RESEARCH COMMUNICATION

Evaluation of Dietary and Life-Style Habits of Patients with Gastric Cancer: A Case-Control Study in Turkey

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Abstract

Objective: Gastric cancer is an important public health problem in the world and Turkey. In addition to *Helicobacter pylori (H. pylori)*, smoking, alcohol consumption and family history, certain dietary factors have been associated with its occurrence. The impact of dietary habits and life-style factors on the risk of gastric cancer in Turkey were evaluated in this study. Design: A questionnaire was applied to 106 patients with gastric adenocarcinoma and 106 controls without cancer matched for age (range 28-85 years) and gender selected from a hospital based population. Adjusted odds ratios (ORs) and 95% confidence intervals (CI) were calculated with logistic regression analysis. Results: The incidence of *H. pylori* was 81.3% in patients. Frequent consumption of salty dishes, very salty foods like pickles, soup mixes, sausages, foods at hot temperature (ORs = 3.686, 7.784, 5.264, 3.148 and 3.273 respectively) and adding salt without tasting (OR = 4.198) were associated with increased gastric risk. Also heavy smoking and high amount of alcohol consumption (p = 0.000) were risk factors. Frequent consumption of green vegetables, onion, garlic and dried fruits (ORs = 0.569, 0.092, 0.795 and 0.041) was non-significantly associated with decreased risk. Conclusion: Improved dietary habits, reducing salt consumption and eradication of *H. pylori* infection may provide protection against gastric cancer in Turkey.

Keywords: Dietary habits - *Helicobacter pylori* - gastric cancer - salt - salty foods - Turkey

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Introduction

Epidemiological and etiological data suggest that *H. pylori* infection, heavy smoking, alcohol consumption, dietary habits and genetics play important roles in gastric carcinogenesis (Ramon et al., 1993; Chan et al., 2003; Fei & Xao 2006; Fock et al., 2008). *H. pylori* has been classified as group 1 carcinogen by International Agency for Research on Cancer (IARC) in 1994 (IARC Working Group, 1994). *H. pylori* infection causes progressive gastric lesions leading to chronic gastritis, gastric atrophy, intestinal metaplasia, dysplasia and eventually gastric adenocarcinoma (Crew, 2006; McColl, 2006).

Genetic factors may also play an important role in the pathogenesis of gastric cancer (Kelly & Duggan, 2003). Familial history of gastric cancer is present in 10-15% of patients (Barr, 2007). Gastric cancer risk has been reported to be 2-3 times higher in individuals with first degree relatives diagnosed with gastric cancer (Kelly & Duggan, 2003).

Heavy smoking has been associated with increased risk of gastric cancer (Chen et al., 2000; You et al., 2005; Sung et al., 2007). Combined exposure to high levels of tobacco and alcohol further increases the gastric cancer risk (You et al., 2005; Sung et al., 2007).

There is significant geographic variation and ethnic differences in the incidence of gastric cancer around the world. In immigrants, the incidence of gastric cancer quickly becomes similar to the place that they live, indicating that gastric cancer is closely related to modifiable factors like dietary habits. Etiological studies as well as case-control and cohort studies have shown that high amount of salt consumption increases the risk while consumption of vegetables and fruits may be protective (Helicobacter and Cancer Collaborative Group, 2001; Tsugane & Sasazuki, 2007; Fock et al., 2008). Processed meat products and N-nitroso compounds may also increase the risk of gastric cancer (Tsugane & Sasazuki, 2007).

Since treatment options are limited, the most efficient way of decreasing the incidence and mortality of gastric cancer is to find preventive strategies (Axon, 2002; Crew & Neugut, 2006; Curran et al., 2009). The success of preventive strategies depends on understanding etiological mechanisms (Axon, 2002).

Gastric cancer incidence is high in Turkey and it is an important public health problem (Yalcin, 2009a; 2009b). This study was planned and conducted to evaluate the effects of dietary and life-style habits of adult subjects diagnosed with gastric cancer in Turkey.

Materials and Methods

This case-control study was approved by the Hacettepe University Medical School Ethics Committee (Registration

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No: HEK07/183). Patients (n=106) who had a diagnosis of gastric adenocarcinoma within one year were enrolled at Hacettepe University Oncology Hospital between March 2008 and June 2009 were included. For control group an equal number of adult subjects without the diagnosis of cancer or any digestive system disease matched with the study group for age and gender were chosen from other outpatient clinics (otorhinolaryngology, ophthalmology clinics etc.) of Hacettepe University Hospitals.

All individuals in the study were applied a questionnaire composed of three sections: first, general demographic information; second, dietary habits and frequency of food consumption; and third, rate and duration of smoking and alcohol consumption. WHO classification was used to asses the degree of alcohol consumption (WHO, 2000). Dietary and lifestyle habits before the onset of the disease were recorded. Dietary habits such as eating too fast, consuming foods at high temperature, usage of salt and consumption of salty foods were assessed by a dietitian. The frequency of consumption 87 different foods including milk and dairy products, meat and meat products, vegetables and fruits, cereals and legumes, fats and fatty seeds, sugar and desserts and other processed foods (like soupmixes, pickles) and soft drinks were questioned. Individuals were asked the frequency category for each group of foods and drinks ("every meal or daily", "3-4 times a week", "1-2 times a week", "1-2 times a month" or "none/less than 1 time a month"). Risk analysis was carried out for foods and drinks which were considered to be related to gastric cancer in this study.

Tumor localization in the stomach (distal, proximal and whole stomach) was based on endoscopic examination, pathology reports and operation notes.

The presence of *H. pylori* in patients with gastric cancer was determined from patients' records, if available. Otherwise, serum *H. pylori* IgG antibody test was performed. *H. pylori* were not tested in the control group.

Statistical Analysis

Data were analysed using SPSS 11.0 statistical package program. ORs and 95% CI were calculated with logistic regression analysis by adjusting for gender, residence, education, smoking, alcohol consumption and family history of cancer for 26 kinds of foods considered to be related to gastric cancer. Mann Whitney U test is used to compare quantitative data of two groups.

Results

Of the patients 66 were man (62.3%) and 40 were woman (37.7%). The mean age of subjects was 57.4±13.0 years (Men: 57.9±12.5, Women: 57.4±14.9 yr) in the study group and was 57.9±12.5 years (Men: 57.8±12.2, Women: 56.9±14.4 yr) in the control group (p = 0.861). Patient's general characteristics are summarized in Table 1.

Distal tumor was found in 71 of 100 patients in whom classification could be done, proximal tumor was found in 19 and tumor in the whole stomach was found in 10 patients. Classification could not be done for 6 patients because pathology report was not available or revealed insufficient information.

In the study group, *H. pylori* were positive in 81.3% of 91 patients in whom the presence of *H. pylori* could be tested. The rate of positive *H. pylori* test was higher in men (82.5%) than in women patients (79.4%).

There was no significant relationship between familial history of gastric cancer (OR: 1.111, p=0.701), however familial history of other cancers was found to increase the risk of gastric cancer nearly 1.5 fold but nonsignificantly (p=0.634).

Smoking and Alcohol Consumption

Smoking and alcohol consumption status of all subjects were shown Table 2. Although no significant difference was detected between the durations of smoking of the two groups (p = 0.802), the daily number of cigarettes smoked by the subjects in the study group was found to be significantly higher than the control group (p = 0.001). Similarly no significant difference was detected between the durations of alcohol consumption of the two groups (p = 0.875), but the daily amount of alcohol consumed by the patients was found to be significantly higher than the control group (p = 0.000). Twenty-five percent of the gastric cancer patients had a history of an alcohol consumption of 61-100g/day which is classified as high risk according to WHO classification.

Dietary Habits and Food Consumption Frequencies

The rate of very fast eaters in the study group was 5 fold compared to the control group (OR = 5.399, 95%CI : 1.698-17.159, $p_{for\ trend}$ = 0.001) (see Table 3). Similarly the ratio of subjects who ate foods at extremely hot

Table 1. General Features of the Subjects in the Study and Control Groups

Characteristic	Study Group		Control Group	
	n	%	n	%
Age (years)				
≤35	4	3.8	4	3.8
36-45	20	18.9	17	16.0
46-55	23	21.7	25	23.6
56-65	25	23.6	27	25.5
66-75	24	22.6	24	22.6
>75	10	9.4	9	8.5
Educational Status				
Not educated	15	14.2	9	8.5
Primary school	49	46.2	34	32.1
Secondary school	11	10.4	13	12.3
High school	12	11.3	22	20.7
College	19	17.9	28	26.4
Occupation				
Housewife	32	30.2	24	22.6
Official	7	6.6	20	18.9
Laborer	11	10.4	11	10.4
Liberal profession	17	16.0	14	13.2
Retired	37	34.9	37	34.9
BMI (kg/m2) (before diagnosis)				
<18.5	2	1.9	-	-
18.5-24.9	27	25.5	33	31.1
25.0-29.9	54	50.9	47	44.4
30.0-34.9	14	13.2	24	22.6
35.0-39.9	7	6.6	2	1.9
≥40.0	2	1.9	-	-

Table 2. Evaluation of Smoking and Alcohol Consumption Status of Subjects

	Study Group		Control Group		P
	n	%	n	%	value
Cigarette Smoking					
Never smoked	43	40.6	47	44.3	
Ex-smoked	58	54.7	31	29.3	
1-10 no./day	17	29.3	20	64.5	
11-20 no./day	21	36.2	9	29.0	
>20 no./day	20	34.5	2	6.5	
Current smoked	5	4.7	28	26.4	
1-10 no./day	4	80.0	19	67.9	
11-20 no./day	-	-	8	28.6	
>20 no./day	1	20.0	1	3.5	
Smoking(no./day) (±SD)*					
	21.5 ± 12.9		12.0 ± 8.0		0.000
Duration of smoking (years) (ex-smoker+current smoker) (±SD)**					
	22.8 ± 12.8		22.9 ± 10.8		0.802
Alcohol comsumption					
Never used	82	77.3	68	64.2	
Ex-used	22	20.8	8	7.5	
Current used	2	1.9	30	28.3	
Amount of alcohol (g/day) (ex-used+current used) (± SD)***					
	37.0 ± 63.7		2.5 ± 2.3		0.000
Duration of alcohol consumption (years) (ex-used+current used) (± SD)****					
	17.4 ± 8.7		19.4 ± 10.1		0.875

*Z=-4.216, ** Z=-0.250, *** Z=-4.216, **** Z=-0.178 (Mann Whitney U test)

Table 3. Evaluation of the Risk of Gastric Cancer in Association with Some Eating Habits

	Study Group		Control Group	
	n	%	n	%
Eating rate: (OR=5.399, 95% CI=1.698-17.159, $P_{for\ trend}$=0.001)				
Very fast	27	25.5	5	4.7
Fast	30	28.3	36	34.0
Normal	31	29.2	47	44.3
Slowly	18	17.0	18	17.0
Food temperature: (OR=3.273, 95% CI=0.983–10.901, $P_{for\ trend}$=0.140)				
Very hot	12	11.3	4	3.8
Hot	50	47.2	54	50.9
Warm	42	39.6	48	45.3
Cooling	2	1.9	-	-
Salt status of dishes:(OR=3.686, 95%CI=1.016-13.374, $P_{for\ trend}$=0.012)				
Very salty	84	79.3	61	57.5
Salty	17	16.0	32	30.2
Salt free	5	4.7	13	12.3
Adding salt in table:(OR=4.198, 95%CI=1.286–13.703, $P_{for\ trend}$=0.011)				
Without testing	25	23.6	10	9.4
After testing	33	31.1	39	36.8
Sometimes	6	5.7	20	18.9

temperature was higher in the study group (OR = 3.273, 95%CI : 0.938-10.901, $p_{for\ trend}$ = 0.140). While in the study group 23.6% of patients added salt to their foods before tasting, in the control group only 9.4% of subjects added salt to their foods before tasting (OR = 4.198, 95%CI : 1.286-13.703, $p_{for\ trend}$ = 0.011) (Table 3).

Evaluation of the risk of gastric cancer in association with consumption frequencies of some foods and drinks was shown that Table 4. Since in this sudy processed meat products like sausages, hot dog and salami were not consumed every day or during each meal, we classified

Table 4. Evaluation of the Risk of Gastric Cancer in Association with Consumption Frequencies of Some Foods and Drinks (ORs and 95%CI)

	Frequency of consumption									
	1	2		3		4		5		$p_{for\ trend}$
Foods and drinks	OR	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	
Salty ayran (buttermilk)[a]	1	0.268	0.044-1.633	1.454	0.562-3.760	1.797	0.650-4.972	0.642	0.145-2.834	0.277
Salty cheese types[a]	1	-	-	0.174	0.004-8.585	0.458	0.013-16.074	0.145	0.005-4.359	0.267
Red meat[a]	1	0.726	0.075-7.064	0.99	0.104-9.443	1.637	0.171-15.685	2.376	0.255-22.124	0.378
Salami[b]	1	1.053	0.363-3.053	2.538	0.805-8.005	0.633	0.128-3.143	-	-	0.377
Sausage[b]	1	0.552	0.217-1.409	3.148	1.089-9.099	0.552	0.131-2.333	-	-	0.007
Hot dog[b]	1	0.691	0.232-2.062	1.83	0.564-5.939	0.364	0.040-3.294	-	-	0.466
Green vegetables[a]	1	2.418	0.091-64.380	1.18	0.134-10.421	1.419	0.175-11.472	0.569	0.071-4.556	0.292
Tuberose vegetables[a]	1	-	-	1.315	0.216-8.004	3.765	0.687-20.647	2.649	0.413-16.996	0.223
Onion[a]	1	-	-	0.154	0.000-74.316	0.248	0.001-52.147	0.092	0.000-41.836	0.234
Garlic[a]	1	0.942	0.122-7.285	0.984	0.187-5.189	2.545	0.525-12.327	0.795	0.162-3.899	0.168
Citrus fruits[a]	1	0.251	0.022-2.837	0.39	0.063-2.400	0.745	0.137-4.045	1.079	0.216-5.386	0.307
Other fruits[a]	1	0.102	0.003-3.058	0.166	0.012-2.202	0.264	0.023-2.995	0.282	0.027-2.966	0.62
Dried fruits[a]	1	0.403	0.149-1.095	0.222	0.077-0.640	0.811	0.128-5.145	0.041	0.007-0.236	0.002
Salty butter[a]	1	0.087	0.007-1.045	2.118	0.500-8.975	1.27	0.410-3.934	1.522	0.561-4.132	0.198
Green olive[a]	1	-	-	0.114	0.020-0.650	0.249	0.058-1.065	0.674	0.282-1.607	0.077
Black olive[a]	1	-	-	0.185	0.026-1.322	0.131	0.018-0.982	0.543	0.155-1.904	0.22
Hazelnut/walnut/almond[a]	1	0.509	0.186-1.393	1.398	0.518-3.769	0.72	0.182-2.849	0.171	0.025-1.186	0.16
Salty sunflower see[d]	1	0.766	0.307-1.909	1.193	0.372-0-3.825	1.262	0.232-6.851	0.604	0.089-4.095	0.071
Sugar[a]	1	-	-	3.102	0.328-29.375	0.955	0.123-7.440	3.23	1.043-10.004	0.226
Honey/Jam[a]	1	0.285	0.031-2.594	2.343	0.527-10.413	1.401	0.334-5.880	1.469	0.427-5.055	0.403
Pastry[a]	1	1.119	0.418-2.996	7.496	2.015-27.880	1.15	0.184-7.166	1.298	0.040-41.892	0.014
Soupmixes[a]	1	2.99	0.946-9.447	2.661	0.780-9.081	5.264	0.474-58.396	-	-	0.184
Meat/chiken bulyon[a]	1	0.52	0.186-1.451	2.53	0.732-8.747	0.887	0.206-3.821	3.61	0.240-54.331	0.256
Pickles[a]	1	0.472	0.144-1.552	1.882	0.551-6.430	4.975	1.349-18.346	7.784	1.759-34.453	0
Colas[a]	1	3.494	1.191-10.253	9.654	2.463-37.834	7.238	1.552-33.751	3.397	0.918-12.568	0.004
Other soft drinks[a]	1	2.802	0.887-8.847	14.43	3.554-58.585	3.206	0.756-13.596	6.146	1.266-29.832	0.002

*Gender, residence, education, smoking, alcohol consumption and familial history of cancer or gastric cancer adjusted with logistic regression analysis, [a]1: less than 1 time a month or none, 2: 1-2 times a month, 3: 1-2 times a week, 4: 3-4 times a week, 5: every meal-every day or ≥1 time/day, [b]1: less than 1 time a month or none, 2: 1-2 time a month, 3: 1-2 times a week, 4: ≥3 times a week

these foods' consumption frequencies in 4 groups. Consumption of sausages 1-2 times a week was found to increase the risk of gastric cancer significantly (OR = 3.148, 95%CI : 1.089-9.099, $p_{for\ trend}$ = 0.007). On the other hand frequent consumption of green vegetables decreased the risk of gastric cancer, but not statistically significant (OR: 0.569, 95%CI : 0.071-4.556, $p_{for\ trend}$ =0.292). For tuberous vegetables (potato, carrot) ORs were found to be >1.0 for each consumption frequency. Consumption of dried fruits (≥1 time a day) was found to decrease the risk of gastric cancer (OR = 0.041, 95%CI : 0.007-0.236, $p_{for\ trend}$ = 0.002).

Although soupmixes consumption was not very common it considered to increase the risk of gastric cancer nonsignificantly (OR = 5.264, 95%CI : 0.474-58.396, $p_{for\ trend}$ = 0.184). Among these foods the most significant association was found between consumption of pickles and gastric cancer risk. The risk of gastric cancer was found to be increased significantly (OR = 7.784, 95%CI : 1.759-34.453, $p_{for\ trend}$ = 0.001), when subjects consuming pickles ≥1 time/day were compared with subjects consuming pickles less than 1 time a month or never consuming. Frequent consumption of colas (OR = 3.397, 95%CI : 0.918-12.568, $p_{for\ trend}$ = 0.004) and other soft drinks (OR = 6.146, 95%CI : 1.266-29.832, $p_{for\ trend}$ = 0.002) were also found to increase the risk of gastric cancer significantly.

Discussion

Although the incidence and mortality rates of gastric cancer decreased significantly in the last 30 years, it is still the fourth common cancer type in the world and also in Turkey; and it is an important public health problem being the second leading cause of death among cancer types (Crew & Neugut, 2006; Yalcin, 2009a). Even in the developed countries, 5-year survival rate is only 10% (Axon, 2002).

Gastric cancer is more common in men than in women (Axon, 2002; Ito et al., 2003; Yalcin, 2009[b]). The majority of patients with gastric cancer were men (62.3%) with a men/women ratio of 1.65 in our study. In another case-control study conducted in Turkey by Demirer et al. (1990), 64% of patients with gastric cancer were men and 36% were women.

In developing countries, distal gastric cancer is more common than proximal gastric cancer (Crew & Neugut, 2006). In the present study 71% of the patients had distal gastric cancer. The rate of the patients with proximal gastric cancer (19%) was lower than the rate in developed countries. Distal gastric cancer incidence is higher in developing countries because of higher rate of *H. pylori* infection in these countries. The prevalance of *H. pylori* in Turkey is reported to be 38.5%-78.5% in different studies (Saruç et al., 2003; Özden et al., 2004; Sari et al., 2007). In our study, *H. pylori* was tested only in patients with gastric cancer and 81.3% of the patients were found to be *H. pylori* positive.

Many studies (Gammon et al., 1997; Zaridze et al., 2000; You et al., 2005; Fei & Xiao, 2006; Forman & Burley, 2006; Wu et al., 2001) have shown that the amount of cigarettes smoked per day (≥ 20/day) or duration of smoking may be associated with increased risk of gastric cancer and gastric dysplasia. Likewise, in our study in the study group the daily number of cigarettes (21.5/day) was significantly higher than the control group (p = 0.000).

The consumption of strong alcoholic drinks in the fasting state may lead to damage of gastric mucosa and consequently enhance penetration of gastric carcinogens, alter their metabolism, or provide a cell-proliferation stimulus leading to promotion of initiated cells (Demirel et al., 1990). In this study, daily amount of alcohol consumption (37.0 ± 63.7g) was found to be significantly higher in gastric cancer patients (p = 0.000).

Dietary or eating habits thought to be closely associated with the development of gastric cancer and hence numerous studies in this area have already been conducted (Ji et al., 1998; Cai et al., 2003; Sung et al., 2007). Studies performed in China showed that eating fast increases the gastric cancer risk (Ji et al., 1998; Sung et al., 2007). Ji et al. (1998), found that eating fast increased the risk of cancer of the gastric cardia by 2.7 fold (p < 0.001) and the risk of non-cardia gastric cancer by 1.9 fold (p = 0.043). Moreover, it was reported that eating fast may cause carcinogenesis by damaging gastric mucosa (Cai et al., 2003). In our study, eating very fast was found to increase the risk of gastric cancer significantly (>5 fold) compared to eating slowly (95%CI : 1.698-17.159, $p_{for\ trend}$ = 0.001). Eating extremely hot dishes increased the risk of gastric cancer by 3 fold but it was not significant (95%CI : 0.983-10.901, $p_{for\ trend}$ = 0.140). The effect mechanism of eating too hot dishes in occurence of gastric cancer has not been fully explained. However, it has been thought that it could cause cell demage by thermal irritation in the stomach. In a case-control study, foods consumed at very hot temperature were associated with the development of gastric cancer (La Vecchia et al., 1990). In a study performed in Iran, drinking very hot tea was specifically shown to increase the risk of gastric cancer by 2.85 fold (Pourfarzi et al., 2009).

In the studies performed about meat consumption, frequent and high amount consumption of meat (red meat and poultry) was shown to increase the risk of gastric cancer (Chen et al., 2002; Silvera et al., 2008). In our study, frequent consumption of red meat (≥1 time daily), was found to increase (2.4 fold) the risk of gastric cancer insignificantly also (95%CI : 0.255-22.124, $p_{for\ trend}$ = 0.378). Red meat is rich of amines which increase nitroso compounds in the stomach. In addition, polycyclic aromatic hydrocarbons (PAH) which are produced during cooking of meat are strong carcinogens. Processed meat products like salami, sausage and hot dog contain excessive amounts of N-nitroso compounds and salt which are considered to be involved in gastric carcinogenesis. Nitrite which is used in production of these meat products are converted to N-nitrosa compounds which is known to be carcinogen by interacting with amine and amides contained in meat and other foods rich of protein (Gonzalez et al., 2006; Larsson et al., 2006[a]; Phukan et al., 2006; Silvera et al., 2008; Campbell et al., 2008). In the present study, subjects were found to prefer sausage most commonly among these processed meat products and

consumption of sausage 1-2 times a week was found to increase the risk of gastric cancer significantly (≈ 3 fold) (95%CI : 0.131-2.333, $p_{for\ trend}$ = 0.007).

Many studies have shown that vegetables and fruits which are rich sources of bioactive compounds like vitamin C, beta-carotene and other carotenes play a protective role against gastric cancer (Powell & McConkey, 1990; Ramon et al., 1993; McCullough et al., 2001; Pourfarzi et al., 2009; Bae et al., 2008). In our study, although there was no statistically significant relationship, frequent consumption (≥1 time/day) of green vegetables, onion and garlic (ORs = 0.569, 0.092, 0.795 and $p_{for\ trend}$ = 0.292, 0.234, 0.168, respectively) were found to decrease the risk of gastric cancer. Garlic has been reported to have anticarcinogenic effect due to the various compounds that it contains. In a meta-analysis evaluating 18 studies, consumption of high amounts of uncooked or cooked garlic was reported to be protective against gastric cancer (RR = 0.53) (Fleischauer et al., 2000). Some studies showed no relationship between consumption of vegetables and fruits and the risk of gastric cancer just like in our study (Nomura et al., 1990; Botterweck et al., 1998; Terry et al., 2001; De Stefani et al., 2004; Freedman et al., 2008; Li et al., 2008).

Rice, white bread, cereals, potato and foods rich in starch were found to be related to gastric cancer positively and the effect of foods rich in starch was considered to be related to the confounding effect of low socioeconomical status (De Stefani et al., 2004). This is also interpreted as follows starchy foods could be associated with low-protein diets, which may favor acidcatalyzed nitrosation in the stomach because of the poor buffering capacity of such diets comsumption (Kono & Hirohata, 1996). Results from our study indicated that frequent consumption of starchy foods increased the risk insignificantly (OR = 2.649, 95%CI : 0.413-16.996, $p_{for\ trend}$ = 0.223).

In the study performed by Bertuccio et al. (2009), diet with a high glycemic index (GI) was reported to increase the risk of gastric cancer significantly (1.9 fold). In our study, Frequent consumption of sugar (95%CI : 1.043-10.004, $p_{for\ trend}$ = 0.226) was found to increase the risk of gastric cancer risk nearly 3 fold but insignificantly.

Many studies have shown that salt and salty foods increase the risk of gastric cancer (Tsugane, 2005; Fei & Xiao, 2006; Larsson et al., 2006[b]; Kurosawa, 2006; Strumylaite et al., 2006). SALTURK study (Erdem et al., 2010) performed in Turkey showed that salt consumption calculated from urine salt excretion was much higher than (18.04 ± 8.34 g/day/person) the recommended salt consumption of WHO (<5 g/day/person) (WHO, 2006).

In our study, the responses to questions like "adding salt to dishes" and "consumption frequency of foods containing high amounts of salt" were evaluated. Eating salty foods and adding salt without tasting foods were found to increase the risk of gastric cancer by 3.7 and 4.2 fold significantly (95%CI : 1.016-13.374, p = 0.012 and 95%CI : 1.286-13.703, p=0.011). It is known that salt is not directly carcinogen, but it is considered to cause damage in the gastric mucosa leading to gastirits, increase in DNA synthesis and cell proliferation (Gonzalez et al., 2006). In addition, mucosal damage caused by salt may increase the probability of refractory *H. pylori* infection and act synergistically in the development of gastric cancer (Yalcin, 2009[a]). An interesting finding in this study was the association of frequent consumption of pickles (≥1 time/day) and increased risk of gastric cancer by nearly 8 fold (95%CI : 1.759-34.453, p = 0.001). In the study performed by Fei and Xiao (2006), frequent consumption of salty and pickled foods was shown to increase the risk of gastric cancer.

In our study, frequent consumption (≥1 time/day) of colas (nearly 3.4 fold) and other soft drinks (nearly 6 fold) was found to increase the risk of gastric cancer significantly. It is thought that these drinks may increase the risk of gastric cancer due to sugar that the soft drinks contain along with acid. In addition, consumption of sugar every day was found to increase the risk of gastric cancer nonsignificantly by 3 fold in our study (95%CI : 1.043-10.004, p = 0.226).

Our study has several limitations. One limitation of this study was inadequate patient number. Other potential limitation was the lack of available data on *H. pylori* infection among control subjects.

In Conclusion, decreasing consumption of salt and salty foods, increasing consumption of vegetables and fruits, cessation of smoking and decreasing the prevelance of H. pylori are considered to be the most efficient and practical methods for protection against gastric gancer. Cohort studies will be helpful to determine dietary risk factors and to develop strategies for prevention relating gastric cancer in our country. Thus, more objective results may be obtained for patients with gastric cancer related to the amounts and types of consumption of foods which are considered to confer a risk for gastric cancer.

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