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Comparison of serum Zn, Cu and Se contents between healthy people and patients in high, middle and low incidence areas of gastric cancer of Fujian Province *

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INTRODUCTION

To find out the difference of Zn, Cu and Se contents in the sera between healthy group in high gastric cancer incidence area and in low incidence area, and the difference among healthy, gastric cancer or other tumor groups, we collected 453 serum samples from healthy, gastric cancer or other tumor groups in high gastric cancer incidence areas of Changle and Putian, middle incidence area of Shaxian, and low incidence area of Fuan between 1992 and 1995, and measured and compared the serum contents of Zn, Cu and Se. The results are presented as follows.

MATERIALS AND METHODS

Sampling objects

According to the gastric cancer mortality from the data of resident retrospective survey on death causes in 1986-1988, we selected high gastric cancer incidence area Changle with a gastric cancer mortality of $92.26/10^5$ and Putian with a mortality of $58.61/10^5$, middle incidence area Shaxian with a mortality of $18.86/10^5$ and low incidence area Fuan with a mortality of $7.76/10^5$. Samples were collected in terms of sex and age proportion from healthy check-up people in the three areas, and from patients with gastric cancer and other tumors diagnosed by hospitals. Table 1 shows the number of samples collected.

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Table 1 Sample number of different groups among the three areas

Area of incidence	County	Healthy (group I)	Gastric cancer (group II)	Other tumor (group III)
High	Changle	100	41	3
	Putian	52	39	14
Middle	Shaxian	95	14	15
Low	Fuan	49	15	16
Total		296	109	48

Sampling method

All appliances and recipients were washed carefully and disinfected to avoid contamination during sampling. Blood was collected from veins. Sera were separated by centrifugation of samples and transferred into plastic tubes, sealed up, frozen, then stored at low temperature.

Sample analysis and measurement

Cu and Zn The samples were diluted and contents of Cu and Zn were measured by flame spectroscopy in Pekin-Elmer 5000 atomic absorption spectr ophotometer.

Se The samples were digested and content of Se was determined by hydride generating method in Pekin-Elmer 5000 atomic absortion spectrophotometer.

Quality control

To assure the accuracy of analysis, we adopted the strict quality-control measures, i. e. analyzed each batch of samples while analyzing national stair standard referential material GBW-09 cattle serum.

Data analysis and statistics

SYSTAM software was used to manage and analyze the data of this survey.

RESULTS AND DISCUSSION

Difference of serum microelement contents of healthy group in high, middle and low gastric cancer incidence areas

Results of serum Zn, Cu and Se in healthy people of different areas were analyzed (Table 2).

Table 2 Serum contents of trace elements in healthy group in high, middle and low gastric cancer incidence areas ($\bar{x}\pm s$)

	n	Zn(mg/L)	Cu(mg/L)	Se(μg/L)	Cu/Zn
High (I)	152	0.886±0.015	0.911±0.015	84.82±2.18	1.065±0.025
Middle (II)	95	0.885±0.015	0.942±0.019	84.57±1.23	1.099±0.035
Low (III)	152	1.002±0.019	0.867±0.032	76.87±3.22	0.867±0.033
Analysis of variance		F = 9.326	F = 2.479	F = 2.297	F = 9.939
		P = 0.00012	P = 0.086	P = 0.102	P = 0.000066
Newmen-Keul test in	I:III	q = 5.782[a]			q = 6.827[a]
comparison of different	I:II	q = 0.0303			q = 0.955
areas	II:III	q = 5.456[a]			q = 6.105[a]

[a]P<0.01.

Table 3 Contents of Zn, Cu and Se in sera of healthy, gastric cancer and other tumor groups ($\bar{x}\pm s$)

	n	Zn(mg/L)	Cu(mg/L)	Se(μg/L)	Cu/Zn
Healthy (I)	294	0.905±0.010	0.914±0.011	83.22±1.32	1.044±0.018
Gastric cancer (II)	109	0.843±0.019	1.045±0.023	73.58±1.68	1.308±0.035
Other tumor (III)	48	0.858±0.028	1.127±0.040	75.29±2.33	1.404±0.078
Analysis of variance		F = 5.137	F = 29.168	F = 9.278	F = 35.220
		P = 0.006	P<0.00001	P = 0.000073	P<0.000001
Newmen-Keul test in	I:III	q = 4.305[a]	q = 7.660[b]	q = 5.852[b]	q = 9.423[b]
comparison of different	I:II	q = 2.362[b]	q = 8.949[b]	q = 3.426[a]	q = 9.113[b]
groups	II:III	q = 0.673	q = 3.094	q = 0.664	q = 2.673

The serum Zn content of healthy group had no difference as compared with that in high incidence area and that in middle incidence area, but was obviously lower than in low incidence area. The ratio of Cu/Zn in high incidence was incon siderably different from that in middle incidence area, but significantly higher than in low incidence area, the difference being statistically significant. However, no obvious difference was found in serum Cu and Se contents among these areas.

The correlation between contents of Cu and Se in healthy human serums and gastric cancer mortality among different areas was insignificant, but in high incidence area the content of Zn was much lower than in low incidence area and the ratio of Cu/Zn was higher. The result indicated that contents of microelement had a certain relationship with gastric cancer incidence although we could not conclude the contents affected gastric cancer incidence. Because of limited inves tigation scope, the conclusion was uncertain in a way, nevertheless it provides a clue to further study the causes of gastric cancer.

Comparision of microelement contents in human serum between healthy and gastric cancer groups

Zn, Cu and Se in the samples collected from healthy, gastric cancer and other tumor groups in the three areas were measured and the ratio of Cu/Zn was calculated. The results of statistics and analysis are presented in Table 3.

According to Table 3, the serum levels of Zn, Cu and Se and the ratio of Cu/Zn are significantly different statistically between the healthy group and gastric cancer group, however the difference between the gastric cancer group and other tumor group was not significant. Newmen-Keuls test was used in compar ison of all groups.

Zn content

The Zn content in the serum of gastric cancer and ot her tumor patients was lower than in healthy group, and the difference being statistically significant. However this difference did not exist between gastric cancer group and other tumor groups. Zn was considered one of the necessary compositions of many enzymes in human body, involved in the synthesis of DNA and RNA polymeric enzymes, took part in the nucleic acid metabolism and immunosurveillance prolection, affecting the process of cancerization directly or indirectly. Epid emiological studies also indicated that content of Zn in serum of tumor patients was lower than in healthy persons. The results of this study showed that the serum content of Zn was closely related to gastric cancer. Though it was uncertain that there existed a cause and effect relationship. Zn was proved to play an

important role in physiological and biochemical process, disease production and c ancerization.

Cu content

The Cu content in serums in gastric cancer and other tumor patients was obviously higher than in healthy group, the difference being statis tically significant. Though the relationship between Cu and cancer are controversial and the mechanism remained ambiguous, most clinical and experimental studies showed that a large variety of cancers are connected with considerably higher Cu content in serum and enhanced activity of cuprein in plasma. Our results were similar to theirs.

Ratio of Cu/Zn

It was reported that contents of Cu and Zn in human serum existed proportionally and affected each other. The determination of ratio of Cu/Zn was helpful for diagnosing many diseases, observing their transformations, preventing recrudescence, and reflected the nutritive status of Zn in human body more effectively than Zn content in serum. It was said that if the ratio was above 2, it would lead to cancerization. The ratio of Cu/Zn in healthy group was markedly lower than in gastric cancer and other tumor groups, with statistically significant difference. In many gastric cancer cases, the ratio exceeded 2, indicating its implication in observing, diagnosing and distinguishing gastric cancer cases. It also provided references on etiology.

Se content

Researches on relationship between Se and cancer were popular. Though they did not come to an agreement in etiology, many epidemiolo gical reports supported that Se content in serum decreased in cancer cases, especially those who suffered from tumors of alimentary canal. Measurement of Se con tent in serum is of some value in diagnosing and distinguishing the kinds of cancers. Se was one of the necessary composites of glutathione peroxidase (GSH-Px), thus can prevent lipid peroxidation from producing free radicals. Most clinical and experimental studies showed that the activity of GSH-Px in consumptive chronic and cancer patients decreased obviously. Our results indicated the content of Se in serum of gastric cancer and other tumor patients was much lower than in healthy population, with statistically significant difference. Most researches supported such a hypothesis.

CONCLUSION

A great deal of investigations have demonstrated that contents of Zn, Cu and Se are connected with tumor. Our study indicated that in healthy population, Zn con tents in serum and ratio of Cu/Zn had significant differences between high incidence area and low incidence area while contents of serum Se and Cu were si milar, and Zn and Cu in sera of gastric cancer patients were found much higher than in healthy population by determining contents of Zn, Cu and Se in 453 serum samples collected from healthy, gastric cancer and other tumor population in high, middle and low incidence areas. Such results were identical to those presented in most epidemiological surveys. The result is of reference value for diagnosing and differentiating tumors, and has provided fundamental data for further investi gation on etiology of tumors.

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