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Exploring the Impact of Anthropometric Measurements on Kidney Cancer Progression in Iraqi Patients: A Comprehensive Analysis

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ABSTRACT

Despite not being digested, trace elements and/or heavy metals are important for the activity of enzymes, physiological processes, and homeostasis. If certain trace elements are present in excess, they can have harmful effects and pose major health hazards. Objective: The aims to examine the connection between serum zinc, copper levels, and the Cu/Zn ratio, and several anthropometric parameters, including an index of body mass and the waist-hip ratio. In our study, we used atomic absorption spectrometry (AAS) to measure serum levels of copper (Cu) and zinc (Zn) in 60 individuals, 30 patients with kidney cancer and 30 healthy controls. We assessed serum uric acid, creatinine, and urea using the semi-auto analyzer BA-88A (Korea). The results revealed a highly significant in the level of serum Cu, Zn and Cu/Zn ratio when compared with control, additionally high significant elevation in serum uric acid, creatinine and urea when compared with control. The result also indicates a prevalence of body mass index (BMI) and waist-hip-ratio (WHR) in patients with kidney cancer when compared with control. Our study compares blood levels of copper (Cu) and zinc (Zn) in kidney cancer patients to those in healthy controls. We aim to investigate any differences in the prevalence of these trace elements between the two groups, additionally of that a good relationship between BMI and WHR with serum Cu and Zn in the patient with kidney cancer. Current data reveal a significant prevalence of altered levels of copper (Cu), zinc (Zn), and the Cu/Zn ratio in patients with kidney cancer

Keywords: BMI, Iraqi patients. Kidney cancer, Trace elements.

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استكشاف تأثير القياسات الأنثروبومترية على تقدم سرطان الكلى لدى المرضى العراقيين: تحليل شامل

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الملخص

تعتبر العناصر الدقيقة والمعادن الثقيلة مهمة لنشاط الإنزيمات والعمليات الفسيولوجية، وكذلك التوازن الداخلي للجسم. وإذا كانت بعض العناصر الدقيقة موجودة بكميات زائدة، فإنها يمكن أن تسبب آثارًا ضارة وتشكل مخاطر صحية كبيرة. الموضوع: يهدف هذا البحث إلى فحص العلاقة بين مستويات الزنك والنحاس في المصل، ونسبة Cu/Zn، وعدد من المعايير الأنثروبومترية، بما في ذلك مؤشر كتلة الجسم ونسبة الخصر إلى الورك. المرضى والطريقة: في دراستنا، استخدمنا مطياف الامتصاص الذري (AAS) لقياس مستويات النحاس (Cu) والزنك (Zn) في المصل لـ 60 فردًا، منهم 30 مريضًا بسرطان الكلى و30 شخصًا سليمًا. كما قمنا بتقييم مستويات حمض اليوريك والكرياتينين واليوريا في المصل باستخدام جهاز التحليل شبه التلقائي BA-88A (كوريا). النتائج: أظهرت النتائج زيادة معنوية في مستوى النحاس (Cu) والزنك (Zn) ونسبة Cu/Zn عند مقارنتها مع مجموعة التحكم. كما تم ملاحظة ارتفاع معنوي في مستويات حمض اليوريك والكرياتينين واليوريا في المصل مقارنة مع مجموعة التحكم. كما أظهرت النتائج وجود انتشار مرتفع لمؤشر كتلة الجسم (BMI) ونسبة الخصر إلى الورك (WHR) لدى المرضى المصابين بسرطان الكلى مقارنة بمجموعة التحكم. دراستنا تقارن مستويات النحاس (Cu) والزنك (Zn) في الدم لدى مرضى سرطان الكلى مع تلك التي لدى الأفراد الأصحاء. نهدف إلى التحقيق في أي اختلافات في انتشار هذه العناصر الدقيقة بين المجموعتين، بالإضافة إلى العلاقة الجيدة بين مؤشر كتلة الجسم (BMI) ونسبة الخصر إلى الورك (WHR) مع مستويات النحاس والزنك في المصل لدى المرضى المصابين بسرطان الكلى. الخلاصة: تكشف البيانات الحالية عن وجود انتشار معنوي لمستويات غير طبيعية من النحاس (Cu) والزنك (Zn) ونسبة Cu/Zn لدى المرضى المصابين بسرطان الكلى.

INTRODUCTION

Kidney cancer makes up around (3 %) of all malignancies, with Western nations having the highest prevalence. Annually, almost 330,000 new instances of worldwide, kidney cancer is diagnosed., making up (2.4 %) of all cancer cases[(1)]. In Europe and around the world, it was until recently that the incidence of kidney cancer was rising at a pace of roughly (2 %) year. In 2018, this trend contributed to around 39,100 deaths related to kidney cancer and In the European Union, 99,200 new cases of renal cell carcinoma (RCC) were reported [(2)]. RCC death rates rose overall across Europe until the early 1990s, at which point they tended to stabilize or decline. Despite not being digested, trace elements and/or heavy metals are important for the activity of enzymes, physiological processes, and homeostasis. A surplus of these trace minerals can have harmful effects that raise the risk of major illnesses, such as cancer [(3)]. Through their ability to either activate or inhibit enzyme reactions, several trace elements (TEs), like zinc (Zn), copper (Cu), iron (Fe), and selenium (Se), are crucial for numerous biological functions. They can alter cell membrane permeability or other processes by competing metalloproteins and other elements as binding sites. These TEs can participate in electron transport, encourage lipid peroxidation to produce free radicals, and start free radical chain reactions, all of which can alter the composition of blood [(4)]. Because they function as antioxidants, zinc (Zn), copper (Cu), and are vital elements that the body needs and are linked to a lower risk of cancer. Zinc

has roles in cell division, Protein synthesis, deoxyribonucleic acid (DNA) synthesis, and immunological response. It also catalyzes the activity of over 300 enzymes. It is also in charge of keeping DNA structural integrity and facilitating DNA's binding to over a thousand transcription factors, which are necessary for the production of numerous protein genes. Cu is essential for maintaining DNA integrity because it inhibits oxidative DNA damage [5].

Anthropometry is the methodical study of human body scales, used to evaluate health. So, utilize numerous anthropometric measurements for fully assessment of the condition of the human body, including systematic dimensions of the size, shape with the composition of the human body. Reproductive cancer, or renal cell cancer, is associated with obesity. Kidney cancer incidence has notably elevated within the previous couple decades, potentially due to the increased incidence of obesity. Less research has been done on the relationship between early-life obesity, alterations in body mass index (BMI), and kidney cancer; racial influences have never been fully examining[6, 7].

However, if these trace elements become out of balance in the body, they can cause oxidative stress (OxS) through oxidative damage to cells, denaturation of proteins, reactive unsaturated bonds in membrane lipids, and damage to nucleic acids. Numerous investigations have demonstrated that these TEs influence the carcinogenic process. Patients with a variety of malignancies have been shown to have altered distributions of these TEs in their tissues and serum. Their specific function in the development of cancer is still unclear, though [8].

Blood is a rich source of SUA, or serum uric acid, is recognized for its role as an antioxidant in the body. It can prevent cell damage by reducing oxidative stress and neutralizing free radicals. that is vital in scavenging free radicals. Studies in the past have connected SUA to cancer risk [9].

One metabolite of human muscle that is directly correlated with total body muscle mass is serum creatinine. A useful metric for assessing for clinical diagnosis and therapy, the glomerular filtration rate, or GFR, is an essential measurement, as it assesses kidney function by indicating how well the kidneys are filtering blood is the measurement of serum creatinine concentration [10]. Our study's objective was to determine the relationship between certain Here's a rephrased version of that phrase: "Anthropometric measurements, including factors like body mass index (BMI), and blood levels of zinc (Zn), copper (Cu), and the copper/zinc ratio in renal cancer patients and the healthy group

MATERIALS AND METHODS

Thirty kidney cancer patients and thirty healthy participants were enrolled between January 2022 and April 2023. The histological investigation at Al-Kadhimia Teaching Hospital diagnosed them with a malignant tumor, and their ages ranged from 45 to 60 years. Serum and venous blood samples from kidney cancer patients were kept apart and at ($^{-}$2 ^{o}C) until examination. The categories for the body mass index were determined using the World Health Organization's cut criteria 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) [11]. Every patient and control group had their waist and hip measured in accordance with World Health Organization (WHO) standard. The atomic absorption spectrophotometry was used to determine the levels of copper and zinc (Cu, Zn) in the serum, following the method by [12]. We measured serum uric acid and creatinine with a semi-auto analyzer BA-88A (Korea).

STATISTICAL ANALYSIS

SPSS software and Microsoft Excel 2010 were utilized for data processing. For statistical analysis, we employed SPSS version 19.0, the Social Sciences Statistical Package. The means ± SD data we used the results to express the data. A t-test was used to compare the means of Zn, Cu, and the Cu/Zn ratio between the patients and the control group. If

a P value was less than (0.001), it was considered significant.

RESULT AND DISCUSSION

Table 1 shows the anthropometric measurement of kidney cancer patients with healthy controls. The means of BMI, waist-hip-ratio (WHR), were significantly different from the controls, in that table show the biochemical renal function uric acid, creatinine and urea in patients and control. The mean amounts of trace elements in patients and controls are displayed in Table 2. The levels of copper and zinc in the sick group and the control group differed significantly. greater among patients ($p = 0.001$). Additionally, the ratios of Cu/Zn were greater than those of controls, although the different was not significant.

Table 1: Some anthropometric measurement and kidney function of patients and control.

Characteristic	Patients	Control	P value
Number	30	30	---
Age (year)	49.91 ± 1.08	49.25±0.29	N. S
BMI (Kg/m^2)	30.39 ± 0.4	25.09±0.3	p ≤ 0.001
WHR	0.93 ± 0.02	0.7 ± 0.031	p ≤ 0.001
Uric acid	8.31 ± 1.5	5.26 ± 1.68	p ≤ 0.001
Creatinine	2.01 ± 0.64	1.12 ± 0.38	p ≤ 0.05
Urea	69.12 ± 15.33	35.33 ± 13.27	p ≤ 0.001

Table 2: Levels of trace elements in patients compared to controls.

Characteristic	Patients	Control	P value
Cu (µg/dl)	183.2 ± 0.28	100.11 ± 0.33	p ≤ 0.001
Zn (µg/dl)	177.3 ± 0.68	99.33 ± 0.48	p ≤ 0.001
Cu/Zn (µg/dl)	1.03 ± 0.41	1.01 ± 0.68	p ≤ 0.05

One of the world's most important health problems, obesity and its related diseases have become more common in both industrialized and developing nations over the past few decades. Obesity and the incidence of several malignancies, such as endometrial, gastric, colorectal, gallbladder, pancreatic, hepatic, renal, and bladder tumors, have recently been linked epidemiologically. Wang et al. earlier meta-analysis provided an overview of those who are obese and overweight in men and women, respectively. Their meta-analysis contained one unique study with a sizable participant count, reporting the mortality of kidney cancer even though they included 21 cohort studies[13].

Numerous mechanisms may exist between obesity and an elevated risk of renal carcinoma. Obesity-related abnormalities of adipose tissue can result in aberrant adipokine secretion (such as leptin, Interleukin-6(IL-6), and Tumor necrosis factor alpha (TNF-a)), which is linked to the initiation and progression of kidney cancer [14]. First of all, as we all know, an unhealthy diet is closely linked to being overweight or obese. However, the analysis of subgroups was more challenging to interpret because so few of the included studies had made any adjustments to food habits. However, the majority of the initial research did not control for certain unidentified confounding variables that could influence the possibility of renal cancer, which could lead to an estimation of the true relationship between the risk of kidney cancer and BMI. Second, it was discovered that those who had visceral obesity had a higher likelihood of having fatty livers than those who did not, and that the buildup of lipids in the liver was connected to kidney cancer [15]. According to our research, patients' uric acid levels are higher than those of the control group. Blood contains a large amount of serum uric acid (SUA), which is an antioxidant and essential for scavenging free radicals. However, research exploring the connection between SUA and kidney cancer remains limited. Currently, only one study has indicated that individuals with hyperuricemia may are more likely to get kidney cancer [16].

A consequence of muscle metabolism, serum creatinine has a strong correlation with the body's total muscle mass. Serum creatinine levels are helpful in measuring for clinical diagnosis and treatment, the glomerular filtration rate (GFR) is

essential [17]. Additionally, serum creatinine has been recognized as clinically valuable in diagnosing and prognosticating many cancerous conditions, such as ovarian cancer, pancreatic cancer, and vulvar cancer [18]. Additionally, our results showed elevated levels of serum uric acid in patients compared to the control group. Recent research suggests a possible connection between the start of cancer and this metabolic process, specifically the disruption of the urea cycle [19]. SUA functions as an antioxidant, crucial for neutralizing free radicals and is present in high concentrations in the blood. Previous research has established a connection between SUA levels and cancer risk. For example, a 2019 meta-analysis of 24 studies found that an elevated risk of cancer has been linked to hyperuricemia [8]. Various preclinical According to research, high SUA levels can cause inflammatory stress reactions. Increased SUA levels stimulate several transcription factors that encourage cell motility and multiplication. These processes can transform regular cells at rest into extremely aggressive cancer cells [20].

From (table 2) when compared to controls, the results show a notable increase in the patients' serum levels of Zn, Cu, and Cu/Zn ratio. The World Health Organization's Human Nutrition Expert Committee determined in 1996 that 13 trace elements (TEs) were necessary for human nutrition and health. Cu, Zn, and the Cu/Zn ratio were measured in this investigation. The emergence and progression of cancer may be connected to alterations in certain types of TEs throughout the body. Cancer may develop as a result of excess Cu. Its carcinogenic mechanism could be linked to the activation of dioxygen and ceruloplasmin by copper zinc superoxide dismutase (Cu/Zn SOD), which alters the process of iron metabolism and scavenges free radicals [21, 22]. Changes in the systemic distribution of copper or an increase in intra, tumoral copper are common features of many cancer forms. Angiogenesis, metastasis, and tumor growth are all aspects of tumor genesis and development that copper is engaged in [23]. Zinc exhibits a broad spectrum of anticancer effects. It's mechanisms of action are not limited to its antioxidant properties; it also influences various biological processes. These include modulating the immune system, influencing transcription factors, modulating apoptosis, and having an effect on the proliferation and differentiation of cells. Additionally, zinc plays a role in the synthesis and repair of nucleic acids, the activation or inhibition of enzymes, cell signaling, and maintaining membrane stability and cell structure [24, 25]. Zinc levels can vary among cancer patients, with some experiencing increased levels while others show decreased levels [26]. This variability may be attributed to differences in the consumption of antioxidant substances. The antioxidant defense system depends on essential trace metals copper (Cu) and zinc (Zn), which should not be overlooked [27]. The ratio of copper to zinc (Cu/Zn) has been linked to more severe disease states and is proposed as an indicator of a lower degree of oxygen saturation [28, 29].

CONCLUSIONS

According to available data, patients with kidney cancer have a notable prevalence of abnormal copper (Cu), zinc (Zn), and Cu/Zn ratio values. Our findings suggest a strong correlation between these trace elements and certain Anthropometric measurements, including waist-to-hip ratio and body mass index (BMI). These parameters may serve as useful predictive factors in the diagnosis of kidney cancer.

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