



HAL
open science

EXPLORING THE DISCREPANCY BETWEEN RECALLED AND RECORDED BOWEL HABITS IN PATIENTS WITH IRRITABLE BOWEL SYNDROME

Marina Coletta, Laura Di Palma, Tomba Carolina, Guido Basilisco

► **To cite this version:**

Marina Coletta, Laura Di Palma, Tomba Carolina, Guido Basilisco. EXPLORING THE DISCREPANCY BETWEEN RECALLED AND RECORDED BOWEL HABITS IN PATIENTS WITH IRRITABLE BOWEL SYNDROME. *Alimentary Pharmacology and Therapeutics*, 2010, 32 (2), pp.282. 10.1111/j.1365-2036.2010.04322.x . hal-00552559

HAL Id: hal-00552559

<https://hal.science/hal-00552559>

Submitted on 6 Jan 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**EXPLORING THE DISCREPANCY BETWEEN RECALLED AND
RECORDED BOWEL HABITS IN PATIENTS WITH IRRITABLE
BOWEL SYNDROME**

Journal:	<i>Alimentary Pharmacology & Therapeutics</i>
Manuscript ID:	APT-0089-2010.R1
Manuscript Type:	Original Scientific Paper
Date Submitted by the Author:	30-Mar-2010
Complete List of Authors:	Coletta, Marina; Fondazione IRCCS Ca Granda Policlinico, Gastroenterology Di Palma, Laura; Fondazione IRCCS Ca Granda Policlinico, Gastroenterology Carolina, Tomba; Fondazione IRCCS Ca Granda Policlinico, Gastroenterology Basilisco, Guido; Fondazione IRCCS Ca Granda Policlinico, Gastroenterology
Keywords:	Functional GI diseases < Disease-based, Irritable bowel syndrome < Disease-based, Large intestine < Organ-based, Motility < Topics

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

**EXPLORING THE DISCREPANCY BETWEEN RECALLED AND
RECORDED BOWEL HABITS IN PATIENTS WITH
IRRITABLE BOWEL SYNDROME**

Marina Coletta, Laura Di Palma, Carolina Tomba, Guido Basilisco.

Postgraduate School of Gastroenterology, Università degli Studi di Milano.

Gastroenterology Unit, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico,

Milan, Italy

Running head: Bowel habit subtypes in IBS

Key words: Irritable bowel syndrome; Rome III criteria; bowel habit; diary cards; stool form;
colonic transit time

47
48
49
50
51
52
53
54
55
56
57
58
59
60

Corresponding author:

Guido Basilisco, MD

Gastroenterologia,

Padiglione Granelli,

Fondazione IRCCS Ca' Granda,

Ospedale Maggiore Policlinico,

Via F. Sforza 35,

20122 Milano,

Italy

Phone:+3902 5503 3736

Fax:+3902 5503 3644

e-mail: basilisc@policlinico.mi.it

SUMMARY

Background: A discrepancy between recalled and recorded bowel habit subtypes has been reported in irritable bowel syndrome (IBS), but the reasons for it are unclear. **Aim:** To assess: 1) the agreement between recalled and recorded bowel habit subtypes; 2) whether any discrepancy is related to stool form variability or psychological factors; and 3) the correlations of recalled and recorded stool form with colonic transit time. **Methods:** Bowel habit subtype was established in 54 IBS patients at the enrolment visit (recalled) and with the aid of diary cards (recorded). Colonic transit time, the variability of stool form, and the patients' psychological profiles were also recorded. **Results:** Recalled and recorded bowel habit subtypes agreed in only 54% of the patients ($\kappa=0.28$). Stool form variability was greater among the patients whose recalled and recorded bowel habit subtypes were discordant ($P=0.03$), whereas the psychological profiles were not different. Colonic transit time significantly correlated with stool form only when it was recorded on diary cards. **Conclusions:** The discrepancy between recalled and recorded bowel habits in IBS patients is related more to stool form variability than an altered psychological profile. Diary cards should be used to ensure that stool form reflects colonic transit time.

INTRODUCTION

Irritable bowel syndrome (IBS) is defined as a functional bowel disorder in which abdominal pain or discomfort improve with defecation and are associated with a change in form or frequency of stool [1]. IBS patients often complain of erratic bowel habits, and previous studies have confirmed the objective variability in their stool form and stool frequency [2-5]. However, despite this inherent variability, the patients are classified on the basis of bowel habit subtypes, with approximately 1/3 having diarrhea, 1/3 constipation, and 1/3 the mixed or undefined bowel subtype [3,5,6]. This classification is clinically relevant because constipation and diarrhea can be specifically treated, and the efficacy of drugs such as alosetron and tegaserod has been demonstrated in subgroups of patients with a specific bowel habit subtype [7].

The Rome II criteria classified bowel habit subtypes on the basis of a retrospective combination of stool frequency, stool form, and the absence or presence of defecation straining or urgency. The more recent Rome III criteria state that a stool form scale should be used to assess bowel habit prospectively and define the different bowel subtypes [1] because both healthy subjects and IBS patients consider diarrhea and constipation more in terms of stool form than stool frequency [8,9] and because there is a physiological correlation between colonic transit time and stool form, but not stool frequency [10]. Previous studies have revealed poor agreement between the Rome III and Rome II criteria [6] in terms of bowel subtyping, and a discrepancy between recalled and recorded bowel habits [11] in patients with functional bowel disorders [4,12].

The aim of this study was to investigate the reasons for the discrepancy between recalled and recorded bowel habits in patients with IBS. We hypothesised two possible factors: 1) the objective variability in bowel habit might affect its recall over time; and 2) the altered psychological profile of patients might affect both recall [13,14] and the reporting of bowel-

1
2
3 related words or symptoms [15]. To explore these hypotheses, we assessed: 1) the agreement
4 between bowel habit subtypes when stool form is recalled at the time of clinical evaluation or
5 recorded by means of a diary card; 2) whether any discrepancy in subtype is related to stool
6 form variability or psychological factors; and 3) the strength of the association between
7 recalled or recorded stool form and colonic transit time.
8
9
10
11
12
13
14
15
16

17 METHODS

18 Subjects

19
20
21
22 **Between January 2008 and December 2009**, 54 IBS patients (33 females) with a mean age of
23 35 ± 12 years were consecutively recruited **at a first appointment from a cohort of 300**
24 **patients referred** to the outpatient **functional bowel disorder clinic** of the Gastroenterology
25 Unit of Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico (Milan, Italy). The
26 exclusion criteria were abdominal surgery (other than appendectomy), pregnancy, and **the use**
27 **of medications that may affect colonic transit and bowel habit** during the previous six months.
28 The patients met the Rome III criteria for the diagnosis of IBS [1] and showed no signs of
29 organic disease on the basis of their medical history, physical examination, blood chemistry
30 **(including the measurement of thyrotropin levels and serological testing for celiac disease)**,
31 stool examination (including Salmonella culture and a search for parasites in five samples),
32 abdominal ultrasound and proctosigmoidoscopy.
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

48 All of the patients gave their informed consent to the study, which was performed in
49 accordance with the Declaration of Helsinki and approved by our local Ethics Committee.
50

51
52
53 **A control group of 23 healthy subjects (15 females) with a mean age of 30 ± 6 years was**
54 **recruited by means of a public advertisement and screened by means of the taking of a clinical**
55 **and gastrointestinal history, and a physical examination. None of them complained of chronic**
56 **gastroenterological or psychiatric symptoms, and none were receiving chronic treatment. All**
57
58
59
60

1
2
3 of them were administered the psychological symptoms checklist (SCL-90), and 17 (mean
4
5 age 31 ± 9 years; 10 females) were randomly assigned to complete the ten-day bowel habit
6
7
8
9 diary cards (see Methods).

10
11 The mean BMI of the healthy subjects and IBS patients was respectively 21.83 ± 4.56 and
12
13 BMI 20.45 ± 2.03 ; none of the healthy subjects and only one of the IBS patients had a body
14
15 mass index of more than 24.9 kg/m^2 [16].

17 **Enrolment questionnaire and recalled bowel habit**

18
19 During the enrolment visit, the patients were shown a picture illustrating the Bristol stool
20
21 form scale [17], and indicated the stool form they had in the majority of their bowel
22
23 movements (recalled bowel habit). Mushy or watery stools (scores 6-7) defines IBS patients
24
25 with diarrhea (IBS-D); hard or lumpy stools (scores 1-2) IBS patients with constipation (IBS-
26
27 C); and scores of 3-5 patients with unsubtyped IBS (IBS-U). Previous epidemiological studies
28
29 of the general population have validated these subgroups of stool form, and shown that they
30
31 are a good surrogate of fast, slow and normal colonic transit times [18].
32
33
34
35

36 **Ten-day diary cards and recorded bowel habit**

37
38 Using a ten-day diary card, the patients recorded the timing and stool form of each defecation,
39
40 starting one week of the clinical evaluation. Stool form was evaluated with the aid of the
41
42 Bristol scale (recorded bowel habit). The subjects were not allowed to take any medication
43
44 influencing bowel function during the period in which they completed the diary cards.
45
46
47

48
49 In accordance with the Rome III criteria and the data recorded on the diary cards, the patients
50
51 were defined as having IBS with diarrhea (IBS-D) if $\geq 25\%$ of their bowel movements were
52
53 characterised by loose (mushy) or watery stools, and $< 25\%$ by hard or lumpy stools; IBS with
54
55 constipation (IBS-C) if $\geq 25\%$ of their bowel movements were characterised by hard or lumpy
56
57 stools, and $< 25\%$ by loose (mushy) or watery stools; IBS mixed (IBS-M) if $\geq 25\%$ of their
58
59 bowel movements were characterised by hard or lumpy stools, and $\geq 25\%$ by loose (mushy) or
60

1
2
3 watery stools; and IBS unsubtyped (IBS-U) if stool consistency was insufficiently abnormal
4
5 to meet the criteria for IBS-C, D or M [1]. Given the small number of patients with IBS-M
6
7 (1%) and the impossibility of identifying this subtype when stool form was recalled, the
8
9 patients with IBS-M and IBS-U were grouped together as IBS-U.
10
11

12 **Concordant and discordant bowel habit subtypes**

13
14 **On the basis of the results of the enrolment questionnaire (recalled bowel habit) and the ten-**
15
16 **day diary cards (recorded bowel habit), two groups of patients were defined: those with**
17
18 **concordant bowel habits at the two evaluations, and those with discordant bowel habits.**
19
20
21

22 **Stool variability**

23
24 Stool frequency and stool form were assessed using the ten-day diary cards. Stool form
25
26 variability was assessed by computing: 1) the range of stool forms for all defecations recorded
27
28 in the ten-day diary cards; 2) the coefficient of variation (CV) of stool form as the standard
29
30 deviation/mean Bristol stool form values x 100; and 3) the CV for the time interval between
31
32 stools as the standard deviation/mean value of the interval between stools x 100 [19]. As they
33
34 are affected by the frequency of an event, the CVs in each patient were calculated using the
35
36 last five defecations (the minimum number of defecations recorded in ten days in healthy
37
38 subjects) [19]. One defecated fewer than five times in the ten days covered by the diary cards,
39
40 and was excluded from the CV calculations.
41
42
43
44

45 **Psychological profiles**

46
47 All of the patients completed a psychological symptoms checklist (SCL-90) designed to
48
49 assess symptom severity in nine primary symptom dimensions [20]. The global severity index
50
51 (GSI) was calculated, together with the somatisation, depression and anxiety dimensions, are
52
53 thought to be specifically related to IBS. The scale scores are given as normalised t scores
54
55 based on a non-psychiatric patient sample [20].
56
57
58
59
60

Reproducibility of stool form in different time periods

In order to investigate the reproducibility of stool form during different time periods, and whether this might explain the discrepancy between recalled and recorded stool form, the mean stool form during the last three days of the diary card (also used to assess colonic transit) was compared with that recorded during the first three days and with that recalled at the time of the first evaluation, using the Bland and Altman method [21].

Colonic transit time

Total colonic transit time was assessed according to Metcalf *et al.* [22] in the last 30 consecutive patients (19 females; mean age 33 ± 8 years). Abdominal X-rays were recorded at 9:00 a.m. on the eleventh day, after three days' ingestion of 20 differently shaped radio-opaque markers at 9:00 a.m. each day (Marquat Genie Biomedichal, Boissy-St Léger, France), using a rapid high-kilovoltage technique in order to reduce radiation exposure to less than 0.5 mSv. Total colonic transit time was calculated using the formula: colonic transit (hours) = 1.2 x the number of markers. The healthy subjects did not undergo this assessment because the European Commission's "Guidance on Medical Exposure in Medical and Biomedical Research" does not allow the exposure of healthy subjects to X-rays for research purposes.

Statistical analysis

The data are given as mean values \pm standard deviation (SD), and were compared using Mann–Whitney U tests and the χ^2 test. A P value of 0.05 (2-sided) was considered statistically significant. Agreement between the recalled and recorded subtypes was assessed using Cohen's kappa statistics, for which values of >0.81 indicate very good agreement, 0.61–0.80 good agreement, 0.41–0.60 moderate agreement, 0.21–0.40 fair agreement, and <0.21 poor agreement. Spearman's rank correlation test was used to explore the correlations

1
2
3 between colonic transit time and the stool form recalled by the patients or recorded during the
4 first and last three days of the diary cards.
5
6
7
8

9 10 **RESULTS**

11 *Agreement between recalled and recorded IBS subtypes*

12
13 The frequencies of IBS subtypes when the predominant stool form was recalled during the
14 enrolment visit were significantly different from those obtained when it was recorded using a
15 ten-day diary card ($P < 0.01$) (Tab. 1). The recalled and recorded subtyping of the IBS patients
16 agreed in only 29 (54%) of the patients (Fig. 1). The change in subtype was generally from
17 IBS-U to IBS-D or IBS-C and *vice versa*, and was from IBS-D to IBS-C or *vice versa* in less
18 than 5% of the cases. Cohen's linearly weighted kappa statistic also showed poor agreement
19 between the recalled and recorded subtypes ($\kappa = 0.28$).
20
21
22
23
24
25
26
27
28
29
30

31 *Characteristics of bowel habit*

32
33 Table 2 shows the characteristics of bowel habit assessed by the healthy subjects and IBS
34 patients using a ten-day diary card. Stool frequency, stool form variability, and the variables
35 reflecting bowel habit variability (range of stool form, CV of stool form, CV of the interval
36 between stools) were all significantly greater in the IBS patients. When the IBS patients were
37 divided on the basis of the discordant or concordant subtyping of bowel habit, the CV of stool
38 form was significantly greater ($P = 0.03$) in the patients with discordant subtyping (Fig. 2),
39 whereas the range of stool form and the CV of the interval between stools were not
40 significantly different between the two groups ($P > 0.20$ for all comparisons).
41
42
43
44
45
46
47
48
49
50
51

52 *Psychological profiles (SCL-90)*

53
54 Table 3 shows the normalised t scores for somatisation, depression, anxiety and GSI in
55 healthy subjects and IBS patients. The patients had higher scores than the healthy subjects,
56 but there were no differences in the psychological profiles of the patients with discordant or
57
58
59
60

1
2
3 concordant bowel habit subtypes ($P>0.40$ for all comparisons), or between the patients with
4
5 different recorded subtypes ($P>0.20$ for all comparisons).
6
7

8 **Reproducibility of stool form in different time periods**

9
10 Stool form was not not significantly different when calculated during the last or first three
11
12 days of the diary cards (mean difference in stool form during the last or first three days:
13
14 0.075 ± 1.21 ; $P=0.68$) or when recalled during the enrolment visit (mean difference between
15
16 stool form during the last three days and that recalled during the enrolment visit: 0.13 ± 1.49 ;
17
18 $P=0.52$). The absolute value of the differences was greater in the latter (1.23 ± 0.91) than the
19
20 former comparison (0.94 ± 0.76), but this difference was not statistically significant ($P=0.13$).
21
22
23

24 *Colonic transit time*

25
26 Colonic transit time was abnormal in 10 out of 30 patients (33%), being accelerated in five
27
28 (17%) and delayed in five (17%). It did not significantly correlate with stool form when stool
29
30 form was recalled at the enrolment visit ($r=-0.20$, $P>0.20$), but the correlation was significant
31
32 when stool form was recorded with the aid of a ten-day diary card (Fig. 3). In particular, the
33
34 correlation was stronger when stool form was assessed on the same days as those used for the
35
36 colonic transit evaluation ($r=-0.53$, $P=0.003$) than when it was addressed during the first three
37
38 days ($r=-0.42$, $P=0.04$). There was no significant correlation between total colonic transit time
39
40 and the anxiety or depression scores ($P>0.40$).
41
42
43
44
45
46
47
48

49 **DISCUSSION**

50
51 The findings of this study confirm the poor agreement between recalled and recorded bowel
52
53 habits in patients with IBS and, for the first time, suggest that this discrepancy might be
54
55 explained more by the objective variability of stool form than the patients' altered
56
57 psychological profiles. They also show that stool form correlates with colonic transit time
58
59 only when stool form is prospectively recorded with the aid of a diary card.
60

1
2
3 In line with the results of previous studies of IBS patients [5,6,23], only 54% of our patients
4 recalled and recorded concordant bowel habit subtypes. The change between the recalled and
5
6 recalled and recorded concordant bowel habit subtypes. The change between the recalled and
7
8 the recorded evaluations were mainly from IBS-U to IBS-D or IBS-C and *vice versa*, and
9
10 rarely involved extreme alterations (directly from IBS-D to IBS-C or *vice versa*). This pattern
11
12 of misclassification has previously been noted in longitudinal studies, which have rarely
13
14 reported direct changes between constipation and diarrhea [4-6].

15
16
17 We hypothesised that the discrepancy between recalled and recorded bowel habit subtypes
18
19 might be related to stool form variability or the patients' altered psychological profiles. We
20
21 therefore divided our series of IBS patients into two groups based on whether their recalled
22
23 and recorded IBS subtypes were concordant or discordant, and investigated whether the two
24
25 altered factors were more represented in one group than the other.

26
27
28 The role of stool form variability was assessed by considering a number of variables. We
29
30 confirmed that the bowel habits of IBS patients are objectively erratic, as found in previous
31
32 studies [2,4-6], but also established that the CV of stool form was significantly higher in
33
34 patients discordant recalled and recorded subtypes, which suggests that objective variability in
35
36 bowel habit might negatively affect patient reports.

37
38
39 In a previous study of the role of altered psychological profiles, Ashraf *et al.* [12] found that a
40
41 history of psychiatric illness was five time more frequent in a series of patients reporting
42
43 constipation but who were not objectively constipated upon prospective evaluation. The
44
45 psychological profiles of IBS patients are often altered: they are hypervigilant for information
46
47 regarding gastrointestinal symptoms and tend to selectively recognise emotionally negative
48
49 words [13], and depression affects their cognitive and memory function [24]. Our findings
50
51 confirm that IBS patients have altered psychological profiles [25,26] but contrary to our
52
53 expectations, the somatisation, depression and anxiety scores of our patients with discordant
54
55 bowel habit subtypes were not significantly higher than those of the other patients.
56
57
58
59
60

1
2
3 Finally, we assessed the strength of the association between colonic transit time and the stool
4 form recalled during the clinical evaluation and recorded on diary cards. O'Donnell *et al.* [10]
5 have previously found a significant ($r=-0.77$) correlation between colonic transit time
6 measured using radio-opaque markers and the mean score of six consecutive defecations
7 evaluated by IBS patients using diary cards, and Saad *et al.* [27] reported a weaker correlation
8 in constipated patients ($r=-0.45$) that improved ($r=-0.62$) when colonic transit was assessed
9 using a wireless motility capsule. We found a weaker correlation ($r=-0.53$) than that found by
10 O'Donnell *et al.* [10], which may be related to the different series of patients. In addition, we
11 found that the correlation between stool form and colonic transit time was only statistically
12 significant when stool form was recorded with the aid of diary card, and not when it is
13 recalled. Moreover, the correlation improved when stool form was evaluated at the same time
14 as colonic transit time. These observations are relevant as they demonstrate the need for a
15 prospective stool form evaluation with diary cards if stool form is to represent an acceptable
16 surrogate of colonic transit time.

17
18 Interestingly, comparison of the individual values of the stool form recalled by the patients
19 (Fig. 3a) with those recorded with the aid of a diary card during the last three days of the diary
20 period (Fig. 3b), and analysis of the reproducibility of stool form when comparing these time
21 periods, suggest that patients tend to recall the more extreme forms as those most
22 representative of their bowel habit, but without any systematic bias towards diarrhea or
23 constipation.

24
25 In conclusion, it may be misleading to rely on IBS patients' recall of their bowel habits
26 because these are objectively erratic and this might influence the patients' apparent recall
27 bias. As indicated by the Rome III criteria, the prospective recording of stool form with the
28 aid of diary cards is essential to ensure that stool form reflects colonic transit time and that the
29 subtyping of patients reflects objective pathophysiological differences.

Statement of interests:

This study was funded in full by the Associazione amici della Gastroenterologia del Padiglione Granelli.

Acknowledgement

We would like to thank Kevin Smart for reviewing the English text.

For Peer Review

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1: Rome III subtyping of IBS patients when bowel habit was evaluated at the time of the enrolment visit (recalled) or with the aid of ten-day diary cards (recorded). Given the small number of patients with IBS-M (1%) and the impossibility of identifying this subtype when stool form was recalled, the patients with IBS-M and IBS-U were grouped together as IBS-U. Number of patients (%).

(n = 54)	Recalled	Recorded
IBS-D	20 (37%)	26 (48%)
IBS-C	9 (17%)	16 (30%)
IBS-U	25 (46%)	12 (22%)

Table 2: Characteristics of bowel habits in healthy subjects and IBS patients assessed using a ten-day questionnaire. CV = coefficient of variation, calculated on the basis of the last five evacuations of each subject.

* P<0.01; ** P<0.05

	Healthy subjects (n=17)	IBS patients (n=54)
Stool frequency (n/day)	1.0 ± 0.3	1.7 ± 1.1*
Stool form (Bristol score)	3.5 ± 0.9	4.4 ± 1.1*
Range of stool form (Bristol score)	2.1 ± 1	3.1 ± 1.3*
CV for interval between stools (%)	54.2 ± 23.1	77.4 ± 37.2**
CV of Bristol stool form score (%)	21.2 ± 14.7	30.2 ± 16.7**

Table 3: Normalised global severity index (GSI), somatisation, depression and anxiety t scores in healthy subjects (HS) and IBS patients as a whole, and divided into those with discordant and concordant bowel habit subtypes.

	HS (n=23)	IBS		
		Total (n=54)	Discordant (n=25)	Concordant (n=29)
GSI	47.1 ± 9.6	*61.8 ± 7.7	61.6 ± 7.9	61.9 ± 7.6
Somatisation	46.6 ± 9.0	*61.1 ± 8.3	62.2 ± 7.3	60.2 ± 9.1
Depression	49.4 ± 7.9	*60.8 ± 9.1	60.8 ± 7.9	60.9 ± 10.1
Anxiety	49.5 ± 8.2	*62.1 ± 9.3	61.6 ± 9.7	62.6 ± 9.1

* P<0.001 vs healthy subjects. The differences between the IBS patients with discordant and concordant bowel habits were not significant (P>0.40).

FIGURE LEGENDS

Figure 1. Differences in bowel habit subtypes based on recalled and recorded assessments of stool form in IBS patients. The total height of the columns indicates the number of patients by subtype (D=diarrhea, C=constipation, U=unsubtyped) based on the recorded evaluations. The shaded portion of each column indicates the number of patients with concordant recorded and recalled subtypes. The white portions indicate the number of patients with discordant subtypes; the letters inside the white boxes specify the recalled subtype.

Figure 2. Coefficient of stool form variation (CV%) in patients with discordant or concordant recalled and recorded bowel habits. Mean values \pm SD.

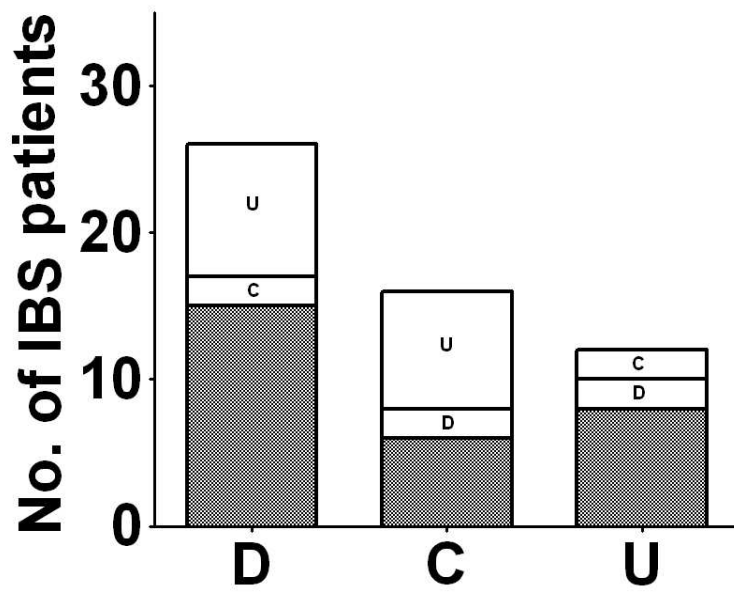
Figure 3. Correlation between colonic transit time and recalled stool form [a] or the stool form recorded on the last three days of the diary cards [b]. Stool form was assessed using the Bristol stool form score. The continuous line is the regression line; the dotted lines show the 95% confidence intervals.

REFERENCES:

1. Longstreth G, Thompson G, Chey W, Houghton L, Mearin F, Spiller R. Functional bowel disorders. *Gastroenterology*. 2006; 130: 1480-91.
2. Heaton K, Ghosh S, Braddon F. How bad are the symptoms and bowel dysfunction of the patients with irritable bowel syndrome? A prospective controlled study with emphasis on stool form. *Gut*. 1991; 32: 73-9.
3. Mearin F, Barò E, Roset M, Badia X, Zarate N, Perez I. Clinical patterns over time in irritable bowel syndrome: Symptom instability and severity variability. *Am J Gastroenterol*. 2003; 99: 113-21.
4. Tillisch K, Labus J, Naliboff B, et al. Characterization of the alternating bowel habit subtype in patients with irritable bowel syndrome. *Am J Gastroenterol*. 2005; 100: 896-904.
5. Drossman D, Morris C, Hu Y, et al. A prospective assessment of bowel habit in irritable bowel syndrome in women: defining an alternator. *Gastroenterology*. 2005; 128: 580-9.
6. Ersryd A, Posserud I, Abrahamsson H, Simren M. Subtyping the irritable bowel syndrome by predominant bowel habit: Rome II versus Rome III. *Aliment Pharmacol Ther*. 2007; 26: 953-61.
7. Mayer E. Irritable bowel syndrome. *N Engl J Med*. 2008; 358: 1692-9.
8. Ragnarsson G, Bodemar G. Pain is temporally related to eating but not to defecation in the IBS patients' description of diarrhea, constipation and symptoms variation during a prospective 6-week study. *Scand J Gastroenterol*. 1998; 10: 415-21.
9. Sandler R, Drossman D. Bowel habits in young adults not seeking health care. *Dig Dis Sci*. 1987; 32: 841-5.
10. O' Donnell L, Virjee J, Heaton K. Detection of pseudodiarrhea by simple clinical assessment of intestinal transit time. *BMJ*. 1990; 300: 439-40.

- 1
2
3 11. Manning A, Wyman J, Heaton K. How trustworthy are bowel histories? Comparison
4
5 of recalled and recorded information. *BMJ*. 1976; 2: 213-4.
6
7
- 8 12. Ashraf W, Park F, Lof J, Quigley E. An examination of the reliability of reported stool
9
10 frequency in the diagnosis of idiopathic constipation. *Am J Gastroenterol*. 1996; 91: 26-32.
11
- 12 13. Gomborone J, Dewsnap P, Libby G. Selective affective biasing in recognition memory
13
14 in the irritable bowel syndrome. *Gut*. 1993; 34: 1230-33.
15
16
- 17 14. Posserud I, Svedlund J, Wallin J, Simren M. Hypervigilance in irritable bowel
18
19 syndrome compared with organic gastrointestinal disease. *J Psychosom Res*. 2009; 66: 399-
20
21 405.
22
23
- 24 15. Dorn S, Palsson O, Thiwan S. Increased colonic pain sensitivity in irritable bowel
25
26 syndrome is the result of an increased tendency to report pain rather than increased
27
28 neurosensory sensitivity. *Gut*. 2007; 56: 1201-9.
29
30
- 31 16. Sadik R, Bjornsson E, Simren M. The relationship between symptoms, body mass index,
32
33 gastrointestinal transit and stool frequency in patients with irritable bowel syndrome. *Eur J*
34
35 *Gastroenterol Hepatol*. 2010; 22: 102-108.
36
37
- 38 17. Lewis SJ, Heaton KW. Stool form scale as a useful guide to intestinal transit time.
39
40 *Scand J Gastroenterol*. 1997; 32: 920-4.
41
42
- 43 18. Choung R, Locke III G, Zinsmeister A., Schleck C, Talley N. Epidemiology of slow and
44
45 fast colonic transit using a scale of stool form in a community. *Aliment Pharmacol Ther*.
46
47 2007; 26: 1043-1050.
48
49
- 50 19. Heaton k, Radvan J, Cripps H, Mountford R, Braddon F, Hughes A. Defecation
51
52 frequency and timing, and stool form in the general population: a prospective study. *Gut*.
53
54 1992; 33: 817-24.
55
56
- 57 20. Derogatis L, Cleary P. Confirmation of the dimensional structure of the SCL-90: A
58
59 study in construct validation. *J Clin Psychol*. 1977; 33: 981-9.
60

- 1
2
3 21. Bland JM, Altman DG. Statistical methods for assessing agreement between two
4
5 methods of clinical measurement. *Lancet*. 1986; 1:307-310
6
7
- 8 22. Metcalf A, Phillips S, Zinmeister A, MacCarty R, Beart R, Wolff BG. Simplified
9
10 assessment of segmental colonic transit. *Gastroenterology*. 1987; 92:40-7.
11
- 12 23. Simren M, Posserud I, Gunnarsson J, et al. IBS patients have normal and abnormal
13
14 bowel habits: relevance for subtyping? *Gut*. 2009; 58: (Suppl II) A21.
15
16
- 17 24. Burt D, Zembar M, Niederehe G. Depression and memory impairment: a meta-
18
19 analysis of the association, its pattern, and specificity. *Psychol Bull*. 1995; 177: 285-305.
20
21
- 22 25. Drossman D, McKee D, Sandler R, Mitchell C, Cramer E, Lowman B, et al.
23
24 Psychosocial factors in the irritable bowel syndrome. A multivariate study of patients and
25
26 nonpatients with irritable bowel syndrome. *Gastroenterology*. 1988; 95: 701-8.
27
28
- 29 26. Whitehead W, Crowell M. Psychologic considerations in the irritable bowel
30
31 syndrome. *Gastroenterol Clin North Am*. 1991; 20: 249-67.
32
33
- 34 27. Saad R, Rao S, Koch K et al. Do stool form and frequency correlate with whole-gut and
35
36 colonic transit? Results from a multicenter study in constipated individuals and healthy
37
38 controls. *Am J Gastroenterol*. 2010; 105:403-411.
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

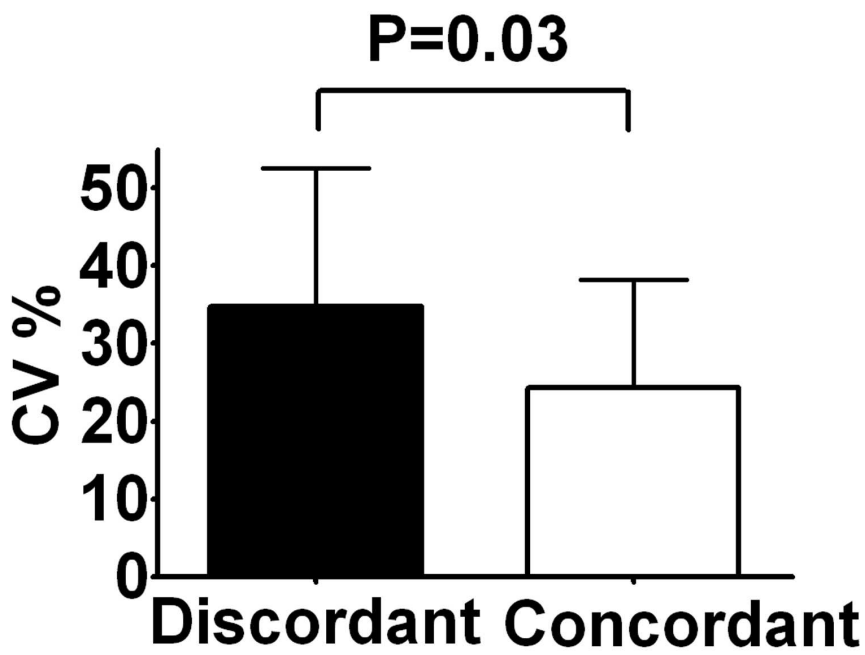


282x197mm (96 x 96 DPI)

Review

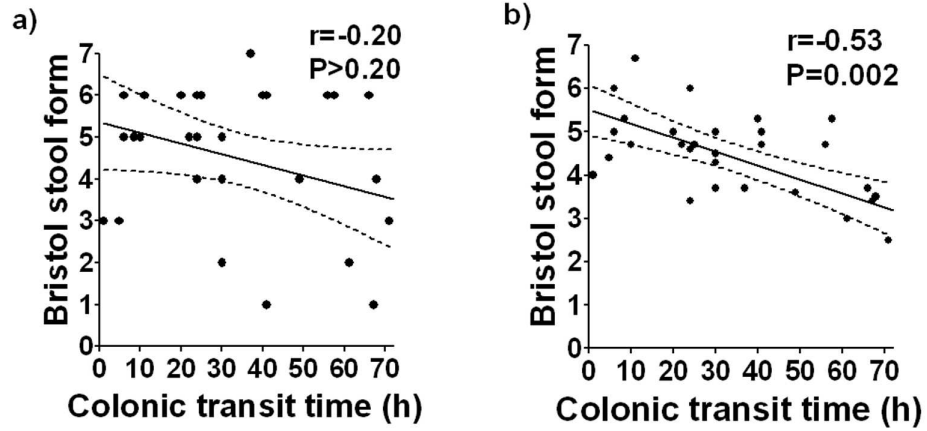
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



299x210mm (600 x 600 DPI)

Review



281x162mm (600 x 600 DPI)

Peer Review