAAS). Laboratory tests

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were completed in the Department of Chemistry, College of Science at the University of Thi-Qar.

Consent was obtained from each patient participating in this study to fulfill the international research ethical criteria. The study's data were analyzed using IBM Statistical Package for Social Sciences (SPSS) Statistics software, version 27. All statistical comparisons were made using independent t-tests, and one-way ANOVA and numeric variables were reported as mean and Standard deviation. In contrast, Chi-square (X2) test was used to compare the frequency with a P-value ≤0.05 considered statistically significant.

Results

Table 1 shows the statistical distribution (frequency & percentage) of study groups by sex and age. The descriptive statistics and differences of study groups by sex were significant differences between patients and control groups (P-value = 0.048). The same table revealed a highly significant (p <0.001) difference in the age of the patients' group as compared to the control group, and the highest percentage of the age subgroup was (65-74 years).

Table 2 exhibits the differences in the measurement of serum selenium between CRC patients and the control group. The mean of the selenium concentration in the CRC group was significantly lower (p < 0.001) than that of the healthy group.

Table 3 reveals no significant differences (P-value = 0.102) in serum selenium levels between men and women among CRC patients.

Table 4 shows no significant differences (P-value = 0.630) in serum selenium levels according to age among CRC patients. Figure 1 shows the statistical distribution (Mean) of selenium according to the age among CRC patients.

Discussion

The descriptive statistics and differences in study groups by sex were significant differences between patients and control groups (P-value = 0.048). Females have a low incidence of colorectal cancer, and colonoscopy studies reveal fewer colorectal adenomas than males. Colon lesions vary by sex, with right-sided malignancies common in women associated with a high diet of carbohydrates and fat, which are more challenging to identify in screening[15-17]. On the other hand, left-sided lesions are more prevalent in males and individuals with familial adenomatous polyposis, corresponding with high protein consumption[18,19]. The Nutritional Prevention of Cancer Trial discovered that selenium supplementation had an inverse relationship with overall cancer incidence only in males[20]. Gender effect modification may be plausible owing to possible sex variations in selenium metabolism; women have been shown to have more excellent excretion rates than males[21]. In one earlier observational study, Knekt[22] identified an inverse relationship between selenium and CRC incidence in males.

In contrast, another found a positive relationship in women only[23]. However, two studies found an inverse correlation between men and women[24,25]. To solve this issue, more research with appropriate numbers is required.

According to the present findings, the most significant proportion of patients was among the age group 65–74 years. The current investigation supported the findings of Wong[26], who found a link between CRC risk and advanced age. On the other hand, the results disagreed with Gondran *et al.*[27], who claimed that the age-specific incidence of CRC rose dramatically among those aged 35-64 years compared with ≥65 years. Similarly, Singh *et al.*[28] have observed that most CRC patients were males aged 40–60 years, with 30% being under 40 years old.

Regarding Se, the study results disagree with those of Bizerea-Moga[29], who evaluated serum selenium concentrations in healthy people and found non-normal selenium distribution in the overall population and a significant difference in selenium levels among age groups. The median selenium levels in participants over the age of 66 were up to 31% higher than in younger participants, and they were more unevenly distributed. The two groups must have the same age distribution to compare selenium levels in healthy people with those in CRC patients. Therefore, the selenium levels among CRC patients were compared, and it was found that individuals over 65 years had lower selenium le-

Character	Category	Groups		Calculated P value
		Healthy No. (%)	Patients No. (%)	
Gender	Male	60(66.66)	47(52.22)	0.048
	Female	30(33.33)	43(47.77)	
Age (Year)	25-34	29(32.22)	18(20)	<0.001
	35-44	31(34.44)	11(12.22)	
	45-54	19(21.11)	16(17.77)	
	55-64	7(7.77)	21(23.33)	
	65-74	4(4.44)	24(26.66)	

Table 1. Demographic Characteristics of study groups (patients and controls).

Parameters	Groups		P value
	Healthy	Patients	
	Mean±Std.D	Mean±Std.D	
Se (ppm)	5.12±0.10	4.33±0.12	<0.001

Table 2. Serum Selenium levels between CRC Patient and control group .

Parameters	Category		P value
	Male	Female	
	Mean±Std.D	Mean±Std.D	
Se (ppm)	4.96±0.13	5.29±0.15	0.102

Table 3. Serum Selenium levels according to the gender among CRC patients.

Parameters	Category (Year)					P value
	25-34	35-44	45-54	55-64	65-74	
	Mean±Std.D	Mean±Std.D	Mean±Std.D	Mean±Std.D	Mean±Std.D	
Se (ppm)	5.26±0.87	5.26±1.03	5.17±1.13	5.20±0.93	4.85±0.97	0.630

Table 4. Levels of Selenium according to the age among CRC patients.

vels than others. The study also found that CRC incidence rose significantly among individuals over 65. As a result, lower selenium levels in the elderly may be linked to an increased risk of CRC cancer.

The outcome of the current research was consistent with the findings of previous studies[30-32], which indicated that the concentrations of Se have significantly been lowered in patients with CRC—selenium, whose function is partly mediated by its incorporation into a family of selenoproteins (SePs). As several SePs perform antioxidant activities, they may protect against CRC progression via their anti-oxidative properties. A greater Se level has been related to a decreased risk for CRC. However, the role of selenium in survival following colorectal cancer diagnosis hasn't been thoroughly investigated. The cohort study evaluated prediagnostic circulating Se level correlations with overall and colorectal cancer-specific mortality. It concluded a high prediagnostic Se concentration at an optimum (100–150 µg/L) might be linked to a better prognosis in CRC patients[12]. Dietary components, such as vitamin D, are thought to impact the progression and development of CRC[33,34].

Later researchers found that dietary selenium intakes per capita were likewise adversely connected with death rates from other cancer forms, including CRC, at recommended daily consumption levels of 55 mg/day[35-37]. Although specific research found that selenium supplementation lowers CRC incidence, this relationship was not generally seen[31]. Conversely, Se supplementation was linked to an increased risk of type 2 diabetes (T2D). These investigations were not the first to relate elevated blood Se to an increased risk of T2D in Se-deficient people[38]. As a result, extensive selenium supplementation is discouraged since it may have negative consequences.

Additionally, the bioavailability of Se may be influenced by the different food formulations utilized in these distinct clinical trials. The bioavailability of selenium as selenomethionine is roughly double that of selenium as selenite. As a result, the relationship between Se supplementation and the development of CRC may be unclear, necessitating additional clinical investigation[39].

Conclusions

There was a highly significant relation between Se levels and CRC but a non-significant association between these levels and the age and sex of the patients.

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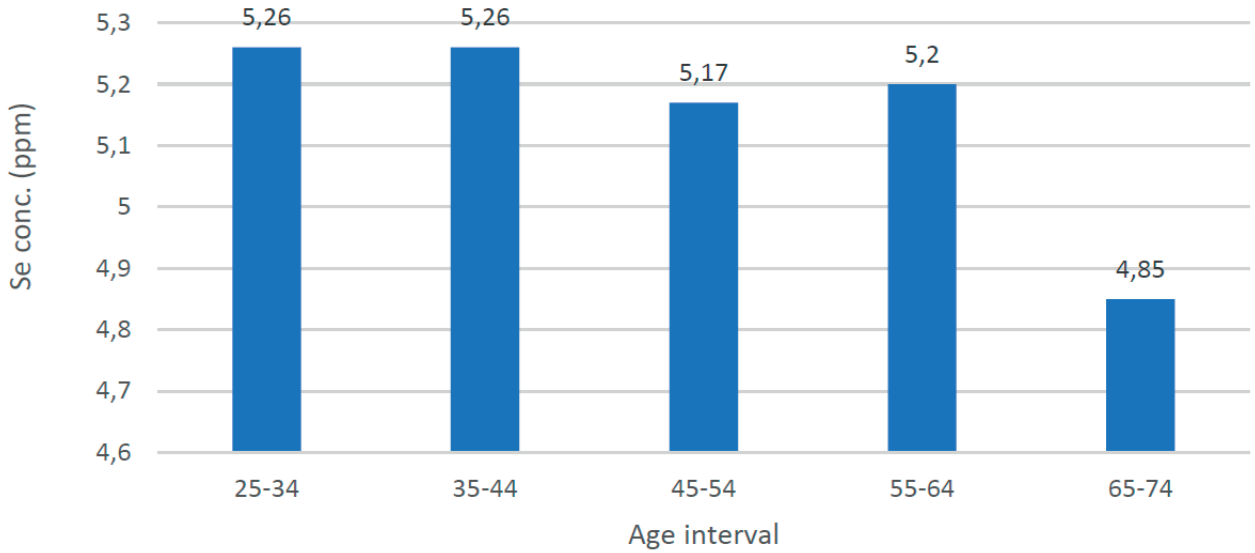

Figure 1. Bar chart for statistical distribution (Mean) of selenium according to the age among CRC patients.

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