

# RELATIONSHIP BETWEEN DRINKING WATER, VEGETABLES AND CANCER DEATH IN THE HIGH INCIDENCE AREA OF DIGESTIVE TRACT CANCER

Han Cunzhi 韩存芝    Jing Jiexian 荆洁线    Zhao Xianwen 赵先文  
Liu Fumin 刘副民    Guo Jingang 郭晋纲    Cao Jirong 曹继荣

Department of Etiology, Shanxi Cancer Institute, Taiyuan, 030013

The paper analyzed of investigation datas on the death causes of digestive tract cancer in high-incidence area between 70s and 80s. The results showed that the cancer-adjusted mortalities were 224.14/100000 and 226.66/100000; it was 7 times as high as low-incidence (31.19/100000 and 29.82/100000). In 70s, the cancer death of esophagus, stomach and liver (87.41/100000, 73.93/100000 and 8.59/100000) were 28 times, 10 times and 4 times as high as low-incidence area (3.70/100000, 10.57/100000 and 1.94/100000), respectively ( $P<0.001$ ). In 80s, the cancer death of esophagus, stomach and liver (68.26/100000, 109.39/100000 and 23.89/100000) were 17 times, 10 times and 4 times as high as low-incidence area (4.54/100000, 10.84/100000 and 6.35/100000), respectively ( $P<0.001$ ). In high-incidence area, the cancer death of esophagus was lower, of stomach and liver were higher in 80s than 70s, respectively ( $P<0.01$ ). The result also showed that the nitrate content of drinking water and vegetables were 21.45mg/l and 1185.27mg/kg in high-incidence area; it were significant higher than that in low-incidence area (2.14mg/l and 41.60mg/kg), the nitrite content (0.01mg/l) of drinking water in high-incidence area was significant higher than that in low-incidence area (0.004mg/l), but the nitrite content among vegetables was no significant difference between the two regions ( $P>0.05$ ). Our results suggest that the nitrate and nitrite contents increase in drinking water and vegetables may be an important risk factor of upper alimentary cancer in high-incidence area.

**Key words:** Digestive tract cancer, Drinking water, Vegetable, Cancer death

## INTRODUCTION

A lot of studied reports have showed a significant correlation between total nitrate intake and digestive tract cancer incidence.<sup>1-3</sup> Yuan Qu County is one of the high incidence area of malignant tumor in Shanxi Province. The mortalities of esophagus cancer and stomach cancer are the first position among cancer deaths; it seriously threaten inhabitants health in the high-incidence area.

During 1969 to 1978 and 1986 to 1990, we investigated the malignant tumor mortality and analyzed the factors of diet and exposure levels of nitrate and nitrite in the high-incidence area. Fan Shi County was used as control group. We attempted finding of an association between ingestive of nitrite, nitrate contents and digestive tract cancer incidence, for prevention of cancer incidence support a evidence in high-incidence area.

## MATERIALS AND METHODS

From 1969 to 1978, 571,350 persons and from 1986 to 1990, 596,320 persons were carried out health investigation in high-incidence area. The register cards of cancer death from Yuan Qu Tumor Hospital, all cases were carried out pathology diagnosis. The

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variant cancer mortality were adjusted according to National Population Standard Constitute (1982).

During 1975 and 1987, we collected drinking water sample (93 shares), vegetables sample (30 shares) and determined the nitrite and nitrate levels for all collection samples.

## RESULTS

### Epidemiologic Investigation

During 1969 to 1978, the total cancer death sum was 2959 persons in high-incidence area (Table 1), the

adjusted death rate was 224.14/100000 (male was 268.55/100000, female was 180.41/100000); it was significant higher than that the low-incidence area of 31.19/100000 (male was 36.42/100000, female was 24.51/100000). The death rate of esophagus cancer was 87.41/100000 (male was 121.53/100000, female was 53.82/100000), stomach cancer was 73.93/100000(male was 100.15/100000, female was 48.11/100000), liver cancer was 8.59/100000 (male was 10.15/100000, female was 6.44/100000); it was 29 times, 7 times and 4 times as high as low-incidence area (3.70/100000, 10.57/100000 and 1.94/100000), respectively ( $P<0.001$ ).

Table 1. Comparison of the adjusted death rates of digestive tract cancers between high and low-incidence areas in 70s (/100000)

	High-incidence area			Low-incidence area			P
	Total	Male	Female	Total	Male	Female	
Esophagus Cancer	87.41	121.53	53.82	3.70	5.34	1.61	<0.001
Stomach Cancer	73.93	100.15	48.11	10.57	14.75	5.62	<0.001
Liver Cancer	8.59	10.15	6.44	1.94	2.51	1.25	<0.001
Total death rate	224.14	268.55	180.41	31.19	36.42	24.51	<0.001

From 1987 to 1990 (Table 2), the cancer adjusted death rate in high-incidence area was 226.66/100000 (male was 282.64/100000, female was 172.37/100000); it was significant higher than that in low-incidence area of 29.82/100000 (male was 26.88/100000, female was 9.94/100000). The death rate of esophagus cancer was 68.26/100000 (male was 79.99/100000, female was 56.88/100000), stomach cancer was 109.39/100000 (male was 152.88/100000

female was 67.22/100000), liver cancer was 23.89/100000 (male was 24.89/100000, female was 24.13/100000); it was 17 times, 10 times and 4 times as high as low-incidence area ( $P<0.001$ , respectively). The mortality of esophagus cancer was lower in 80s than that in 70s, the stomach cancer and liver cancer death rates were significantly higher in 80s than that in 70s ( $P<0.001$ , respectively).

Table 2. Comparison of the adjusted death rates of digestive tract cancers between high and low-incidence area in 80st 100000)

	High-incidence area			Low-incidence area			P
	Total	Male	Female	Total	Male	Female	
Esophagus cancer	68.26	79.99	56.88	4.54	8.21	0	$P<0.001$
Stomach cancer	109.39	152.88	67.22	10.84	14.77	2.01	$P<0.001$
Liver cancer	23.89	24.89	24.13	6.35	8.21	4.02	$P<0.001$
Total death rate	226.66	282.64	172.37	29.82	26.88	9.94	$P<0.001$

### Analysis about Drinking Water and Vegetables

In 1975 and 1987 summer season, we collected drinking water samples 130 shares (Table 3), vegetable 150 shares (Table 4), and determined the nitrite and nitrate contents of all collected samples.

The results showed that in drinking water of nitrate and nitrite average levels were significant

higher in high-incidence area (21.45mg/liter and 0.011mg/liter) than that in low-incidence area (2.14mg/ liter and 0.004mg/liter), respectively ( $P < 0.001$ ). The nitrate average level (1185.27mg/kg) in vegetables was significantly higher in high-incidence area than that in low-incidence areas (41.60mg/kg) ( $P < 0.001$ ), but the nitrite level did not reach statistical difference between high and low-incidence area ( $P > 0.05$ ).

Table 3. Comparison of nitrite and nitrate levels of drinking water between high and low-incidence areas (mg/liter)

Area	No	No <sup>-3</sup>		P	No <sup>-2</sup>	
		$\bar{x} \pm S$			$\bar{x} \pm S$	P
High-incidence						
(1975, summer)	62	22.45 ± 18.83		>0.05*	0.011 ± 0.003	>0.05*
(1987, summer)	31	20.50 ± 18.86			0.010 ± 0.007	
Low-incidence				<0.001**		<0.001**
(1987, summer)	37	2.14 ± 1.16			0.004 ± 0.002	

\* Comparison of 1975 and 1987 in high-incidence

\*\* Comparison of the average levels of high and low-incidence area

Table 4. Comparison of nitrite and nitrate levels in vegetables between high and low-incidence areas (mg/kg)

Area	No.	No <sup>-3</sup>		No <sup>-2</sup>	
		$\bar{x} \pm S$		$\bar{x} \pm S$	
High-incidence	100	1185.27 ± 625.40		0.29 ± 0.16	
Low-incidence	50	41.60 ± 31.60		0.23 ± 0.08	
P		<0.001		>0.05	

### DISCUSSION

Epidemiologic studies and investigation results of death causes showed there has been a significant reduction trend in esophagus cancer death and there has been a significant rise trend in the stomach cancer death in 80s. We think that disease classification is one of the chief causes (cardia cancer be included in esophagus cancer in 70s, but it was classified to stomach cancer in 80s).

Our studies also showed that chief cancer death are the upper alimentary cancer in Yuan Qu County. The high-incidence area inhabitants ingest high

contents of nitrite and nitrate from drinking water and vegetables, this may be one of the important risk factor for digestive cancer incidence.<sup>4,5</sup> The stomach and esophagus are the places where diet first come into prolonged contact with the gastrointestinal mucosa. Different carcinogens might be involved, depending on the population group. Nitrosoureas are produced in the stomach from amides and nitrite derived from diet and act in that organ to induce cancer.<sup>6</sup> Nitrosamides are a subgroup of N-nitroso compounds, which are generally strong carcinogens and also include the nitrosamines.

A lot of studying datas have showed that a

strong positive correlation between risk of gastric cancer and nitrite, nitrate contents from diet. Our studying results is identical with theirs. Therefore, we suggest that reducing the diet polluted by nitrite and nitrate and inhibiting formation of N-nitration *in vivo* may be a efficacy measure for decreasing the incidence and death rates of digestive cancer in high-incidence area.<sup>7,8</sup>

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