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Effect of Red Chili Powder on Gastro-oesophageal Reflux, Esophageal pH, and Gastric Emptying in Patients with Reflux like Dyspepsia

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ABSTRACT

Spicy foods, or red chili ingestion has been considered as an aggravating factor of gastro-oesophageal reflux symptom. But the effect of chili on gastro-oesophageal reflux disease (GORD) has not been well understood.

Aims: To determine the effect of acute ingestion of red chili powder with meal on gastro-oesophageal reflux, and gastric emptying in patients with gastro-oesophageal reflux symptoms.

Methods: Twelve patients with typical GORD symptoms, each underwent simultaneous esophageal pH and gastric emptying scintigraphy study after ingestion of 2 different test meals (i) standard meal (instant noodle with egg) (ii) standard meal with chili (instant noodle with egg mixed with 2 gm of red chili powder) in randomized, cross-over fashions, with a 1-week washout period. Gastrointestinal symptoms were evaluated by 100 mm visual analog scale (VAS).

Results: After the test meal ingestion, 11 subjects completed the study. After ingestion, both standard meal and spicy meal increased gastro-oesophageal reflux. An increase in gastric retention was observed at 1st hour after spicy meal ingestion compared with standard meal ($p = 0.05$). Number of gastro-oesophageal reflux, % time pH <4 in distal esophagus, mean esophageal and gastric pH, and gastro-oesophageal reflux symptoms were not different between standard meal and standard meal with red chili ($p > 0.05$). However, in patients with positive 24-hour esophageal pH test, there was a significant increase in acid reflux number at 2nd hour. This difference was not observed in patients with negative 24-hour esophageal pH test.

Conclusion: After meal ingestion, both standard meal and spicy meal induced an increase in gastro-oesophageal acid refluxes. During the 2nd hour after ingestion, spicy meal induced more acid reflux. This suggested that spicy meal ingestion induce acid reflux longer than standard meal and this may be associated with an increase in food retention in the stomach.

Key words : Gastro-esophageal reflux, GORD, dyspepsia, capsaicin, chili

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INTRODUCTION

Red chili (Capsicum) is a spicy ingredient commonly used around the world. Chili ingestion produces a variety of gastrointestinal symptoms in up to 25% of the patients presenting with chronic upper abdominal pain, including heartburn, nonburning chest discomfort, abdominal discomfort, nausea, belching, distension, burning sensation in the mouth and facial sweating.[1,2] Capsaicin (8-methyl-N-vanillyl-6-nonenamide) is the main component of chili responsible for its characteristic hot taste (pungency).

Spicy foods, red chili or capsaicin ingestion has been considered to aggravate gastro-oesophageal reflux symptom. But the effect of chili and capsaicin on gastro-oesophageal reflux syndrome (GORD) was not well understood. Acute exposure by intra-oesophageal application and intragastric infusion of capsaicin containing red pepper in healthy volunteers induced esophageal and gastric hypersensitivity.[3,4] While another study in heartburn sufferers found that oesophageal and gastric pH profiles and gastric emptying were not different between meals with or without 5 mg of capsaicin in capsules.[5]

Therefore, the aim of this study was to evaluate the effect of acute ingestion of red chili powder with meal on gastro-oesophageal reflux symptoms, esophageal pH profiles, and gastric emptying in patients with typical GORD symptoms.

MATERIALS AND METHODS

Subjects

Twelve healthy subjects (eight men and four women; age range 26-65 years) with at least a 3-month history of heartburn or acid regurgitation were included. All patients had a negative esophagogastroduodenoscopy (EGD) within 3 month before the study. All subjects were interviewed about their general health and gastrointestinal symptoms prior to the study.

Study protocol

All subjects were asked to avoid chili, spicy foods, and acid suppression therapy or medication known to influence oesophageal and/or gastric motility for at least 7 days prior to the study. Qualified subjects underwent standard oesophageal manometry to identify possible oesophageal motility disorders and to locate the lower oesophageal sphincter for subsequent placement of the pH catheter. All subjects underwent standard 24-hour esophageal pH monitor. A positive 24-hour esophageal pH test result was defined as the distal oesophageal pH at 5 cm above the lower oesophageal sphincter (LOS) less than four for greater than 4.5% of the total time.

Each subject underwent gastric emptying scintigraphy, intragastric and intra-esophageal pH assessments under two occasions: (i) a standard meal (instant noodle with egg); (ii) a standard meal with red chili powder (Capsicum frutescens Linn, 1.956 mg of capsaicin / 2 g dry weight, Hand Brand No. 1, Nguan Soon Co., Ltd., Bangkok, Thailand) in randomized, cross-over fashions, with seven days washout period. All subjects remained upright during the entire monitoring interval.

pH monitoring

In the morning of the day of each study, all subjects fasted overnight and underwent an esophageal-gastric pH monitoring using a dual channels (15 cm apart) antimony pH catheter. The proximal electrode was placed at 5 cm above the lower esophageal sphincter and the distal electrode was placed at 10 cm below the lower esophageal sphincter. Esophageal and gastric pH levels were monitored for 2-hour post-prandial period using a pH Digitrapper^{TM} pH 400 (Synectics Medtronics, Inc.)

Symptom assessment

After pH catheter was placed, subjects rated heartburn, acid regurgitation, abdominal pain and dyspepsia (nausea, fullness, bloating) on a 100-mm VAS Scale, at baseline, immediately after meal and then at every 15 minutes for 2 hours after meal.

Gastric emptying scintigraphy

The standard test meal was labeled with 99 m Technetium sulphur colloid (500 lCi)-labelled scrambled egg with instant noodle and 300 mL of water. All subjects were instructed to complete ingestion of the meal within 10 minutes. One minute images were obtained in the anterior and posterior projection immediately, 15, 30, 45, 60, 75, 90,105 and 120 minutes after meal ingestion while the patient was standing. Scintigraphic images were obtained with a large field of view gamma camera (Biad XLT 20 : Trionix, Inc.) using a low energy all-purpose collimator with a 20% energy window setting centred at 140 keV. Patients were allowed to sit in a chair between the stand-

ing images acquisitions.

Statistics

Data are expressed as mean ± SEM and percentages. Reflux parameters and gastric emptying time with or without chili were compared using the Wilcoxon's rank test. Differences were considered statistically significant with $p < 0.05$.

RESULTS

One subject was dropped from the study after first visit (meal without chili) due to unable to control symptom after holding acid suppression therapy. Therefore, 11 subjects completed the study.

Patient's characteristics

There were 11 patients (7 males and 4 females) with mean age 45 ± 12 years (range 26-65 years) completed the study. Six patients presented with heartburn and five patients presented with acid regurgitation as a predominate symptom. 24-hour esophageal pH monitoring demonstrated an increase in acid exposure in five patients. All patients avoid spicy foods and chili in their daily life and also reported that spicy foods and chili increased severity of their symptoms.

Symptoms

There was no difference in the baseline gastrointestinal symptoms before ingestion of the standard meal. Subjects experienced more severe hot taste when chili was taken with meal than the meal without chili (0 vs. 1.86 ± 1.9, $p = 0.026$) There was no difference in heartburn, acid regurgitation, abdominal pain and dyspepsia symptom scores (nausea, fullness and bloating) between standard meal and standard meal with chili.

Esophageal and gastric pH

There were no differences in the means and maxima of the gastric and esophageal pH profiles or number of reflux episodes following ingestion of meal with chili vs. without chili. In subgroup analysis, 24 hr pH monitor positive subjects had significant increases in number of acid reflux during 90 to 120 minutes post-prandially (meal = 7.6 ± 3.8 vs. meal with chili = 16.6 ± 3.8; $p = 0.042$) and the second hour post-prandially (meal = 7.6 ± 3.8 vs. meal with chili = 16.6 ± 3.8; $p = 0.042$).

Table 1. Show the patients characteristic.

Age	Range 26-65 years	Mean = 45 ± 12 years
Sex	Male = 64% (7/11)	Female = 36% (4/11)
Predominate symptom	Heartburn = 55% (6/11)	Acid regurgitation = 45% (5/11)
24-hour pH monitoring	Positive = 45% (5/11)	Negative = 55% (6/11)

Table 2. Mean and minimal esophageal and gastric pH in 11 patients (mean ± SD)

		Standard meal	Standard meal with chili	p-value
Esophageal pH	Min	2.50 ± 1.6	1.68 ± 1.5	p = 0.155
	Mean	5.55 ± 1.2	5.44 ± 0.9	p = 0.534
Gastric pH	Min	0.58 ± 0.2	0.52 ± 0.3	p = 0.959
	Mean	1.38 ± 0.5	1.47 ± 0.6	p = 0.386

Table 3. % Time pH <4 in distal esophagus during study in 11 patients (mean ± SD, $p > 0.05$)

	30 min	30-60 min	60-90 min	90-120 min	1st hour (0-60 min)	2nd hour (60-120 min)
Chili	2.10 ± 5.7	11.50 ± 17.9	21.05 ± 30.8	24.44 ± 30.8	6.83 ± 11.7	25.92 ± 30.1
No chili	8.34 ± 20	17.93 ± 29.8	22.25 ± 36.8	20.60 ± 31.3	13.15 ± 24.3	21.44 ± 31.6

Table 4. Number of reflux during study in 11 patients (mean ± SD, p >0.05)

	30 min	30-60 min	60-90 min	90-120 min	1st hour (0-60 min)	2nd hour (60-120 min)
Chili	1.45 ± 3.2	4.55 ± 6.5	4.00 ± 4.5	4.45 ± 5.2	5.91 ± 9.2	8.27 ± 8.4
No chili	2.73 ± 4.6	3.00 ± 3.8	2.09 ± 2.7	2.72 ± 3.3	5.64 ± 7.3	4.55 ± 4.9

Table 5. Number of reflux during study between meals in 24-hour pH monitoring positive patients (n = 5, mean ± SD)

	30 min	30-60 min	60-90 min	90-120 min	1st hour (0-60 min)	2nd hour (60-120 min)
Chili	2.60 ± 4.7	8.40 ± 8.4	7.40 ± 4.7	9.60 ± 2.5*	10.80 ± 12.4	16.60 ± 3.8*
No chili	4.80 ± 6.6	5.80 ± 4.1	2.80 ± 1.9	5.40 ± 4.7*	10.40 ± 8.7	7.60 ± 3.8*

*p <0.05

Table 6. % Gastric retention between meals during study in 11 patients (mean ± SD)

	30 min	60 min	90 min	120 min
Chili	85.18 ± 4.8	67.90 ± 10.8*	45.36 ± 8.9	29.64 ± 8.4
No chili	78.73 ± 11.1	58.64 ± 13.2*	43.45 ± 16.4	29.00 ± 15.1

*p = 0.05

Gastric emptying

Red chili 2 gm with the standard meal did not alter mean gastric emptying (t1/2 = 83.64 ± 27.4 minutes for the meal without chili vs. 82.84 ± 11.9 minutes for the meal plus chili; p >0.05). However, % gastric retention between meals was increased at 60 minute (58.64 ± 13.2% for the meal without chili vs. 67.90 ± 10.8% for the meal plus chili; p = 0.05) after spicy meal compared with standard meal.

DISCUSSION

Previous studies that evaluated the effect of chili or capsaicin in human were shown different results between healthy volunteers and patients with reflux like dyspepsia. In 1998, R. Gonzalez, *et al* enrolled 7 healthy volunteers and infused intra-esophageally with 2.5 ml of red pepper sauce (Tabasco) 25%v/v (0.42 mg of capsaicin) compared with saline solution. Infusion of red pepper sauce suspension significantly increased the amplitudes and propagation velocity of esophageal pressure waves and lower esophageal sphincter pressure and delayed gastric emptying time.[3] In 2000, S. Rodriguez-stanley, *et al* enrolled 11 heartburn sufferers that consumed the meal plus 5 mg of capsaicin in capsules compared with the meal plus placebo capsules and underwent two separate pH monitoring sessions and assessments of gastric emptying, heartburn and dyspepsia. Esophageal and gastric pH profiles and gastric emptying were not different between meals. Capsaicin did not alter mean heartburn and dyspepsia scores but significantly decreased time to peak heartburn.[5] Recent study suggest that the chronic ingestion of chili significantly increase acid reflux variables in healthy volunteers.[6]

Our study was designed to evaluate the effect of acute ingestion of red chili powder which represented the most physiologically by consumed meal with or without chili on gastro-oesophageal reflux, esophageal pH, and gastric emptying in patients with reflux like dyspepsia. The result in this study showed that chili did not increase reflux symptoms except hot taste that significantly increased with chili. It has been reported that a Thai subject consumed 5 gm of chili per day[7]. The 2 gm of chili per meal that we used in our study corresponded with typical amount of chili in one serving meal of Thai people.

Esophageal and gastric pH profiles were not different between meals in overall patients with reflux symptoms. But in subgroup analysis, patients with positive 24-hour pH esophageal monitoring results had significantly increases number of refluxes in the second hour of post-prandial period.

Gastric emptying were not different between meals in all patients (t1/2 = 83.64 ± 27.4 minutes for the meal without chili vs. 82.84 ± 11.9 minutes for the meal plus chili; p >0.05). A previous study suggested that the retention of gastric contents in the proximal stomach was significantly greater in GORD patients than normal controls both early (0 min) and late (2, 3 and 4 hr) after meal ingestion suggests enhanced proximal stomach reflex relaxation and subsequent impaired tonic contractions.[8] In this study gastric retention trend to increase at 60 min (67.90 ± 10.8 with chili vs. 58.64 ± 13.2 without chili; p = 0.05). These results corresponded with previous studies that reported exaggerated[9,10] and delayed recovery[11] of post-prandial proximal gastric relaxation or the accommodation reflex in GORD.

In summary, acute ingestion of chili with meal in patients with GORD symptoms significantly increase the number of reflux during 60-120 minute-postprandial period in patients with positive result of baseline 24-hour pH monitoring. The increases in acid refluxes may associate with gastric retention of food at early period of the study.

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