RESEARCH ARTICLE

Is there any Relationship between Food Habits in the Last Two Decades and Gastric Cancer in North-western Iran?

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Abstract

Purpose: The aims of this case-control study were to assess the correlation between some food habits in the last two decades and gastric cancer in East Azerbaijan of Iran. Materials and Methods: In this hospital based case control study, 616 patients (212 gastric cancer patients, 404 cancer free patients) were recruited. Food habits of patients over the past two decades were assessed with a structured questionnaire. We used conditional logistic regression analysis for estimating crude and adjusted odds ratios (OR) and their respective 95% confidence intervals (95%CI). Results: In this study, over-eating, consumption of high fat milk and yogurt and especial types of cheese increased the risk of gastric cancer (All<0.05). Consumption of such especial cheeses such as Koze and Khiki increased the risk of gastric cancer by 12.6 fold (95% CI:1.99-79.36) and 7.36 fold (95% CI:1.33-40.54), respectively. In addition, high fat food, moldy food, and pickled vegetables consumption as well as reuse of cooking oil for frying were significantly associated with gastric cancer risk. Furthermore, intake of Ghorme (deep fried meat) was positively correlated with gastric cancer risk (OR:1.31;95%CI: 0.91-1.87). Conclusions: It can be confirmed that particular food habits which have been very common in East-Azerbaijan in the last two past decades increase risk of gastric cancer. According to our results and taking into account the long latency period of gastric cancer it can be concluded that nutrition education for a healthy diet should be performed from early childhood. However, further well designed cohort studies are needed to achieve more clear results.

Keywords: Gastric cancer - case-control study - food habit - Iran

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Introduction

Gastric cancer is one of the most common cancers worldwide and the second cause of death from cancer (Parkin et al., 2005). In spite of the decreasing rate of gastric cancer in the world from the mid-1980s in most developed countries (Parkin et al., 1993), incidence of gastric cancer is increasing in Iran. It is the second cancer in men and the fourth in women (2009-2010). In addition, incidence of gastric cancer is very high in North and North Western Iran (Babaei et al., 2009). The results of a population based cancer registry bySomi et al. (2008) indicated that gastric cancer is the first cancer in men and the third in women in East-Azerbaijan.

Several factors are involved in the wide geographical variation of gastric cancer. These factors include genetic, life style and environmental risk factors (Gonzalez et al., 2013). Among these risk factors, dietary factors are modifiable factors which may play an important role in the different rates of gastric cancer in the world(Nagini, 2012).

The results of previous studies conducted on the relationship between diet and gastric cancer indicated that low consumption of fruit and vegetables, high intake of salt, processed red meat, smoked food and dried fish are the major risk factors of gastric cancer (Crew and Neugut, 2006; Forman and Burley, 2006). However, the findings of some studies in this field are inconsistence. Recently, a meta-analysis of cohort studies assessed the relationship between dietary factors and the gastric cancer risk. The findings of this study showed a significant protective effect for the consumption of fruit on gastric cancer risk, but not for the consumption of vegetables (Wang et al., 2014). The results of another study indicated that stomach cancer only in women was correlated with meat (Rohani-Rasaf et al., 2013). Gonzalez et al. (2003) observed a negative but not significant correlation between the total vegetables intake

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and intestinal gastric cancer (Gonzalez et al., 2006) while the results of another study indicated that high intake of fruit, vegetable, fish and soybean products may reduce gastric cancer risk in women (Ito et al., 2003).

In spite of high prevalence of gastric cancer in North-western Iran, there are few studies which evaluate the nutritional risk factors for gastric cancer in this area. The findings of case-control study in Ardabil province of north-west of Iran showed inverse associations between vitamin C, iron, and zinc intake and risk of gastric cancer and its subgroups (cardia, non-cardia). Moreover, fruits and vegetables consumption and refrigerator use were inversely associated with the risk of gastric cancer. Positive association was observed among those who preferred fried food or consumed highly salted/ roasted seeds (Pakseresht et al., 2011).

In addition, it has been reported that the initial exposure of offensive agents may take place in early life time of gastric cancer patients; therefore the latency period of gastric cancer lasts more than two decades (Correa, 2004). On the basis of this theory, we decided to assess relationship between food habits in the past two decades and gastric cancer in North-western of Iran.

To the best of our knowledge, there is no published article about the correlation between food habit and gastric cancer in East Azerbaijan province of Iran. On the other hand, some food habits such as consumption of smoked food, dried fish, and soya sauce which are increased risk of gastric cancer are not a case of food habit in East Azerbaijan. Therefore, we decided to assess the correlation between some food habits in the two past decades and gastric cancer as a case-control study in East Azerbaijan of Iran.

Materials and Methods

This hospital base case-control study was conducted between May 2009 and May 2011. The study was approved by the Ethic Committee of Tabriz University of Medical Sciences. In this study 212 patients aged 21-84 years who had histologically confirmed diagnosis of gastric cancer, recruited from Imam Reza and Amiralmonin hospitals in Tabriz. Inclusion criteria were patients with history of gastric cancer, without other malignancies, who had resided in East Azarbaijan province for over 20 years. Controls were selected from hospitalized patients in orthopaedic and ophthalmic wards of Shohada and Alavi hospitals in Tabriz. Exclusion criteria included: history of cancer; family history of cancer; and gastrointestinal diseases. Ratio of cases to controls was 1:2. Written informed consent was obtained from all patients. Finally, a total of 616 patients were included in the study with 212 in the case and 404 in the control groups.

A training period was held for head nurse of each ward before starting the study. During the study, the same nurse in ward interviewed each patient. Face to face interviews were conducted by trained nurses to complete a structured questionnaire containing demographic characteristics (such as age, gender, level of education, marital status, ethnicity,occupation, personal and family medical history ,height, weight, per capita income) and, living habits (such as smoking, passive smoking, and alcohol drinking).

Food habits of patients over the past two decades were assessed by structured questionnaire. It included questions about food habits (over eating, reuse of cooking oil for frying , intake of bread, rice, high fat food, pickled vegetables, moldy food, milk, yogurt and especial types of cheeses) and food frequency (fresh tomato, onion, fruits and etc). For food frequency, the subjects chose one of the following frequencies: never, <1 time/month, 1-3 times/ month, 1-3 times/ week and daily. Salty food preference was classified into not salty, medium, and salty.

In addition, we asked patients to recall some food habits over the past two decades which were very common in food habit of people lived in East Azerbaijan. For example, consumption of Ghoreme, a sort of preserved meat which is made by deep frying, and adding a large amount of salt to the fried meat, and then keeping it in some special jar for one year.

The production methods of especial cheeses (Koze and khiki) are briefly explained below:

Koze cheese: the normally made cheese is cut down and is mixed with a lot of salt and put into special clay jugs, and is kept in special places under pebble to ripen.

Khiki cheese: the cheese is made normally, cut and mixed with a lot of salt and then put into sheepskin, and is put in a ditch which gets covered with soil to ripen in a few months.

Statistical analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS, version 11.5, Chicago, IL). Descriptive statistics were obtained for all study variables. We used conditional logistic regression analysis for estimating Crude and adjusted odds ratios (OR) and their respective 95% confidence intervals (95%CI). In the univariate analyses, each (demographic or tobacco smoking related) variable were entered separately and in the next step for multivariate analyses, those variable entered which were significant in the univariate analyses. A P-value of less than 0.05 was considered statistically significant.

Results

Descriptive characteristics of case and controls were presented in Table1. A total of 616 patients were included in the study with 212 in the case and 404 in the control groups. Generally, missing data in case and control groups were in the range of 1.9-21% and 3.1-33.7% respectively. According to the results of simple logistic regression (un-adjusted OR) for patients characteristics, sex, age, marital status, educational level and smoking history were significantly correlated with gastric cancer (All $p<0.01$). Male had 2.02 times more than female risk of gastric cancer. Low degree level and history of smoking increased risk of gastric cancer by 2.53 and 2.55 respectively. These variables were candidate as to enter in the multivariate analysis.

As shown in Table2, over eating, daily consumption of milk, cheese, yogurt were significantly related to risk of gastric cancer (All $p<0.05$). Daily consumption of bread

Table 1. Descriptive Characteristics of Cases and Controls

Variables		Control (%)	Case (%)	Unadjusted *OR	95%CI#	p
Sex	Male	209(51.7)	145(68.4)	2.02	1.42-2.81	<0.001
	Female	195(48.2)	67(31.6)	Ref		
Age (years) Mean±SD	55.36±14.39	61.17±11.72	1.03	1.01-1.047	<0.001	
Marital status	Single	30(7.4)	3(1.4)	0.9	0.25-0.32	<0.001
	Married	347(85.9)	179(84.4)	0.46	0.26-0.895	<0.001
	Separated or widowed	27(6.7)	30(14.2)	Ref		
Educational level	Illiterate	158(40.4)	100(51.8)	2.53	1.24-5.13	0.001
	Reading/writing	40(10.2)	29(15)	2.9	1.28-6.55	0.01
	Primary school	48(12.3)	14(7.3)	1.16	0.47-2.83	0.73
	Secondary school	39(10)	21(10.9)	2.15	0.92-5.02	0.07
	Diploma	62(15.9)	18(9.3)	1.16	0.49-2.7	0.72
	College	44(11.3)	11(5.7)	Ref		P(trend) 0.004
History of smoking	Yes	80(19.8)	82(38.7)	2.55	1.76-3.69	<0.001
	No	324(80.2)	130(61.3)	Ref		

*OR: odds ratio; #CI: confidence interval

Table 2. Odds Ratio (OR) and 95% Confidence Interval (CI) for Gastric Cancer in Relation to Selected Food Habits

Variables	Control (%)	Case (%)	Unadjusted OR*	95% CI#	p	Adjusted OR**	95% CI	p
Over Eating								
Yes	151(37.4)	119(56.7)	2.24	1.58-3.17	<0.001	2.6	1.7-3.9	<0.001
No	236(58.4)	83(39.5)	Referent					
Daily consumption of Bread								
Yes	382(94)	205(97.6)	4.83	0.60-38.38	0.13	1.41	0.65-3.37	0.34
No	9(2.2)	1(0.5)	Referent					
Daily consumption of Rice								
Yes	265(65)	145(59)	1.06	0.73-1.54	0.73	1.39	0.87-2.21	0.16
No	117(29)	60(28.6)	Referent					
Daily consumption of Milk								
Yes	289(71.5)	180(85.7)	2.31	1.48-3.79	<0.001	2.05	1.21-3.48	0.007
No	99(24.5)	26(12.4)	Referent					
Types of milk								
Whole milk	50(12.4)	66(31.4)	2.84	1.84-4.40	<0.001	1.95	1.11-3.43	0.01
Semi-skimmed milk	218(54)	101(48.1)	Referent					
Daily consumption of Yogurt								
Yes	365(90.3)	205(97.6)	13.47	1.81-100.3	0.01	16.26	2.10-125.73	0.008
No	24(5.9)	1(0.5)	Referent					
Types of yogurt								
Plain yogurt	230(56.9)	157(74.8)	0.6	0.20-1.41	0.26	1.12	0.44-2.87	0.807
Drained yogurt	30(7.4)	11(5.2)	1.18	0.75-1.85	0.47	1.6	0.90-2.85	0.07
Pasteurized yogurt	64(15.8)	37(17.6)	Referent					
Daily Consumption of cheese								
Yes	367(90.8)	203(96.7)	4.056	1.19-13.71	0.02	15.05	1.64-137	0.01
NO	22(5.4)	3(1.4)	Referent					
Types of cheeses								
Khiki	5(1.2)	14(6.7)	12.6	1.99-79.43	0.007	22.98	2.96-178.35	0.003
Koze	11(2.7)	18(8.6)	7.36	1.33-40.54	0.02	8.95	1.35-59.21	0.02
Lighvan	154(38.1)	38(18.1)	1.11	0.23-5.35	0.89	1.43	0.265-7.77	0.67
Aged cheese	65(16.1)	67(31.9)	4.63	0.96-22.28	0.05	3.89	0.71-21.26	0.11
Cottage cheese	70(17.3)	64(30.5)	4.11	0.85-19.76	0.07	3.96	0.73-21.31	0.109
Pasteurized cheese	9(2.2)	2(1)	Referent					
Consumption of Ghorme								
Yes	122(30.2)	76(36.2)	1.31	0.91-1.87	0.13	1.05	0.67-1.64	0.82
No	259(64.1)	123(58.6)	Referent					
Consumption of high fat food								
Yes	133(32.9)	125(59.5)	2.87	2.02-4.09	<0.001	3.83	2.47-5.94	<0.001
No	242(59.9)	79(37.6)	Referent					
Consumption of moldy food								
Intake of unmoldy part of food	98(24.8)	89(42.4)	1.84	1.27-2.66	0.001	1.92	1.23-3.0	0.004
Discard moldy food	215(53.2)	106(50.5)	Referent					

Table 2 (cont). Odds Ratio (OR) and 95% Confidence Interval (CI) for Gastric Cancer in Relation to Selected Food Habits

Variables	Control	Case (%)	Unadjusted OR*	95% CI#	p	Adjusted OR**	95% CI	p
Pickling liquid								
Brine	88(21.8)	64(30.5)	3.29	1.72-6.28	<0.001	4.76	2.19-10.37	<0.001
Mixture of vinegar and brine	167(41.3)	89(42.3)	2.41	1.30-4.47	0.005	3.34	1.58-7.05	0.002
vinegar	68(16.8)	15(7.1)	Referent					
Reuse of cooking oil for frying								
Yes	64(15.8)	58(27.6)	1.96	1.31-2.95	0.001	2.47	1.5-4.07	<0.001
No	315(78)	145(69)	Referent					
Fresh Onion								
Never	43(10.6)	20(9.5)	0.41	0.22-0.78	0.008	0.33	0.15-0.76	0.009
<1 times /month	68(16.8)	17(8.1)	0.22	0.11-0.42	<0.001	0.22	0.10-0.49	<0.001
1-3 times /month	85(21)	28(13.3)	0.21	0.16-0.52	<0.001	0.31	0.15-0.64	0.001
1-3 times /week	135(33.4)	77(36.7)	0.51	0.32-0.81	0.005	0.52	0.21-0.94	0.03
Daily	54(13.4)	60(28.6)	Referent					
Fresh tomato								
Never	13(3.2)	22(10.5)	2.33	1.07-5.07	0.03	1.5	0.6-4.03	0.41
<1 times/month	42(10.4)	20(9.5)	0.65	0.34-1.25	0.2	0.4	0.18-0.89	0.02
1-3 times /month	59(14.6)	30(14.3)	0.7	0.397-1.24	0.22	0.56	0.27-1.13	0.11
1-3 times /week	207(51.2)	82(39)	0.54	0.35-0.85	0.008	0.4	0.23-0.70	0.001
Daily	69(17.1)	50(23.8)	Referent					
Fruit (total)								
Never	1(0.2)	1(0.5)	1.95	0.12-31.51	0.63	-	-	-
<1 time /month	8(2)	11(5.2)	2.68	1.04-6.87	0.04	1.1	0.33-3.59	0.87
1-3 times/month	25(6.2)	25(11.9)	1.95	1.06-3.56	0.03	1.13	0.53-2.42	0.74
1-3 times/week	152(37.6)	58(27.6)	0.74	0.50-1.09	0.13	0.6	0.38-0.95	0.03
Daily	199(49.3)	102(48.6)	Referent					
Jam								
Never	51(12.6)	11(5.2)	0.31	0.13-0.72	0.007	0.23	0.085-0.63	0.004
<1 times/month	164(40.6)	63(30)	0.56	0.30-1.01	0.05	0.43	0.20-0.90	0.02
1-3 times/month	79(19.6)	51(24.3)	0.94	0.50-1.76	0.85	1.04	0.47-2.27	0.91
1-3 /week	61(15.1)	54(25.1)	1.29	0.68-2.43	0.45	1.19	0.53-2.64	0.67
Daily	35(6.7)	24(11.4)	Referent					
Honey								
Never	44(10.9)	15(7.1)	0.34	0.15-0.75	0.008	0.19	0.07-0.56	0.002
<1 times /month	189(46.8)	58(27.6)	0.3	0.16-0.56	<0.001	0.22	0.10-0.48	<0.001
1-3/month	88(21.8)	53(25.2)	0.6	0.31-1.14	0.12	0.59	0.26-1.33	0.21
1-3 /week	44(10.9)	53(25.2)	1.2	0.613-2.36	0.58	1.52	0.64-3.64	0.33
Daily	26(6.4)	26(12.4)	Referent					
Pickled vegetables								
Never	51(12.6)	30(14.3)	0.71	0.36-1.41	0.34	0.48	0.20-1.12	0.09
<1 times/month	147(36.4)	64(30.5)	0.53	0.29-0.95	0.03	0.39	0.19-0.81	0.01
1-3times/month	93(23)	33(15.7)	0.43	0.22-0.82	0.01	0.34	0.15-0.77	0.01
1-3 times /week	58(14.4)	47(22.4)	0.99	0.52-1.87	0.97	0.84	0.37-1.86	0.66
Daily	33(8.2)	27(12.9)	Referent					
Salty food preference								
Not salty	73(18.9)	40(19)	0.63	0.37-1.08	0.09	0.64	0.34-1.21	0.17
Medium salty	256(63.4)	115(54.8)	0.52	0.33-0.80	0.003	0.63	0.37-1.04	0.08
Salty	59(14.6)	51(24.3)	Referent					

was positively associated with risk of gastric cancer. Drinking whole milk were more frequent in case group than control group (31.4% vs. 12.4%) and whole milk increased risk of gastric cancer by 2.84 (95%CI=1.84-4.40), however; after adjustment for sex, age, educational level and history of smoking, the observed association were decreased (OR=1.95;95%CI=1.11-3.43). Especial cheese consumption such as Koze and Khiki which are very common in Iranian food habit in North-west of Iran especially in many years ago increased risk of gastric cancer by 12.6 (95%CI:1.99-79.36) and 7.36 (95%CI:1.33-40.54). The increased risk of gastric cancer by koze and khiki cheese consumption became more obvious after adjustment for sex, age, education level, history of smoking and body mass index (BMI). In addition, aged cheese and cottage cheese consumption were significantly correlated with gastric cancer. The positive but not significant relationship was found between intake of Ghorme and gastric cancer (OR:1.31;95%CI: 0.91-1.87).

Eating high fat food was more frequent in case than control group (59.5% *vs* 32.9%). Most of the patients in case group accustomed to eating foods contaminated with mold after removing contaminated part of food (e.g.

tomato paste, lemon juice). Those were used to eating these moldy foods had 84% more risk of gastric cancer than those discarded contaminated food. The ORs for consumption of pickled vegetable in brine and mixture of vinegar and water as compared with vinegar were 3.29 (95% CI:1.72-6.28) and 2.41 (95%CI:1.30-4.47) respectively. The correlation between this type of pickled vegetables consumption and gastric cancer became stronger after adjusting for sex, BMI, educational level, age and history of smoking. Of 212 of patients in case group, 27.6% of subjects reported reused of cooking oil for frying. Those who reported reused of cooking oil for frying had 96% the odds of gastric cancer than subjects did not use it for cooking.

The association between food habit and gastric cancer were presented in Table 2. Fresh tomato consumption had protective effect against gastric cancer while non consumption of fresh onion was inversely correlated with gastric cancer (OR: 0.41; 95%CI: 0.22-0.78). Non consumption, <1times /month and 1-3times/month of fruit consumption increased risk of gastric cancer in comparison with daily consumption. Low intake of jam, honey and pickled vegetables reduced risk of gastric cancer. We found that subjects who preferred not salty food had lower risk for gastric cancer (OR:0.52; 95%CI: 0.33-0.80)

Discussion

To the best of our knowledge, there is no published article about the relationship between food habit in the two past decades and gastric cancer in North-western of Iran.

In this hospital-based case-control study, the positive association was observed between overeating, consumption of bread and high fat food and gastric cancer. Similarly, the findings of previous studies showed starchy grain intake (including potatoes, bread, rice and pasta) and diet contains high fat increased risk of gastric cancer (1997; Navarro Silvera et al., 2008; Babaei et al., 2010). Overeating, diet contains high fat and starchy grains lead to weight gain and obesity(Schrauwen and Westerterp, 2000) which increase risk of gastric cancer. In addition, overeating and high fat diet increase risk of reflux that may consider a major risk for developing gastric cancer (Mayne and Navarro, 2002; Crew and Neugut, 2006).

In the present study, we found that daily consumption of high fat milk, yogurt and cheese especially Koze, Khiki and aged cheese were positively related to risk of gastric cancer. In line with present results, Silver etal. reported that consumption of high fat dairy products was associated with an increased risk of gastric cardia adenocarcinoma (Navarro Silvera et al., 2008). Moreover, Pourfarzi etal. observed daily consumption of dairy products and cheese was associated with 1.56-2.16 fold higher risk for gastric cancer (Pourfarzi et al., 2009). The results of population-based case-control study showed high milk dietary pattern in comparison with healthy dietary pattern increased risk of gastric cancer by 2.2 (95%CI:0.68-7.0) (Chen et al., 2002). In a cohort study, Pols etal. found childhood dairy intake was not associated with gastric cancer risk (van der Pols et al., 2007). Findings of meta-analysis by Tian and colleagues indicated that there was no significant correlation between dairy intake and gastric cancer(Tian et al., 2014). They concluded that well-designed cohort and interventional studies are needed to achieve more precise results (Tian et al., 2014). The findings of the present study are not in agreement with results of the above-mentioned studies. The discrepancy between our results and other study may be due to design and type of the studies, sample size, genetic factors and different food habits. For example, especial types of cheeses which are produced in different ways (explained in method section) are very common in East-Azerbaijan. These cheeses contain high salt, fat and different microbial culture because of especial aging process. Therefore, it seems that daily consumption of these types of cheeses may increase risk of gastric cancer. However, further studies are needed to evaluate the composition of these types of cheeses with more details. On the other hand, it should be kept in mind that we evaluated the food habits in two past decades while most of the studies assessed the relationship between food habit in last year and gastric cancer.

Another result of this study was that those ate un-moldy part of contaminated food had high risk for gastric cancer (OR:1.84; 95%CI:1.27-2.66) rather than those discarded moldy food .This association became more significant after adjusting for sex, BMI, education level, age and history of smoking (OR:1.92; 95%CI:1.23-3.30). Previously, Sun etal. reported that risk for gastric cancer was very high among subjects who consumed more than 2times/week moldy food (OR:5.17;95%CI: 2.75-9.70) (Sun et al., 2013). Moldy foods contain many different type of mycotoxins including aflatoxins, ochratoxin and etc. According to the WHO-International Agency for Research on Cancer reports, aflatoxins was classified as a carcinogen to human while other mycotoxin such as ochratoxins and fumonisins are categorized as possible carcinogens (WHO, 1993a; 1993b). However, the role of other mycotoxins in etiology of cancer remained uncertain (Stevel Taylor, 2014).

We observed consumption of Ghorme (deep fried red meat) increased risk of gastric cancer by 1.31 (95%CI:0.91-1.87). Heterocyclic amines (HCA) are produced by high temperature cooking of meat (Goldman and Shields, 2003). It is plausible that cooking method of Ghorme causes formation of some levels of HCA. It has been reported HCA may consider as a risk factors for human cancer (Humans and Cancer, 1993).

Also, reuse of cooking oil for frying was associated with gastric cancer risk (OR:1.96;95% CI:1.31-2.95), this association became stronger after further adjusting (OR:2.47;95% CI:1.5-4.07). This part of our results is in agreement with Hakami etal. who noted reuse of cooking oil for frying increased risk of esophageal squama cell carcinoma (Hakami et al., 2014). The results of previous studies showed that different carcinogens including polycyclic aromatic hydrocarbons (PAHs) are produced during repeated frying (De Stefani et al., 2003; Pandey et al., 2006; Stefani et al., 2012).

Here, we observed that fresh tomato consumption decreased risk of gastric cancer which are compatible with those of previous studies (Nouraie et al., 2005; Liu

and Russell, 2008). Recently, Yang etal. reported that consumption of tomato and tomato products are inversely correlated with gastric cancer (Yang et al., 2013). Tomato and tomato products are rich source of antioxidant including lycopne and vitamin C. Lycopne is one of the main components of tomato which has antioxidant properties (Agarwal and Rao, 2000; Rao and Agarwal, 2000) and reduces risk of some cancer such as prostate and gastric cancer (Etminan et al., 2004; Liu and Russell, 2008). Moreover, tomatoes are rich source of vitamin C that may prevent incidence of gastric cancer by various mechanisms including: vitamin C protects gastric mucosal against reactive oxygen species, ameliorates gastric mucosal inflammation by scavenging reactive oxygen species, inhibits intragastric formation of nitrosamines as well as it inhibits growth of H.pylori (Jarosz et al., 1998; ZHANG and Farthing, 2005; Jenab et al., 2006). Another result of this study was that total fruit consumption reduced risk of gastric cancer. Our results are supported by earlier studies which reported high intake of fruits has the protective effect against gastric cancer (Tsugane and Sasazuki, 2007; Bastos et al., 2010; Lee and Derakhshan, 2013).

Surprisingly, we found that non consumption of fresh onion had the protective effect against cancer. In contrast to our results, previous epidemiological studies have documented that alliums vegetables such as onion and garlic reduced risk of gastric cancer (Pakseresht et al., 2011; Lee and Derakhshan, 2013). However, results of meta-analysis cohort studies by Wang etal. showed that vegetable consumption are not linked to decrease risk of gastric cancer (Wang et al., 2014). Taking into account the possible role of N-Nitroso compounds in gastric cancer etiology (Cancer and Cancer, 1987), we assumed that no significant protective effect of onion consumption may be due to high residue of nitrate from nitrogen fertilizers in onions.

Similar to findings of other epidemiological and cohort studies (Pakseresht et al., 2011; Ren et al., 2012; Lin et al., 2014) in the present study, low consumption of pickled vegetables decreased risk of gastric cancer incidence. Since pickled vegetables contain high amount of salt and N-nitroso compounds, high consumption of pickles may increase risk of gastric cancer (Pakseresht et al., 2011; Sun et al., 2013).

There are many ways to make pickles in different countries in all over the world, because it depends on how much salt is used or degree of fermentation and acidity in the pickles. We assumed that these factors have many different effects on gastric cancer etiology. In this regard, the results of our study showed that brine pickled vegetables and vinegar brine pickled vegetables consumption were significantly associated with gastric cancer risk. This association became stronger after further adjusting for age, sex, BMI and education level.

In the present study, low intake of jam and honey were correlated to low risk of gastric cancer risk. In line with our findings, Cambell etal. reported that low consumption of sweets/snack were negatively associated with gastric cancer (Campbell et al., 2008) . The results of other studies showed that there was no significant association between glycemic load, glycemic index and carbohydrate intake with risk of stomach cancer(Larsson et al., 2006; Mulholland et al., 2009; Hu et al., 2013). However, according to the findings of invitro and invvio studies, honey is a natural product which has the protective effect against cancer(Ghaffari et al., 2012; Othman, 2012; Erejuwa et al., 2014).Therefore, we thought that the protective effect of low intake of honey in this study may be due to this fact that patients consumed artificial honey.

We found that subjects who preferred not salty food had lower risk for gastric cancer. It has been documented that high intake of salt and salty food increased risk of gastric cancer (Key et al., 2004; Lazarević et al., 2011; D'Elia et al., 2012; Yassibas et al., 2012; Zhong et al., 2012). High intake of salt by different mechanisms has an important role in gastric cancer etiology. These mechanisms include: destroying gastric mucosa, leading inflammation and enhancing the colonization of H.pylori(Takahashi and Hasegawa, 1986; Fox et al., 1999).

Similar to other case-control studies, the present study has some limitations including recall and selection bias especially in hospital based study. In addition, controls are not individually matched to cases. The strength of this study is to evaluate the correlation between of food habit in the two past decades and gastric cancer risk. As far as we know that there is no published article about the relationship between food habit in the two past decades and gastric cancer risk.

In conclusion, the results of present study indicated that over eating, consumption of high fat milk, yogurt and especial types of cheeses increased risk of gastric cancer. In addition, high fat food, moldy food and pickled vegetables consumption as well as reuse of cooking oil for frying were significantly associated with gastric cancer risk. Intake of Ghorme was positively correlated with gastric cancer risk. Fresh tomato and fruit consumption had the protective role against cancer. Moreover, low intake of fresh onion, jam, honey and salt decreased risk of gastric cancer.

Finally, it can be confirmed that especial food habits which have been very common in East-Azerbaijan in the last two past decades increased risk of gastric cancer. However, further well designed cohort studies are needed to achieve more clear results.

According to our results and previous studies and taking into account the long latency period of gastric cancer it can be concluded that nutrition education for a healthy diet should be performed from early childhood.

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