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ABSTRACT

Influence of Dietary Zinc Intake, socio-economic status, H. pylori infection, and lifestyle on Gastric Cancer Risk:

A Case-Control Study

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BACKGROUND

- Preclinical and epidemiological studies have indicated that diet, in addition to lifestyle factors play a vital role in the etiology of gastric cancer(GC).
- In particular, Zinc has been suggested to reduce the risk of developing several types of cancer, including gastric cancer risk (GCR).

OBJECTIVE

- This study investigated the association between dietary Zinc intake, socio-economic status, H. pylori infection, and lifestyle factors versus GCR.

METHODS

- This study applied a case-control study design in Korean population using a validated semi-quantitative food frequency questionnaire (SQFFQ) based on a 24-hours recall.
- The dietary Zinc intake values were was computed using a computer-based nutritional software analysis program knowns as Can-Pro 4.0, developed by Korea Nutrition Society).
- Logistic regression modeling was used to assess the association between dietary Zinc intake, socio-economic status, H. pylori infection, and lifestyle factors versus gastric cancer risk.

RESULTS

- Higher education level (OR: 0.131(0.022 – 0.790)) and income level (OR: 0.528 (0.343-0.814)) respectively, and being physically active (OR: 0.540(0.401 – 0.725)) exhibited inverse associations with GCR.
- Conversely, H. pylori infection (OR: 7.065 (4.551 – 10.966)), and current smoking (OR:1.625(1.110 – 2.379)) were significantly associated with increased risk of GC.
- Overall, despite a modest decrease in risk, dietary intake of Zinc was not significantly associated with gastric cancer risk by median (OR: 0.942 (0.703 – 1.263), tertile (OR: 0.906 (0.633 – 1.298)) and quartile (OR: 0.967 (0.636– 1.472)) intake values.
- Stratified by sex and age group, there was no significant association between dietary Zinc and GCR in both the sex ((males: OR: 1.219 (0.702 – 2.116); females: OR: 0.729 (0.364 – 1.461)) and the age group strata; age below 50 (OR: 1.642 (0.751 – 3.589) and above 50 years (OR: 0.808 (0.480 – 1.359).

RESULTS

Table 1. Participants' Characteristics in Influence of Dietary Zinc Intake, Socio-economic status, H. pylori infection, and Lifestyle and Gastric Cancer Risk

	CASE (n= 415)	CONTROL (n= 830)	P- value
Sex (%)			
Male	270 (65.06)	540 (65.06)	
Female	145 (34.94)	290 (34.94)	***1.000†***
Age (%)			
>50	139 (33.49)	285 (34.34)	
≥ 50	276 (65.66)	545 (66.51)	***0.767†***
Educational Status (%)			
Elementary school	54 (13.08)	43 (5.39)	
Middle school	81 (8.90)	71 (19.61)	
High school	174 (42.13)	338 (42.35)	***<0.001†***
University graduate	97 (23.49)	343 (42.98)	
Occupation (%)			
White Collar	77 (20.21)	163 (20.07)	
Blue Collar	277 (72.70)	549 (67.61)	***0.022†***
Income (%)			
Middle Income	148 (39.26)	341 (44.69)	
High Income	96 (25.46)	273 (35.77)	***<0.001†***
High BMI (%)	135 (33.08)	269 (33.09)	***1.000†***
Marital Status (%)			
Married	361 (86.58)	716 (87.41)	
Separated	6 (1.45)	3 (0.36)	
Bereavement	14 (3.14)	26 (3.39)	
Cohabitation	5 (1.21)	29 (3.51)	***0.072†***
Divorce	12 (2.91)	24 (2.91)	
H. Pylori (%)			
Negative	33 (8.00)	320 (39.70)	
Positive	382 (92.00)	486 (60.30)	***<0.001†***
With Family History (%)	190 (45.89)	392 (47.34)	***0.629†***
Smoking (%)			
Current Smoker	128 (19.52)	162 (30.92)	
Ex-smoker	119 (34.22)	284 (28.74)	***<0.001†***
Alcohol intake (%)			
Current drinker	254 (61.35)	534 (64.34)	
Former drinker	41 (7.22)	60 (9.90)	***0.243†***
With Regular physical activity (%)	147 (35.42)	466 (56.35)	***<0.001†***
Zinc Intake (sd)	10.19 (1.60)	10.17 (2.93)	***0.833‡***
Zinc Intake in mg (%)			
Low (<9mg)	213 (51.33)	415 (50.00)	***0.659†***
High (≥9mg)	202 (48.67)	415 (50.00)	
Zinc Intake in mg (%)			
Q1 (<9.47420)	146 (35.35)	268 (32.33)	
Q2(9.47420–10.51450)	136 (32.92)	277 (33.41)	***0.520†***
Q3(>10.51450)	131 (31.72)	287 (34.26)	
Zinc Intake in mg (%)			
Q1 (<9.21245)	110 (26.51)	207 (24.24)	
Q2 (≥9.21245 - <9.98865)	103 (24.82)	208 (25.06)	
Q3 (≥9.98865 - <10.91684)	103 (24.82)	207 (24.94)	***0.932†***
Q4 (≥10.91684)	99 (23.86)	208 (25.06)	

Note: *Data presented in frequency (%)*
Calculated p-value using † Chi- square test and ‡ independent t-test
Positive H. pylori infection included active and past H. pylori infection

Table 2. The Association Between Dietary Zinc Intake, Socio-economic status, H. pylori infection, and Lifestyle and Gastric Cancer Risk

		OR (95% CI)
Sex	Male	1
	Female	1.000 (0.781- 0.280)
Age	<50	1
	≥ 50	1.038 (0.809 - 1.332)
Educational Status	Out of School	1
	Elementary school	0.538 (0.131 – 2.206)
	Middle school	0.489 (0.122 - 1.962)
	High school	0.221* (0.056 – 0.864)
	University graduate	0.121* (0.031 – 0.478)
Occupation	Unemployed	1
	White Collar	1.750* (1.057- 2.897)
	Blue Collar	1.869* (1.193- 2.928)
Income	Low	1
	Middle	0.486* (0.359- 0.658)
	High	0.394* (0.283- 0.548)
BMI	Low	1
	High	1.000 (0.777-1.288)
Marital Status	Single	1
	Married	0.975 (0.516 – 1.841)
	Separated	3.867 (0.846 – 17.673)
	Bereavement	1.041 (0.423 – 2.562)
	Cohabitation	0.333 (0.107 - 1.038)
	Divorce	0.967 (0.381 – 2.455)
H. Pylori	Negative	1
	Positive	7.622* (5.199 – 11.147)
Family History	No	1
	Yes	0.943 (0.745 – 1.195)
Smoking	Non-smoker	1
	Current Smoker	1.817* (1.353 – 2.439)
	Ex-smoker	0.963 (10.728- 1.276)
Alcohol intake	Non-drinker	1
	Current drinker	0.943 (0.723 - 1.231)
	Former drinker	1.355 (0.861- 2.134)
With Regular physical activity	No	1
	Yes	0.425* (0.333 – 0.542)
Zinc Intake [a]		0.994 (0.939 – 1.052)
Zinc Intake [a]	Low	1
	High	0.948 (0.749 – 1.200)
Zinc Intake [a]	Q1	1
	Q2	0.901 (0.676 – 1.202)
	Q3	0.847 (0.634 – 1.130)
Zinc intake [a]	Q1	1
	Q2	0.932 (0.670 - 1.297)
	Q3	0.936 (0.673 - 1.303)
	Q4	0.896 (0.642 – 1.249)

- ***Note: Robust standard errors in parentheses: *<0.005***
- *a Zinc intake level cutoff as table 1*

RESULTS

Table 3. Analysis for the association Between Dietary Zinc Intake, Socio-economic status, H. pylori infection, and Lifestyle and Gastric Cancer in a Complete-case Analysis

		Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)	Model 3[c] OR (95% CI)
Zinc Intake†		0.994 (0.939 – 1.052)	1.021 (0.959 – 1.087)	1.015 (9.954 – 1.078)
Zinc Intake [a]	Low ((<9mg))	1	1	
	High (≥9mg)	0.948 (0.749 – 1.200)	0.934 (0.692 – 1.262)	0.942 (0.703 – 1.263)
Zinc Intake [a]	Q1	1	1	1
	Q2	0.901 (0.676 – 1.202)	0.872 (0.609 – 1.248)	0.859 (603 – 1.224)
	Q3	0.847 (0.634 – 1.130)	0.901 (0.621—1.306)	0.906 (0.633 – 1.298)
Zinc intake [a]	Q1	1	1	1
	Q2	0.932 (0.670 - 1.297)	1.014 (0.674 – 1.522)	1.006 (0.675 – 1.500)
	Q3	0.936 (0.673 - 1.303)	0.946 (0.611 – 1.406)	0.926 (0.615 – 1.394)
	Q4	0.896 (0.642 – 1.249)	0.959 (0.619 – 1.487)	0.967 (0.636– 1.472)
Sex	Male		1	
	Female		1.233 (0.750 – 2.029)	
Age	<50		1	
	>50		0.726 (0.510 – 1.031)	
Education Status	Out of School		1	1
	Elementary school		0.463(0.062 – 3.469)	0.621 (0.100 – 3.865)
	Middle school		0.318 (0.044 – 2.297)	0.458 (0.076 – 2.756)
	High school		0.143 (0.020 – 1.020)	0.234 (0.040- 1.378)
	University graduate		0.082* (0.011 – 0.601)	0.131* (0.022 – 0.790)
Occupation	Unemployed		1	1
	White Collar		3.182* (1.607 – 6.303)	3.489* (1.809 – 6.726)
	Blue Collar		1.864 (1.008-3.447)	1.889* (1.050-3.398)
Income	Low		1	1
	Middle		0.549* (0.374-0.807)	0.586* (0.405- 0.848)
	High		0.492* (0.313-0.772)	0.528* (0.343-0.814)
BMI	Low		1	
	High		0.871 (0.630 – 1.204)	
Marital Status	Single		1	
	Married		1.201 (0.495 – 2.919)	
	Separated		2.677 (0.414 – 17.311)	
	Bereavement		0.717 (0.216 – 2.284)	
	Cohabitation		0.381 (0.087 – 1.671)	
	Divorce		0.468 (0.128 – 1.707)	
H. pylori	Negative		1	1
	Positive		7.017* (4.504 – 10.932)	7.065* (4.551 – 10.966)
Family History	No		1	
	Yes		0.978 (0.727 – 1.316)	
Smoking	Non-smoker		1	1
	Current Smoker		1.946*(1.160 – 3.266)	1.625*(1.110 – 2.379)
	Ex-smoker		1.234 (0.750– 2.030)	0.968 (0.668 – 1.401)
Alcohol intake	Non-drinker		1	1
	Current drinker		1.017 (0.703– 1.473)	0.987 (0.692 – 1.409)
	Former drinker		1.584 (0.866– 2.898)	1.508 (0.836 – 2.718)
With Regular physical activity	No		1	1
	Yes		0.567* (0.419 – 0.765)	0.540* (0.401 – 0.725)

CONCLUSIONS

- Despite a modest decrease in risk, dietary intake of Zinc was not significantly associated with gastric cancer risk in the Korean population, but being physically active regularly may be protective against GC. H. pylori infection remains a significant risk factor for GC.
- However, other studies have established a strong association between the disruption of zinc homeostasis and development cancer, including GC.
- In particular, GC patients have been observed to exhibit a significant elevation of serum copper-to-Zinc superoxide dismutase (SOD) level than the healthy controls.
- Moreover copper-zinc SOD is considered a vital free radical scavenger, because it is an enzyme that protects against reactive oxygen species.
- Therefore, pertaining the role of Zinc, large-scale prospective studies and a meta-analysis are needed to provide more insights on the effect of dietary Zinc intake on GCR.
- **Keywords:** Dietary Zinc, socio-economic status, H. pylori infection, Gastric Cancer