

# Factors Associated with Peptic Ulcer in Taiwan: A Case-control Study

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**Purpose.** This study compared demographic characteristics, lifestyle and family history of peptic ulcer disease (PUD) among patients with PUD and those without PUD.

**Methods.** From 2001 to 2002, we recruited 102 patients with PUD among outpatients aged 18 years and older who had visited the gastrointestinal clinic and underwent endoscopy examinations at a medical center. Controls (N = 71) comprised patients without PUD from the same clinic. We collected data on age, height, weight, blood type, lifestyle, such as smoking, areca quid chewing and alcohol drinking, specific dietary habits, such as spice and vinegar consumption, and family disease history by self-reported questionnaire interviews.

**Results.** There was a higher proportion of males in the patient group compared with control group (65.7% vs 42.3%,  $p = 0.002$ ); individuals in the patient group were also older and had received lesser education than controls. Analyses on lifestyle and diet showed patients have higher ratio of smoking (44.1% vs 23.9%,  $p = 0.02$ ) and areca quid chewing (14.7% vs 2.8%,  $p = 0.010$ ) than controls. Compared with those who had more than 13 years of education, people educated 9-years and less were at a higher risk of peptic ulcer (OR = 6.76, 95% CI = 2.15 to 21.3). People with self-perceived stress were at higher risk of developing peptic ulcer than those who reported not having any stress (OR = 4.96, 95% CI = 2.03 to 12.1).

**Conclusions.** Factors associated with PUD include low education, family history of the disease, and self-perceived stress. Larger scale studies are needed to further investigate the association.

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## Key words

case-control study, family history, lifestyle, peptic ulcer

## INTRODUCTION

Peptic ulcer disease (PUD) is a common disease of the digestive system [1,2]. The self-reported PUD prevalence among people aged 18 years and older in the United States was 10.3% in 1989 [3], compared with 21% among people aged 20 to 81 years in Taiwan [4]. Complications associated with PUD include gastrointestinal hemorrhage [5] and perforation.

*Helicobacter pylori* infection has been

recognized as the main cause of both duodenal ulcers [6-9] and gastric ulcers [7,9,10]. A study in an inner-city minority population in the United States found that *Helicobacter pylori* infection rates were as high as 66.7% in patients with gastric ulcer and 69.5% in patients with duodenal ulcer [9]. Smoking [3,10-15] and alcohol drinking [16] also have been reported to be risk factors for developing peptic ulcers.

Approximately 74.1% of PUD patients in Taiwan are *H. pylori* positive [17]. To our knowledge, however, very few studies have reported on other possible risk factors for developing peptic ulcer disease in Taiwan.

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**Table 1. Comparison of socio-demographic factors between patients and controls**

Factors	Patients n (%)	Controls n (%)	Total N (%)	<i>p</i>
Sex				0.002
Men	67 (65.7)	30 (42.3)	97 (56.1)	
Women	35 (34.3)	41 (57.7)	76 (43.9)	
Age (yr)				0.002
20–45	57 (55.9)	57 (80.3)	114 (65.9)	
46–60	33 (32.4)	13 (18.3)	46 (26.6)	
> 60	12 (11.7)	1 (1.4)	13 (7.5)	
Education (yr)				0.002
≤ 9	42 (41.1)	13 (18.3)	55 (31.8)	
10–12	32 (31.4)	23 (32.4)	55 (31.8)	
≥ 13	28 (27.5)	35 (49.3)	63 (36.4)	
BMI				0.68
19–24	69 (67.6)	47 (66.2)	116 (67.1)	
25–30	30 (29.4)	20 (28.2)	50 (28.9)	
≥ 31	3 (3.0)	4 (5.6)	7 (4.0)	
Blood type				0.87
A	27 (26.5)	20 (28.2)	47 (27.2)	
B	22 (21.6)	17 (23.9)	39 (22.5)	
O	49 (48)	30 (42.2)	79 (45.7)	
AB	4 (3.9)	4 (5.7)	8 (4.6)	
Total	102 (100.0)	71 (100.0)	173 (100.0)	

BMI = body mass index (kg/m<sup>2</sup>).

Therefore, this study investigated the socioeconomic and lifestyle factors that may be associated with peptic ulcer disease among adults in Taiwan.

### MATERIALS AND METHODS

We conducted a case-control study at the China Medical University Hospital (CMUH) from 2001 to 2002. All outpatients aged 18 years and older who had visited the gastroenterological clinic and underwent endoscopic examination at the CMUH were potential study subjects. Patients in whom gastric and duodenal ulcers were diagnosed for the first time were recruited. Controls were composed of people with no PUD who had been randomly selected from the same clinic. We used a questionnaire to interview patients and controls in person. At the initiation of each interview, the interviewer explained the purpose of the study and asked if the interviewee was 18 years of age or older; participants were then asked for information on age, height, weight, blood type, lifestyle such as smoking status and alcohol drinking, specific dietary habits such as spice and vinegar consumption, and family history of the disease.

All variables were categorized for data analyses. We first compared the demographic difference in age, education, and BMI (body mass index) between patients and controls. Dietary patterns, including regular meals and the intake of spice and vinegar were compared. Our study also investigated the association between lifestyles such as alcohol drinking, smoking, coffee consumption and areca quid chewing, and family history of PUD. The Fisher's exact test was used when cell sizes contained less than 5 subjects in the chi-square test. Test statistics were considered statistically significant at  $p \leq 0.05$ . All analyses were completed using the statistical package SAS version 8.1 (SAS Institute, Inc., Cary, NC, USA).

### RESULTS

The study participants comprised 102 patients and 71 controls; there was a male predominance in the patient group (65.7% vs 42.3%,  $p = 0.002$ ) (Table 1). Patients were also older ( $p = 0.002$ ) and had received less education ( $p = 0.002$ ) than those in the control group. Table 2 shows the comparison of dietary factors between patients and controls. There was no

**Table 2. Comparison of dietary factors between patients and controls**

Factors	Patients n (%)	Controls n (%)	Total N (%)	<i>P</i>
Spicy food consumption*				0.93
Yes	64 (62.7)	45 (63.4)	109 (63.0)	
No	36 (35.3)	26 (36.6)	62 (35.8)	
Vinegar consumption				0.04
Yes	33 (32.4)	34 (47.9)	67 (38.7)	
No	69 (67.6)	37 (52.1)	106 (61.3)	
Daily meal				0.32
2 meals	7 (6.9)	4 (5.6)	11 (6.4)	
4 meals	77 (75.5)	60 (84.5)	137 (79.2)	
≥ 4 meals	18 (17.7)	7 (9.9)	25 (14.4)	
Regular breakfast				0.15
Yes	41 (40.2)	21 (29.6)	62 (35.8)	
No	61 (59.8)	50 (70.4)	111 (64.2)	
Regular lunch				0.09
Yes	75 (73.5)	60 (84.5)	135 (78.0)	
No	27 (26.5)	11 (15.5)	38 (22.0)	
Regular dinner				0.24
Yes	54 (52.9)	44 (62.0)	98 (56.6)	
No	48 (47.1)	27 (38.0)	75 (43.4)	
After meal				0.16
Working	19 (18.6)	13 (18.3)	32 (18.5)	
Resting	80 (78.4)	51 (71.8)	131 (75.7)	
Walking	3 (3.0)	7 (9.9)	10 (5.8)	
Change in diet for GI discomfort				0.04
No	44 (43.1)	20 (28.2)	64 (37.0)	
Yes	58 (56.9)	51 (71.8)	109 (63.0)	
Total	102 (100.0)	71 (100.0)	173 (100.0)	

\*2 missing. GI = gastrointestinal.

significant difference between patients and controls in the consumption of coffee, spicy food, daily meals, regular lunch, and regular dinner; however, controls were more likely to use vinegar (47.9% vs 32.4%,  $p = 0.04$ ). Patients were less likely to change their dietary habits compared with controls (56.9% vs 71.8%,  $p = 0.005$ ).

The proportion of areca quid chewers (14.7% vs 2.8%,  $p = 0.01$ ) and tobacco smokers (44.1% vs 23.9%,  $p = 0.016$ ) was higher in the patient group than in the control group (Table 3). Patients also had a much higher rate of self-perceived stress (75.5% vs 45.0%,  $p < 0.0001$ ). Compared with controls, patients had a higher rate of parental history of the disease (31.4% vs 18.3%,  $p = 0.01$ ); on the other hand, the PUD prevalence rate in spouses of controls was higher than in spouses of patients (21.1% vs 8.8%,  $p = 0.0001$ ).

Multivariate logistic regression revealed that males had a higher risk (odds ratio, OR =

2.99) of developing peptic ulcer disease than females (95% confidence interval, CI = 1.13 to 7.90). People who had received 9-years or less education had a higher risk of developing peptic ulcers compared with those who had received more than 13 years of education (OR = 6.76, 95% CI = 2.15 to 21.3). People with self-perceived stress were at higher risk of developing PUD than those who reported no stress (OR = 4.96, 95% CI = 2.03 to 12.1). People with a parental history of PUD were at higher risk than those with no parental history (OR = 2.81, 95% CI = 1.03 to 7.62). People whose spouses had a PUD history (OR = 0.21, 95% CI = 0.06 to 0.75) were at lower risk compared with people whose spouses did not have a history of PUD.

## DISCUSSION

A study in Shanghai found that men and the elderly were at increased risk of developing peptic ulcer [18]. Patients in the present study

**Table 3. Comparison of lifestyle and family disease history between patients and controls**

Factors	Patients n (%)	Controls n (%)	Total N (%)	<i>p</i>
Areca quid chewing				0.01
Yes	15 (14.7)	2 (2.8)	17 (9.8)	
No	87 (85.3)	69 (97.2)	156 (90.2)	
Alcohol drinking				0.10
Yes	23 (22.5)	9 (12.7)	32 (18.5)	
No	79 (77.5)	62 (87.3)	141 (81.5)	
Smoking				0.02
2 meals	8 (7.8)	5 (7.0)	13 (7.5)	
4 meals	37 (36.3)	12 (16.9)	49 (28.3)	
≥ 4 meals	57 (55.9)	54 (76.1)	111 (64.2)	
Coffee drinking				0.73
Yes	39 (38.2)	29 (40.8)	68 (39.3)	
No	63 (61.8)	42 (59.2)	105 (60.7)	
Self-perceived stress				< 0.0001
Yes	77 (75.5)	32 (45.0)	109 (63.0)	
No	25 (24.5)	39 (55.0)	64 (37.0)	
Parental PUD history				0.01
Yes	32 (31.4)	13 (18.3)	45 (26.0)	
No	44 (43.1)	47 (66.2)	91 (52.6)	
Unknown	26 (25.5)	11 (15.5)	37 (21.4)	
Maternal PUD history				0.08
Yes	13 (12.7)	11 (15.5)	24 (13.9)	
No	60 (58.8)	50 (70.4)	110 (63.6)	
Unknown	29 (28.5)	10 (14.1)	39 (22.5)	
Spouse PUD history				0.0001
Yes	9 (8.8)	15 (21.1)	24 (14.4)	
No	74 (72.5)	32 (45.1)	106 (63.5)	
Unknown/unmarried	13 (18.7)	24 (33.8)	37 (22.2)	
Total	102 (100.0)	71 (100.0)	173 (100.0)	

PUD = peptic ulcer disease.

were older and had received less education than those in the control group. The National Health Interview Survey (NHIS) in the United States demonstrated a dose-response relationship between education and the risk of peptic ulcer [3]. In the GLOBE study, van Oort et al [19] reported that inequalities in education can explain mortality and unhealthy lifestyle; therefore, they stated that less-educated people may be at a higher risk for developing the disease [13]. Our study found that people educated 9-years or below had a higher risk of peptic ulcer (OR = 6.76, 95% CI = 2.15 to 21.3) compared to those educated more than 13 years and above.

Lifestyle and dietary habits are considered important factors in peptic ulcer disease [13]. A Japanese study of men aged 45 years and older revealed that current smokers are at higher risk of both gastric (relative risk (RR) = 3.4, 95% CI =

2.4 to 4.7) and duodenal ulcers (OR = 3.0, 95% CI = 1.9 to 4.7), compared with nonsmokers [12]. Another study found that the cure rate of duodenal ulcer disease was higher in nonsmokers than in smokers (95% vs 53%,  $p < 0.01$ ) [11]. However, a perspective study failed to confirm their finding this beneficial effect [20]. In this study, we found that patients have a higher incidence of tobacco smoking and areca quid chewing. Our study showed that the odds ratio of PUD was 2.92 (95% CI = 1.38 to 6.18) for people who have smoked; however, it was not significant in the multivariate logistic regression. Kato et al reported a similar finding for risk of gastric ulcer in Japanese smokers compared with nonsmokers (OR = 1.7, CI = 1.2 to 2.5) [12]. Our finding that areca quid chewing is associated with peptic ulcer has not been reported previously. On the other hand, people with lower education may have

**Table 4. Odds ratios for factors associated with peptic ulcer in the multivariate logistic regression**

Factors	Crude OR (95% CI)	Adjusted OR (95% CI)
Sex		
Female	1.0	1.0
Male	2.62 (1.40-4.88)**	2.99 (1.13-7.90)*
Age (yr)		
20-45	1.0	1.0
46-60	0.99 (0.50-1.96)	0.89 (0.33-2.42)
> 60	3.42 (1.07-10.87)*	4.56 (0.89-23.4)*
Education (yr)		
≥ 13	1.0	1.0
10-12	1.74 (0.84-3.61)	2.03 (0.75-5.52)
≤ 9	4.04 (1.82-8.95)**	6.76 (2.15-21.3)***
Vinegar consumption		
No	1.0	1.0
Yes	0.52 (0.28-0.97)*	0.44 (0.19-1.01)
After GI discomfort		
Changing diet	1.0	1.0
No	1.93 (1.01-3.70)*	2.03 (0.85-4.82)
Areca quid chewing		
Never	1.0	1.0
Yes	6.98 (1.56-31.27)*	1.50 (0.21-10.72)
Smoking status		
Never	1.0	1.0
Ex-smoker	1.52 (0.47-4.92)	0.67 (0.15-3.06)
Current smoker	2.92 (1.38-6.18)*	1.40 (0.48-4.07)
Self-perceived stress		
No	1.0	1.0
Yes	3.75 (1.96-7.19)***	4.96 (2.03-12.1)***
Parental PUD history		
No	1.0	1.0
Yes	2.52 (1.12-5.71)**	2.81 (1.03-7.62)*
Unknown	2.63 (1.22-5.65)**	4.02 (1.40-11.5)
Spouse PUD history		
No	1.0	1.0
Yes	0.26 (0.10-0.65)*	0.21 (0.06-0.75)*
Others	0.34 (0.17-0.71)**	0.26 (0.09-0.75)*

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ . GI = gastrointestinal; PUD = peptic ulcer disease.

unhealthy lifestyle was not considered in this study and it showed some limitations. The prevalence of areca quid chewing among patients in the present study was slightly higher than that in the general population in Taiwan. Stress and family history of PUD have been shown to be associated with the risk of PUD [18,21]. Patients in the present study did have higher rates of self-perceived stress and parental PUD than controls. As a result, it is possible that stress (including social stress) may play an important role in initiating ulcer disease [22].

Compared with non-drinkers, men who drink one cup of coffee per day have a significantly elevated risk of developing gastric

cancer [23], although a previous study suggested coffee drinking seems to be of no importance [24]. In this study, we failed to find an association between coffee drinking and the disease. We found that vinegar may be a beneficial factor though it was not significant in the multivariate logistic regression (OR = 0.44, 95% CI = 1.01). Vinegar is regarded as a good dietary source of antioxidant [23] but no study has ever reported an association between vinegar and decreased risk of peptic ulcer disease. Regular intake of breakfast has been observed as one of a number of health-related behaviors associated with improving health status [25]; we found that consumption of breakfast on a regular basis has a beneficial effect

on preventing PUD.

In a longitudinal study of adults in America [21], persons who perceived themselves as being stressed were found to be 1.8 times more likely to develop peptic ulcers (95% CI = 1.3 to 1.5). We found a higher rate of self-perceived stress among patients than among controls (75.5% vs 45.0%,  $p < 0.0001$ ) in this study. After adjusting for related factors, people who perceived themselves as being stressed were found to be 4.96 times more likely to develop peptic ulcers (95% CI = 2.03 to 12.1).

In Shanghai, family history (parental and/or maternal) of peptic ulcer disease was shown to be associated with increased risk of PUD [18]. However, we found a higher rate of PUD history in spouses of controls than those of patients. To our knowledge, no other report declaring this type of association has been published. Because men are more likely to have the disease than women, we believe that women's husbands are more likely to be PUD patients.

The results reported in this study have shown that low socioeconomic status is associated with PUD, and that family history may actually reflect the socioeconomic status. Self-perceived stress is also a risk factor for developing PUD.

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# 消化性潰瘍的相關因子：病例對照研究

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**目的** 本文比較消化性潰瘍病人與沒有消化性潰瘍病人的人口地理特徵、生活型態與消化性潰瘍的家族病史。

**方法** 從2001到2002年期間，經由消化系醫師的診斷我們在一家醫學中心收集了消化性潰瘍的病例與對照。全部的參加者皆是醫院腸胃科18歲以上的門診病人且接受內視鏡的檢查。經由問卷訪視，我們收集了病例與對照的資料，包括年齡、身高、體重、血型、生活型態如抽菸及喝酒等、特定的飲食習慣如辛辣物及醋的攝食與家族病史等。

**結果** 共有102位消化性潰瘍病例與71位對照，病例組的男性比例較對照組稍高。相對於對照組，病例組年紀較高及教育程度較低。由生活型態與飲食的資料顯示，病例組曾經有抽菸(44.1% vs 23.9%， $p = 0.02$ )、嚼檳榔(14.7% vs 2.8%， $p = 0.010$ )的比例都比對照組高。與大專教育程度的人相較，教育程度國中以下的人有較高的消化性潰瘍風險(OR = 6.76，95% CI = 2.15-21.3)。自我陳述有壓力的人發生消化性潰瘍之危險比沒有壓力的人來得高(OR = 4.96，95% CI = 2.03-12.1)。

**結論** 本研究結果顯示消化性潰瘍的發生可能與低教育程度、家族病史及自我陳述壓力相關，但需要更大型的臨床研究做進一步的探討。(中台灣醫誌 2006;11:1-8)

## 關鍵詞

病例對照研究，家族史，生活型態，消化性潰瘍

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