Effect of red chillies on small bowel and colonic transit and rectal sensitivity in men with irritable bowel syndrome

Article *in* Indian Journal of Gastroenterology · September 2002

Source: PubMed

CITATIONS
22

READS
139

5 authors, including:

Shobna Bhatia
King Edward Memorial Hospital
128 PUBLICATIONS **1,377** CITATIONS
SEE PROFILE

Ujwal Bhure
11 PUBLICATIONS **289** CITATIONS
SEE PROFILE

Effect of red chillies on small bowel and colonic transit and rectal sensitivity in men with irritable bowel syndrome

MANISH K AGARWAL, SHOBNA J BHATIA, SHANTA A DESAI,* UJWAL BHURE,* S MELGIRI*

Departments of Gastroenterology and *Pharmacology,
B Y L Nair Hospital and T N Medical College, Mumbai 400 008

Background: Altered motility and threshold for pain have been incriminated in the pathogenesis of the irritable bowel syndrome (IBS). Capsaicin affects visceral sensory perception and chillies, which contain capsaicin, have been shown to accelerate gut transit. **Aims:** To evaluate the effect of red chillies on small bowel transit (SBT) and colonic transit (CT) and rectal sensitivity in normal men and men with IBS. **Methods:** Twenty-nine men with IBS diagnosed using Manning's criteria, and 21 healthy men, were studied before and after ingestion of 10 g red chilli powder (capsaicin equivalent 14 mg). SBT time was measured as the time taken for ^{99m}Tc-sulfur colloid to reach the cecum after leaving the stomach. Total and segmental CT times were assessed using radio-opaque markers. Rectal sensitivity and pain threshold to intrarectal balloon distension were measured. **Results:** The median (range) bowel frequency in patients and healthy men was 2 (1-6) and 1 (1-3) per day ($p=0.03$), respectively. After ingestion of chillies, it increased to 3 (1-8) per day and 2 (1-4) per day ($p=0.01$), respectively. There was no difference in transit times between patients and healthy men; chilli ingestion did not alter SBT time, total or segmental CT time. IBS patients had a lower threshold to balloon distension for both discomfort and pain in the basal state ($p<0.01$). Chillies increased this threshold in healthy men ($p<0.01$). **Conclusions:** Men with IBS do not have SBT or CT abnormalities, but have a lower rectal balloon sensitivity threshold. Chilli powder does not alter either SBT or CT in men with IBS or healthy men; however, it increases the rectal threshold for pain in the latter. [*Indian J Gastroenterol* 2002;21:179-182]

Key words: Capsaicin, colonic transit, gut hypersensitivity, gut motor response, small bowel transit

Disturbance of gastrointestinal motility has been incriminated in the pathogenesis of the irritable bowel syndrome (IBS), based on experimental as well as clinical observations.[1] However, motility patterns unique to IBS have not been identified. Hypersensitivity of the gut,[2] as evidenced by low threshold for pain in response to balloon distension in the rectum, is another observation in IBS.

Red chillies, which contain capsaicin as the active ingredient, are a widely used spice in Indian food.[3] Chillies are known to accelerate colonic transit[4] and cause sensory desensitization of the esophagus.[5] Tomlin *et al*[6] found that addition of two grams of red chillies to diet delayed gastric emptying but speeded whole gut transit in healthy individuals. We evaluated the effect of red chillies on rectal sensitivity and on small bowel and colonic transit in healthy men and men with IBS.

Methods

The protocol of the study was approved by our institution's ethics committee and written, informed consent was obtained from all the subjects.

Patients were included if they satisfied at least three of Manning's criteria for the diagnosis of IBS.[7] Those with dyspepsia, previous abdominal surgery, medical disorders likely to interfere with bowel motility, or any structural cause for abdominal symptoms detected on clinical, radiological or endoscopic examination, and those consuming drugs known to influence gut motility or receiving treatment for IBS were excluded. Women were not studied because it is known that symptoms of IBS often worsen with the menstrual cycle.[8] Twenty-three healthy men were studied as controls.

Patients were subjected to physical examination, complete blood count with erythrocyte sedimentation rate, and stool examination including occult blood and ova/cysts of parasites. Sigmoidoscopy was done to rule out diseases of the rectosigmoid region.

Study design

Baseline small bowel transit (SBT) and colonic transit (CT) time and sensitivity to rectal balloon distension were measured in all subjects. One week later, subjects were given 10 g red chilli powder (approximately 14 mg capsaicin[3]) filled in ten '00' gelatin capsules. After an overnight fast, the subject was asked to swallow the capsules simultaneously. Two hours later, SBT and CT studies were begun. Any gastrointestinal symptoms like diarrhea, abdominal pain, nausea and vomiting, which occurred during the next 24 hours, were recorded; the IBS patients were specifically asked whether they experienced any aggravation of their pre-existing symptoms. Rectal sensitivity testing was done the next morning approximately 24 h after ingestion of the chilli powder.

SBT was assessed using a method described ear-

lier.[9] Ultrasonography of the abdomen was done and a radioactive marker placed on the anterior abdominal wall to mark the cecum. After an overnight fast, the subject was asked to drink one millicurie of ^{99m}Tc-sulfur colloid dissolved in 250 mL of water and scintigraphic scanning was begun with the subject lying supine under anteriorly-placed large-field-of-view gamma camera (ADAC Pegasys, USA) with high-resolution parallel-hole collimators positioned over the abdomen. Images were acquired at the rate of 1 min/frame. Scans were obtained every 2 min for the first 30 min, every 4 min for the next 30 min, and at 10-min intervals during the second hour, at 20-min intervals during the third and the fourth hours, and every 30 min thereafter till at least 80% of the radioactive marker had entered the colon. Both anterior and posterior images were obtained.

Geometric mean was used for the calculation of SBT time. SBT was calculated by subtracting the gastric lag time from the cecal lag time. Gastric lag time was defined as the time taken for a 10% fall in gastric peak activity, whereas cecal lag time was time taken for 10% of the activity first appearing in the cecum or right colon. As the cecum-to-ascending colon transfer time is approximately 4 min, this was deducted from calculations when the ascending colon marking was used as the end point.

Colonic transit was measured by the radio-opaque marker technique,[10] with 20 radio-opaque markers each given thrice at 9-h intervals.[11] Abdominal and pelvic radiographs were taken 9 hours after ingestion of the last set of capsules. If more than 40 markers were detected in the radiograph, another film was taken 9 hours later. Total colonic and segmental transit times were calculated after counting the total number of markers on the abdominal radiograph, using the following formula: total CT time (in hours) = 9/20 x N, where N denotes the sum of markers. Segmental CT time was calculated using the same formula, where N is the number of markers seen in the given colonic segment.

If the bowel outlines showed the cecum, a transverse colon or a large sigmoid loop above the fifth lumbar vertebra, markers were judged to be in the anatomic segment based on the gaseous outlines. In the absence of clear outlines of the bowel, markers located to the right of the vertebral spinous processes above a line from the fifth lumbar vertebrae to the pelvic outlet were assigned to the right colon; markers to the left of the vertebral spinous processes above an imaginary line from the fifth lumbar vertebra to the anterior superior iliac crest were assigned to the left colon; markers inferior to a line from the pelvic brim on the right and the superior iliac crest on the left were judged to be in the rectosigmoid and rectum.[12] If a colonic segment did not contain any marker, the data for that particular segment were excluded from further analysis.

Rectal sensitivity to balloon distension was measured with the help of a 5-cm-long latex balloon, tied to the tip of a pediatric feeding tube of 8 Fr size. The distal end of the feeding tube was connected to a manometer and a 100 mL plastic syringe with the help of a three-way stopcock. With the subject in the left lateral position, the balloon was inserted into the rectum with the help of a rigid sigmoidoscope, such that the center of the balloon was 10 cm from the anal verge. The rectal sensitivity to balloon distension was tested as described previously.[13] The balloon was serially inflated at increments of 20 mL. The subject was instructed to indicate the first appearance of feeling of discomfort or pain; at these time points, the volume of air and the pressure in the balloon were recorded. At least three readings were taken for each parameter, and the average of readings recorded.

Statistical analysis

Data are shown as mean (SD). Stool frequency is expressed as median (range). Analysis was done using the Student's *t* test for unpaired or paired data, as applicable. Comparison of stool frequency between groups was done using the Mann-Whitney test. The χ^2 test for proportions was used to assess the frequency of symptoms following chilli ingestion.

Results

Thirty-five consecutive men with IBS (mean age 28.8 [6.5] years) were enrolled; 6 of them did not complete the study (1 developed fever, 1 developed gastroenteritis, and 4 declined to participate in the second part of the study). Twenty-three healthy men (mean age 29.2 [8.2] years) were recruited as controls; two of them refused to participate in the post-chilli study. Results of only those subjects who completed both parts of the study were taken into consideration.

Symptom evaluation

All patients with IBS had abdominal pain as well as altered bowel habits. All had relief after passage of stools, 27 had feeling of incomplete evacuation, 24 had mucus in stools, 20 had straining, and 13 had urgency at stools. The median (range) duration of symptoms was 15 (6 - 96) months.

The median bowel frequency was 2 (1-6) in patients, and 1 (1-3) per day in healthy men (p=0.03). In the 24-h period following ingestion of chillies, it was 3 (1-8) per day (p=0.01 compared to baseline) and 2 (1-4) per day (p=ns compared to baseline), respectively.

Post-chilli ingestion

In the IBS group, 11 patients developed nausea, 1 had vomiting, 11 developed abdominal pain, 12 had feeling of abdominal distension, 10 developed gurgling, 7 had

Table 1: Baseline and post-chilli small intestinal and colonic transit times in controls and in patients with irritable bowel syndrome (IBS)

	Controls (n=21)				IBS patients (n=29)			
	Baseline		Post-chilli		Baseline		Post-chilli	
	nt*		nt		nt		nt	
SBT time (min)		43.7 (16.3)		40.6 (17.5)		48.9 (20.7)		48.8 (33.2)
Total colonic TT (h)	21	15.9 (5.8)	21	15.0 (4.6)	29	14.6 (4.5)	29	11.9 (5.5)
Right segmental TT (h)	21	6.3 (4.1)	21	6.4 (3.1)	29	**8.9 (4.6)	28	7.1 (4.7)
Left segmental TT (h)	17	6.0 (4.6)	20	4.2 (2.7)	27	4.1 (3.3)	21	5.4 (4.3)
Recto sigmoid TT (h)	20	4.9 (4.1)	21	4.5 (3.9)	19	4.8 (4.9)	18	4.7 (3.4)

SBT = Small bowel transit; TT = Transit time; *nt = Number of subjects in whom markers were present on the radiograph during CTT; **p=0.049 as compared to controls
Data are shown as mean (SD)

diarrhea and 14 had rectal discomfort. These symptoms appeared 12-24 hours after ingestion of chillies.

In the control group, 2 subjects developed nausea, 5 experienced abdominal pain, 3 had feeling of abdominal distension, 3 developed gurgling, and 2 each had diarrhea and rectal discomfort. Nausea, distension and rectal discomfort were more frequent in patients with IBS ($p<0.05$).

Transit times (Table 1)

No study subject had >40 markers on the radiograph. There was no difference in the SBT time and total CT time between patients and control subjects. Right-sided colonic transit was slower in patients with IBS ($p=0.049$). In both controls as well as IBS patients, chillies did not significantly alter SBT, total CT time, or the segmental CT time.

Sensitivity to balloon distension (Table 2)

IBS patients experienced discomfort and pain at a lower volume ($p<0.005$) and pressure ($p<0.005$) after balloon distension as compared to controls. After ingestion of chillies, there was an increase in threshold for discomfort ($p<0.01$) and pain ($p<0.01$) in control subjects; in men with IBS, the threshold pressure to pain was higher than baseline ($p<0.01$).

Table 2: Baseline and post-chilli rectal sensitivity to balloon distension in controls and in patients with irritable bowel syndrome

	Controls		IBS patients	
	Baseline	Post-chilli	Baseline	Post-chilli
Discomfort				
Volume (mL)	76 (23.7)	91.3 (28.7)@	57.0 (22.8)*	61.2 (20.8)
Pressure (mmHg)	34.2 (9.6)	42.6 (12.6)@	25.6 (9.4)*	29.1 (19.9)
Pain				
Volume (mL)	123.4 (33.3)	140.8 (36.5)@	91.3 (31.6)*	107.7 (33.2)
Pressure (mmHg)	55.7 (13.5)	63.1 (15.4)@	40.0 (10.2)*	48.8 (14.8)@

*p<0.005 as compared to corresponding values in controls
@p<0.01 as compared to baseline values

Discussion

The SBT time in our healthy men was shorter than that reported in Western studies. A similar finding has been reported previously in normal Indian subjects.[14] We did not find any difference in small bowel transit time between healthy men and men with IBS. Ileo-cecal transit, as measured by scintigraphy after delivery of radionuclide in distal ileum in enteric-coated capsules, has been shown to be faster in diarrhea-predominant IBS patients.[15] Also, the oro-cecal transit time in diarrhea-predominant IBS has been found to be significantly shorter as compared to healthy subjects.[16]

The total and segmental CT times in our healthy men were lower than those reported from Western studies. The right segmental CT was slower in our patients with IBS as compared to controls. IBS patients were also found to have a lower threshold for the sensation of discomfort and pain in response to rectal balloon distension. Such lower thresholds have been reported earlier in IBS.[2,17]

Following the administration of chillies, a variety of symptoms occurred in healthy men as well as in IBS patients. Nausea, abdominal distension and rectal discomfort were experienced more often by patients with IBS. However, there was no deleterious or beneficial effect on the overall symptoms of IBS. Chilli ingestion also did not significantly alter SBT times in IBS patients and, as observed by other investigators too,[4,6] in healthy volunteers.

We did not find any alteration in the total or segmental CT in either healthy men or IBS patients, after the ingestion of 10 g chillies. Horowitz *et al*[4] used 20 g of chilli powder, whereas Tomlin *et al*[6] gave their volunteers only 2 g. Both these groups found faster total CT and rapid right segmental CT. This could be explained on the basis of different dietary habits. Thus, Western subjects may respond to chillies with gut hypermotility, whereas Indian subjects, exposed normally to more spicy diet, may not. Shah *et al*[18] showed that ingestion of 15 g chilli daily for 3 days had a variable effect on symptoms in Indian patients with IBS, but there was no effect on rectosigmoid motility.

We cannot explain why chillies raised the threshold for both discomfort and pain in response to rectal balloon distension in controls, but not in IBS patients. Capsaicin is a well-known neurotoxin that significantly affects visceral sensory perception. Calcitonin gene-related peptide (CGRP) is believed to be the key neu-

rotransmitter involved in capsaicin-sensitive afferent neuronal functions. CGRP receptors have been localized both in the central and the enteric nervous systems.[19] In an experimental study, CGRP antagonist h-$CGRP_{8-37}$ reversed the sensitizing effects of acetic acid on nociceptive response to colorectal distension.[20] It is possible that the increased threshold to balloon distension observed in our study was mediated by a similar mechanism.

The effect of repeated dosing with capsaicin will probably differ from the acute effect. This is because most of the biological effects of capsaicin result from an initial, intense excitation of sensory neurons that is followed by a prolonged period of insensitivity to physico-chemical stimuli.[21]

We conclude that men with IBS do not have small or large bowel transit abnormalities; rectal balloon sensitivity threshold in them is lower than in healthy men. Ingestion of ten grams of chilli does not alter transit in healthy persons as well as in patients with IBS, but increases the threshold to pain in normal subjects.

References

1. Cook IJ, Irvine EJ, Campbell D, Shannon S, Reddy SN, Collins SM. Effect of dietary fiber on symptoms and rectosigmoid motility in patients with irritable bowel syndrome. A controlled crossover study. *Gastroenterology* 1990;98:66-72.
2. Mertz H, Naliboff B, Munakata J, Niazi N, Mayer EA. Altered rectal perception is a biological marker of patients with irritable bowel syndrome. *Gastroenterology* 1995;109:40-52.
3. Desai HG, Venugopalan K, Antia FP. The effect of capsaicin on the DNA content of gastric aspirate. *Indian J Med Res* 1976:64;163-7.
4. Horowitz M, Wishart J, Maddox A, Russo A. The effect of chilli on gastrointestinal transit. *J Gastroenterol Hepatol* 1992;7:52-6.
5. Bhatia SJ, Kuo B, Gideon M, Castell DO. Jalapeno peppers increase pain threshold of esophagus temporarily (Abstract). *World Congresses of Gastroenterology, Digestive Endoscopy, and Colo-proctology*, Los Angeles, USA, 1994.
6. Tomlin J, Joshi A, Read NW. Effect of chilli powder on gut transit (Abstract). *Gut* 1992;33:518.
7. Manning AP, Thompson WG, Heaton KW, Morris AF. Towards a positive diagnosis of the irritable bowel. *Br Med J* 1978;2:653-4.
8. Whitehead WE, Cheskin LJ, Heller BR, Robinson JC, Crowell MD, Benjamin C, *et al*. Evidence for exacerbation of irritable bowel syndrome during menses. *Gastroenterology* 1990;98:1485-9.
9. von-der Ohe MR, Camilleri M. Measurement of small bowel and colonic transit: indications and methods. *Mayo Clin Proc* 1992;67:1169-79.
10. Chaussade S, Khyari A, Roche H, Garret M, Gaudric M, Couturier D, *et al*. Determination of total and segmental colonic transit time in constipated patients. *Dig Dis Sci* 1989;34:1678-72.
11. Nabar AA, Bhatia SJ, Abraham P, Priti R, Mistry FP. Total and segmental colonic transit time in non-ulcer dyspepsia. *Indian J Gastroenterol* 1995;14:131-3.
12. Metcalf AM, Phillips SF, Zinsmeister AR, McCarty RL, Beart RW, Wolff BG. Simplified assessment of segmental colonic transit. *Gastroenterology* 1987;92:40-7.
13. Prior A, Colgan SM, Whorwell PJ. Changes in rectal sensitivity after hypnotherapy in patients with irritable bowel syndrome. *Gut* 1990;31:896-8.
14. Mehta NN. Small intestinal changes in patient with idiopathic ulcerative colitis and correlation with response to 5-amino-salicylic acid. *Dissertation submitted for D.M. (Gastroenterology), University of Bombay,* 1996.
15. Hutchinson R, Notghi A, Smith NB, Kumar D. Scintigraphic measurement of ileocaecal transit in irritable bowel syndrome and chronic idiopathic constipation. *Gut* 1995;36:585-9.
16. Gorard DA, Libby GW, Farthing MJ. Ambulatory small intestinal motility in 'diarrhoea' predominant irritable bowel syndrome. *Gut* 1994;35:203-10.
17. Whitehead WE, Holtkotter B, Enck P, Hoelzl R, Holmes KD, Anthony J, *et al*. Tolerance for rectosigmoid distention in irritable bowel syndrome. *Gastroenterology* 1990;98:1187-92.
18. Shah SK, Mistry FP, Abraham P. Effect of cold pressor test and a high-chilli diet on rectosigmoid motility in irritable bowel syndrome. *Indian J Gastroenterol* 2000;19:161-3.
19. Tache Y, Raybould H, Wei JY. Central and peripheral actions of calcitonin gene-related peptide on gastric secretory and motor functions. *Adv Exp Med Biol* 1991;298:183-98.
20. Plourde V, Bolvin M, St Pierre S, McDuff J. CGRP plays a role in mediating visceral nociception induced by rectocolonic distension in the rat (Abstract). *Gastroenterology* 1995;108:A669.
21. Karrer T, Bartoshuk L. Capsaicin desensitization and recovery on the human tongue. *Physiol Behav* 1991;49:757-64.

Correspondence to: Dr Bhatia, Professor and Head. Fax: (22) 302 1168. E-mail: sjbhatia@vsnl.com

Acknowledgments: The authors thank the Research Society, TN Medical College and BYL Nair Hospital, Mumbai for financial support

Received March 27, 2002. Received in final revised form June 4, 2002. Accepted July 21, 2002