Irritable bowel syndrome subtypes differ in body awareness, psychological symptoms and biochemical stress markers

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Abstract

AIM: To elucidate the differences in somatic, psychological and biochemical pattern between the subtypes of irritable bowel syndrome (IBS).

METHODS: Eighty IBS patients, 30 diarrhoea predominant (D-IBS), 16 constipation predominant (C-IBS) and 34 alternating IBS (A-IBS) underwent physiotherapeutic examinations for dysfunctions in body movements and awareness and were compared to an apparently healthy control group (AHC). All groups answered questionnaires for gastrointestinal and psychological symptoms. Biochemical variables were analysed in blood.

RESULTS: The D-IBS group showed less body awareness, less psychological symptoms, a more normal sense of coherence and psychosocial rating as well as higher C-peptide values. C-IBS had a higher degree of body dysfunction and psychological symptoms, as well as the lowest sense of coherence compared to controls and D-IBS. They also demonstrated the most elevated prolactin levels. A-IBS had the lowest degree of body disturbance, deteriorated quality of life and affected biochemical pattern. All subtypes had higher pain scores compared to controls. In addition they all had significantly increased triglycerides and elevated morning cortisol levels, however, without statistical significance compared with the controls.

CONCLUSION: IBS subtypes showed different profiles in body awareness, somatic and psychological symptoms and in biochemical variables. D-IBS differed compared to the other groups by lowered body awareness, less psychological symptoms and a higher sense of coherence and elevated C-peptide values. C-IBS and A-IBS subtypes suffered more from depression and anxiety, associated with a lower quality of life. These differences may be important and will be taken into account in our treatment of these patients.

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Key words: Irritable bowel syndrome subtypes; Physiotherapy; Body awareness; Stress; Biochemistry

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INTRODUCTION

Irritable bowel syndrome (IBS) is considered to be the most common of all gastrointestinal dysfunctions[5-14]. Patients with IBS are suffering from a variety of gastrointestinal complaints, as well as associated symptoms like headache and dysuria. Furthermore, there is also a strong connection to fibromyalgia, chronic fatigue syndrome, anxiety, and depression[5-6].

The understanding of IBS and especially the interaction between the central and enteric nervous systems has grown considerably over the last years[7]. There are several studies demonstrating abnormalities in the autonomic nervous system[8-9], whereas the expression of different biochemical parameters has been studied with somewhat diverging results[10-14].

The division of IBS into different subgroups is based on the fact that these patients behave in dissimilar ways. According to the Rome II criteria, building on stool and defecation patterns, IBS can be divided into diarrhoea
predominant (D-IBS), constipation predominant (C-IBS) and alternating (A-IBS) subtypes\(^{[15,16]}\). Although, lately questioned, the Rome II criteria are widely used in clinical practice\(^{[17]}\).

When comparing the various subtypes of IBS, Whitehead \textit{et al.}\(^{[18]}\) did not find any disparity in colonic motility and psychological testing. In contrast, other authors have found differences in gender, abdominal discomfort/pain and psychological comorbidity between the IBS subtype\(^{[19-22]}\). Disparities in endocrine factors between the subtypes of IBS have not been extensively studied. However, Elsenbruch \textit{et al}\(^{[23]}\) found a significant increase in postprandial saliva cortisol in D-IBS patients, not evident in C-IBS patients and controls. Jonsson and Theorell\(^{[24]}\) found that plasma cortisol correlated negatively with diarrhoea symptoms and lower prolactin values were seen in patients with functional dyspepsia.

In earlier studies, we have shown that IBS could be associated with deviated tension in the body\(^{[13,28]}\). A physiotherapeutic approach to adjust and reduce pathological tension in the body is by the use of Body Awareness Therapy (BAT). This method is devoted to take care of, and improve, the patient’s ability to become aware of his or her own capability by the use of self recruited resources to recapture a normal balance in the body\(^{[26-30]}\). We found that 12 wk of treatment with BAT gave symptom relief of both gastrointestinal and psychological symptoms\(^{[28]}\). However, patients with C-IBS were more relieved than the D-IBS and alternating types of IBS. In a second trial we treated the patients for 24 wk and satisfying effects were obtained for the entire group of IBS patients\(^{[30]}\).

The aim of the present study was to elucidate the differences in somatic and psychological symptoms, as well as biochemical stress markers in the IBS subtypes. The hypothesis was that these subtypes present with dissimilar symptomatic expressions.

**MATERIALS AND METHODS**

**Study population**

All patients with IBS as diagnosed by gastroenterologists, GI surgeons or GPs referred for Body Awareness Therapy at the Unit for Functional Gastroenterology, participated in the study. Patients with an acute psychiatric disease and patients not understanding the Swedish language were excluded from the study.

IBS patients, 73 women and 7 men (age, 21-65 years), with a BMI 23.3 ± 3.7 participated in the study. According to the Rome II criteria patients were divided into 3 groups: D-IBS (n = 30, 24 women and 6 men), C-IBS (n = 16, 15 women and 1 man) and A-IBS suffering from combined symptoms (n = 34, all women). Fifty-six IBS patients had suffered from their gastrointestinal symptoms for more than 5 years (for D-IBS 67%, for C-IBS 88% and for A-IBS 65%). There were no differences in BMI between the subtypes.

A healthy control group consisting of 18 women and 3 men (age, 21-61 years) had a BMI of 22.3 ± 2.2. They were free of gastrointestinal symptoms and without ongoing pharmacological treatment.

**Study design**

The groups of IBS test patients and the AHC group underwent complete physiotherapeutic examinations in accordance to the Body Awareness Scale (BAS). They also filled in the questionnaires GIS, SCL90, SOC, PRS, and pain drawing. Blood samples were taken from an antecubital vein. The ethics committee of the University of Göteborg approved the study. All subjects gave their written consent before acceptance of inclusion into the study.

**Body examinations**

BAS test is based on one hand observations by the physiotherapist of dysfunctions in defined items of basic movements (BASobs) and was carried out during video recording. In addition, standardized questions in order to measure the patients’ own opinion concerning their body awareness (BASself) was performed. The variables were ranging from 0-6 where a higher score represented more symptoms\(^{[31,32]}\).

**Questionnaires**

A modified form of Gastro Intestinal Symptom questionnaire (GIS) was used\(^{[33]}\). This survey evaluates 35 general gastrointestinal symptoms. A total score and scoring of specified symptoms were used. The test utilizes a seven-graded scale (0-6). A higher score means increased gastrointestinal complaints.

The Symptom Checking List questionnaire (SCL90) is a self-rating scale evaluating symptomatic behaviour of psychological state using questions related to everyday life\(^{[34]}\). The questionnaire includes 90 questions. The answers score in a five-graded scale (0-4) and allow subdivision into different items. A higher score reflected more symptoms.

The Sense of Coherence Scale (SOC) measures the degree to which individuals find the world around them comprehensible and manageable and thus represents a measurement of coping skills\(^{[35]}\). The questionnaire includes 29 questions. The answers score in a seven-graded scale (0-6) and allow subdivision into different items. A high SOC score is linked to successful coping with factors that induce stress and is consequently reflecting a higher health level/quality of life.

Psychosocial rating scale (PRS) (slightly modified from Headley Court psychosocial rating scale) has 33 items and score from 0-4 ranging from ‘very severe problems’ to ‘no problems’\(^{[36]}\).

The distribution of pain was visualized on a pain-map, figuring the human body with a front and backside. When calculating the results, the body was divided into 45 sections\(^{[37]}\). Points were given for every section where pain was marked. The points were summed up to a score.

**Biochemistry in blood**

Venous blood samples were taken under fasting condi-
tions from an antecubital vein in the morning for analysis of C-peptide, triglycerides, prolactin and cortisol (at 8:00 and 13:00).

**Statistical analysis**
This study consisted of ordinal data (BAS and questionnaires) and quantitative data (biochemical parameters). A high value for BAS, GIS, SCL90, PRS, and pain drawing meant more symptoms. A high SOC value reflected a higher degree of sense of coherence. Median (Md), inter-quartile range (IQR), mean (M), standard deviation (SD) and percentage were used for presentation of data. Although median and IQR were optimal for ordinal data, means were presented as well for better visualization. Mann Whitney U test was used for ordinal and quantitative data[98].

**RESULTS**

**Study population**
There was an obvious gender difference between the IBS subtypes with 20% men in the D-IBS, 6.25% in the C-IBS and 0% men in the A-IBS subgroup.

**Physiotherapeutic data**

**BAS:** All subtypes of IBS patients scored higher in the BASobs than the controls. Comparing the subtypes, the A-IBS group showed less body disturbances compared to the other two groups (Table 1). In BASself the D-IBS group expressed lower score compared to the other two groups, with levels similar to the AHC group.

**Questionnaires**

**Gastrointestinal symptoms:** All subtypes scored higher than the control group. There was no difference between the subtypes in total score. The A-IBS group scored higher for constipation and flatulence and less for diarrhoea and motility compared to the D-IBS group. The C-IBS group scored more constipation, less motility and less diarrhoea compared to the D-IBS group (Table 2). Thus, the patients scored in accordance with their own subtype.

**Psychological symptoms:** The C-IBS and the A-IBS group scored higher psychological symptoms compared to the D-IBS group and all groups scored higher than the controls. Also, the C-IBS group scored more symptoms compared to the A-IBS group, especially for sensitivity, phobic anxiety, psychoticism and somatisation (Table 3).

**SOC:** The SOC questionnaire revealed that there were significant differences between the subtypes compared to the controls. The A-IBS group and the C-IBS group scored lower sense of coherence than then D-IBS group, which differed from healthy controls only in the total score and present time and external conditions (Table 4).

**PRS:** All subtypes showed lower psychosocial rating compared to the control group (Table 5). Besides, both C-IBS and A-IBS showed lower psychosocial rating/quality of life compared to the D-IBS group.

**Pain:** The subgroups of IBS showed higher scores of pain presented on the body drawings compared to the healthy controls. However, there were no differences in pain score for the different locations between the subtypes (Table 6).

**Biochemical analysis:** The D-IBS group differed from the other two subtypes and the AHC with significantly higher C-peptide values (Table 7). The C-IBS patients

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**Table 1 Body awareness scale (BAS-H)**

| Category          | AHC (n = 21) | D-IBS (n = 30) | C-IBS (n = 16) | A-IBS (n = 34) |
|-------------------|--------------|----------------|----------------|---------------|
|                   | M (IQR)      | M (IQR)        | M (IQR)        | M (IQR)       |
| Total             | 1.5 (2.0)    | 2.6 (3.0)      | 2.7 (3.3)      | 1.5 (2.3)     |
| Grounding         | 1.5 (2.0)    | 2.6 (3.0)      | 2.9 (3.3)      | 1.5 (2.3)     |
| Mid-line          | 2.1 (3.0)    | 2.5 (3.0)      | 3.4 (3.0)      | 2.1 (3.0)     |
| Centring          | 2.1 (3.2)    | 2.4 (3.0)      | 3.4 (3.0)      | 2.1 (3.0)     |
| Flow              | 1.5 (2.0)    | 2.5 (3.0)      | 2.7 (3.0)      | 1.5 (2.0)     |
| Respiration       | 1.4 (2.0)    | 2.3 (3.0)      | 3.5 (3.0)      | 1.4 (2.0)     |
| Boundaries        | 0.5 (0.0)    | 1.0 (2.0)      | 1.1 (2.0)      | 0.5 (0.0)     |

Results from BASobs and BASself examination score from AHC group and D-IBS, C-IBS and A-IBS patients. The results are shown in total and as items categorised. The higher score, the more symptoms. A-IBS, C-IBS and A-IBS showed higher score compared to the other two subtypes and the AHC with significantly lower score compared to the AHC group. There was no difference between the subtypes in total score. The A-IBS group and the AHC group expressed lower score compared to the other two subtypes and the AHC with significantly lower score compared to the AHC group.
GIS score from AHC group, D-IBS, C-IBS and A-IBS patients. The results are shown in total and as items categorised. The higher score, the more symptoms. $^aP < 0.05$, $^bP < 0.001$ vs AHC; $^cP < 0.05$, $^dP < 0.01$, $^eP < 0.001$ vs D-IBS. M: Mean; Md: Median; IQR: Inter quartile range.

| Category     | AHC ($n = 21$) | D-IBS ($n = 30$) | C-IBS ($n = 16$) | A-IBS ($n = 34$) |
|--------------|----------------|------------------|------------------|-----------------|
|              | M (Md, IQR)    | M (Md, IQR)      | M (Md, IQR)      | M (Md, IQR)     |
| Total        | 0.4 (0, 1)     | 1.9 (3)         | 1.7 (3)         | 2.0 (3)         |
| Pain         | 0.5 (0, 1)     | 1.9 (2)         | 2.0 (2)         | 1.9 (2)         |
| Flatulence   | 0.5 (0, 0)     | 2.4 (3)         | 2.5 (3)         | 2.9 (3)         |
| Nausea       | 0.5 (0, 1)     | 1.5 (0)         | 1.3 (2)         | 1.4 (0)         |
| Constipation | 0.4 (0, 1)     | 0.8 (1)         | 3.6 (4)         | 2.9 (2)         |
| Diarrhoea    | 0.5 (0, 0)     | 3.2 (3)         | 0.5 (0)         | 2.2 (2)         |
| Motility     | 0.5 (0, 0)     | 3.8 (4)         | 2.6 (3)         | 3.0 (3)         |
| Miscellaneous| 0.3 (0, 0)     | 1.2 (1)         | 1.1 (1)         | 1.2 (1)         |

GIS: Gastrointestinal scale; AHC: Healthy controls; D-IBS: Diarrhoea type irritable bowel syndrome; C-IBS: Constipation type irritable bowel syndrome; A-IBS: Abdominal pain type irritable bowel syndrome; M: Mean; Md: Median; IQR: Inter quartile range.

Psychological symptoms scale (SCL-90) score from AHC group, D-IBS, C-IBS and A-IBS patients. The results are shown in total and as items categorised. The higher score, the more symptoms. $^aP < 0.05$, $^bP < 0.001$ vs AHC; $^cP < 0.05$, $^dP < 0.01$, $^eP < 0.001$ vs D-IBS. M: Mean; Md: Median; IQR: Inter quartile range.

| Category         | AHC ($n = 21$) | D-IBS ($n = 30$) | C-IBS ($n = 16$) | A-IBS ($n = 34$) |
|------------------|----------------|------------------|------------------|-----------------|
|                  | M (Md, IQR)    | M (Md, IQR)      | M (Md, IQR)      | M (Md, IQR)     |
| Total            | 0.3 (0, 0)     | 0.8 (0)          | 1.3 (0)          | 1.1 (0)         |
| Obsessive-comp   | 0.4 (0, 1)     | 1.0 (1)          | 1.5 (1)          | 1.3 (1)         |
| Sensitivity      | 0.3 (0, 0)     | 0.6 (0)          | 1.3 (0)          | 0.9 (0)         |
| Depression       | 0.4 (0, 0)     | 1.1 (0)          | 1.6 (2)          | 1.5 (0)         |
| Anxity           | 0.4 (0, 0)     | 1.0 (0)          | 1.3 (0)          | 1.2 (0)         |
| Hostility        | 0.2 (0, 0)     | 0.3 (0)          | 0.8 (0)          | 0.7 (0)         |
| Phobic anxiety   | 0.4 (0, 0)     | 0.4 (0)          | 0.7 (0)          | 0.5 (0)         |
| Paranoid ideation| 0.2 (0, 0)     | 0.4 (0)          | 1.2 (2)          | 0.7 (0)         |
| Psychoticity     | 0.1 (0, 0)     | 0.3 (0)          | 0.7 (0)          | 0.4 (0)         |
| Somatisation     | 0.2 (0, 0)     | 1.3 (2)          | 1.9 (2)          | 1.5 (0)         |

SCL-90: Somatic symptom Checklist—90 items; AHC: Healthy controls; D-IBS: Diarrhoea type irritable bowel syndrome; C-IBS: Constipation type irritable bowel syndrome; A-IBS: Abdominal pain type irritable bowel syndrome; M: Mean; Md: Median; IQR: Inter quartile range.

Sense of coherence score from AHC group and C-IBS, D-IBS and A-IBS patients. The results are shown in total and as items categorised. The higher score, the better SOC. $^aP < 0.05$, $^bP < 0.01$, $^cP < 0.001$ vs AHC; $^dP < 0.05$, $^eP < 0.01$, $^fP < 0.001$ vs D-IBS. M: Mean; Md: Median; IQR: Inter quartile range.

| Category          | AHC ($n = 21$) | D-IBS ($n = 30$) | C-IBS ($n = 16$) | A-IBS ($n = 34$) |
|-------------------|----------------|------------------|------------------|-----------------|
|                   | M (Md, IQR)    | M (Md, IQR)      | M (Md, IQR)      | M (Md, IQR)     |
| Total             | 4.2 (2)        | 3.8 (3)          | 3.1 (3)          | 3.4 (3)         |
| Comprehensibility | 3.7 (2)        | 3.3 (3)          | 2.5 (3)          | 3.1 (3)         |
| Manageability     | 4.4 (5)        | 4.0 (3)          | 3.3 (3)          | 3.6 (3)         |
| Meaningfulness    | 4.6 (5)        | 4.2 (3)          | 3.8 (2)          | 3.7 (2)         |
| Present time      | 4.5 (5)        | 4.0 (3)          | 3.3 (3)          | 3.5 (3)         |
| External conditions| 4.1 (4)        | 4.0 (3)          | 2.9 (4)          | 3.4 (3)         |

SOC: Sense of Coherence; AHC: Healthy controls; D-IBS: Diarrhoea type irritable bowel syndrome; C-IBS: Constipation type irritable bowel syndrome; A-IBS: Abdominal pain type irritable bowel syndrome; M: Mean; Md: Median; IQR: Inter quartile range.

Psychosocial rating scale (PRS) score presented as M, Md (IQR) from the AHC group and D-IBS, C-IBS and A-IBS patients. A higher score indicates a better psychosocial rating/quality of life. $^aP < 0.001$ vs AHC; $^bP < 0.01$, $^cP < 0.001$ vs D-IBS. M: Mean; Md: Median; IQR: Inter quartile range.

| Category | AHC ($n = 21$) | D-IBS ($n = 30$) | C-IBS ($n = 16$) | A-IBS ($n = 34$) |
|----------|----------------|------------------|------------------|-----------------|
|          | M (Md, IQR)    | M (Md, IQR)      | M (Md, IQR)      | M (Md, IQR)     |
| PRS      | 3.75 (4)       | 3.33 (4)         | 3.17 (4)         | 3.12 (4)        |

PRS: Psychosocial rating scale; AHC: Healthy controls; D-IBS: Diarrhoea type irritable bowel syndrome; C-IBS: Constipation type irritable bowel syndrome; A-IBS: Abdominal pain type irritable bowel syndrome; M: Mean; Md: Median; IQR: Inter quartile range.

expressed higher prolactin values both compared to the controls and the D-IBS subtype. Concerning the morning cortisol measurement the subtypes showed higher values compared to the controls, while the midday cortisol levels were only slightly raised. However, the differences in cortisol values did not attain statistical
significance. All subgroups showed higher triglyceride levels than controls.

Looking at the variation above or below one standard deviation all subtypes had a larger variation compared to the controls. There was also a difference in the patterns of standard deviation, e.g. the prolactin values were, for the D-IBS group mostly below one standard deviation while for the C-IBS and A-IBS group the values were mostly above one standard deviation.

**DISCUSSION**

In the present study our IBS population compared to healthy controls, showed overall a higher degree of dysfunctions in basic movements and awareness, as well as more psychological and gastrointestinal symptoms. They also scored a lower sense of coherence and increased pain. In addition the IBS patients had higher and more edged values of biochemical parameters.

When dividing the patients into subgroups according to their stool and defecatory patterns, i.e. D-IBS, C-IBS and alternating type of IBS the following characteristics were identified.

The D-IBS group showed a disturbed body movement pattern on BASobs in the same magnitude as the other two groups. However, on self-estimation (BASself) they rated themselves as having less dysfunction reflecting a lower sense of body awareness compared to the other two groups. They had the same amount of gastrointestinal, but less psychological symptoms compared to C-IBS and A-IBS. The D-IBS patients scored a nearly normal degree of sense of coherence and thus a good quality of life, also reflected in a slightly less distorted psychosocial rating scale compared to the other subgroups. However, they expressed a high pain score similar to the other subtypes. They also had a higher C-peptide value, not being so prominent in C-IBS and A-IBS. All subgroups also showed higher triglyceride values compared to controls.

The C-IBS and A-IBS groups exhibited to some extent similar patterns. However, the A-IBS patients revealed less body disturbance than the C-IBS. On self-estimation (BASself) both groups rated themselves at the same level as the physiotherapist. Both subtypes suffered from more gastrointestinal and psychological symptoms, than the AHC group. However, the C-IBS patients had more psychological symptoms than the D-IBS and A-IBS groups. Both groups displayed a lowered sense of coherence, and thus a lower quality of life, also outlined in the psychosocial rating scale. Furthermore, they were afflicted with high pain scores compared to the controls. When looking at the biochemistry the C-IBS patients had elevated prolactin values compared to the other groups.

The outcome of the gastrointestinal scale (GIS) reflecting the same symptom patterns as the subtype is supportive of an initially correct subtyping of the patients prior to referral. Actually, GIS could be used as a tool to subtype the IBS patients.

From the present study it seems as the D-IBS patients differed from the other two groups. They were not aware of their dysfunctional body awareness not realising their depreciated state of health, thus coping with preserved quality of life. These patients had less psychological symptoms, and higher C-peptide values. Thus, the increased C-peptide value could be secondary to hyperinsulinemia, reflecting an altered adrenergic drive. Although, sympathetic activation normally inhibits bowel motility, one could speculate whether this tentative adrenergic abnormality may be one component of the enteric neuropathy seen in D-IBS. Overall, they revealed themselves as ambitious persons, with a higher proportion of men compared to the other subtypes and many of them in the midst of their professional careers.

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**Table 6 Pain**

| Category      | AHC (n = 21) | D-IBS (n = 30) | C-IBS (n = 16) | A-IBS (n = 34) |
|---------------|-------------|---------------|---------------|---------------|
|               | M           | Md (IQR)      | M             | Md (IQR)      |
| Total         | 4.2         | 4 (4)         | 12.4          | 11 (12)       |
| Abdominal     | 0.3         | 0 (0)         | 1.5           | 2 (1)         |
| Rest of body  | 3.9         | 4 (6)         | 10.1          | 9 (10)        |
| Pain score    | M           | Md (IQR)      | M             | Md (IQR)      |
| AHC           | 389 ± 144   | 10/10         | 316 ± 65      | 31/10         |
| D-IBS         | 491 ± 144   | 10/14         | 591 ± 274     | 31/19         |
| C-IBS         | 40/3        | 10/6          | 44/23         | 35/12         |
| A-IBS         | 301 ± 148   | 31/0          | 374 ± 178     | 31/0          |

Pain score presented as M, Md (IQR) experienced as drawings from the AHC group and D-IBS, C-IBS, and A-IBS patients. The higher score the more symptoms. *P < 0.05, **P < 0.01, ***P < 0.001, vs AHC. M: Mean; Md: Median; IQR: Inter quartile range.

**Table 7 Biochemical levels (mean ± SD, %)**

| Category | AHC (n = 21) | D-IBS (n = 30) | C-IBS (n = 16) | A-IBS (n = 34) |
|----------|-------------|---------------|---------------|---------------|
|          | M           | Md (IQR)      | M             | Md (IQR)      |
| C-peptide| 0.46 ± 0.14 | 10/10         | 0.62 ± 0.28   | 40/3          |
| Triglyceride| 0.7 ± 0.3 | 10/0          | 1.3 ± 0.6     | 57/3          |
| Prolactin | 264 ± 118   | 5/10          | 232 ± 94      | 7/23          |
| Cortisol 8| 491 ± 144   | 10/14         | 539 ± 239     | 10/6          |
| Cortisol 13| 316 ± 65 | 10/14         | 334 ± 157     | 27/30         |

Biochemical status presented as mean ± SD and percent (%) above/below ± 1SD for the AHC group and D-IBS, C-IBS, and A-IBS patients. Cortisol 8 and 13 equals cortisol level at 8 am, and at 1 pm, respectively. *P < 0.05, **P < 0.01, ***P < 0.001, vs AHC; †P < 0.01, vs D-IBS.
The higher C-peptide and triglyceride levels may be part of a metabolic syndrome, which is known to correlate with psychosocial stress. Prolactin may be important in the process of coping with stress and traumatic experience and Sivik et al. reported active soldiers to have lower prolactin values. Sondergaard et al. have shown a strong correlation between prolactin and alexithymia; specially the item ‘difficulty to identifying feelings’. The D-IBS group in our study had both lowered prolactin values and lower body awareness.

These results are in accordance with the outcome of a study by Aggarwal et al. When studying predominant symptoms in IBS and the correlation with autonomic nervous system abnormalities they found that the D-IBS subgroup was associated with adrenergic nervous system malfunctions. They also found that C-IBS patients were more psychologically distressed, with higher degree of depression and anxiety. Also, the C-IBS patients were found to have vagal cholinergic dysfunction in that study. This may also be in line with our results of higher prolactin values for the C-IBS group, which may correspond to increased vagal tone, as well as higher SCL90 scores. The C-IBS and A-IBS patients are characterised by their psychological symptoms of anxiety and depression. Emotional strain is correlated to increased levels of prolactin and this could be one of the reasons for the prolactin increase in the C-IBS group.

Also in agreement with our results, Elsenbruch et al. found in a study on postprandial autonomic and cortisol responses that D-IBS patients elicited an enhanced sympathetic drive as measured by heart rate variability compared to the C-IBS patients and controls. The D-IBS had significantly higher postprandial saliva cortisol levels, but the cortisol values at baseline were equal for these groups, which is in conformity with our results on cortisol levels. Although morning fasting cortisol levels were increased equally for all subtypes, the differences compared to controls did not turn out as statistically significant. There was also a considerable spread of the values above and below one standard deviation compared to controls. These findings were also partly true for the midday cortisol levels.

Although the sample size of the present study is fairly modest in this context, the recruitment of subjects was from patients presenting with fairly advanced disease, with several years history of symptoms. However, since they are referred from different types of care providers they can be regarded as representing a general population of IBS patients. Thus, our results can probably be generalised for a larger IBS population.

IBS is described as a gastrointestinal functional disorder, which onset and course is affected by psychological factors. Ashina et al. suggest that treatment of psychological factors should also be considered when dealing with IBS. Moser et al. points out that functional gastrointestinal disorders are the most frequent clinical conditions seen in practice and suggests that integrated psychosomatic care should be provided i.e. the patient’s psychosocial status and the demand for additional psychological care should be assessed and offered. This is supported by the results of randomised controlled studies having shown that psychotherapy is superior to conventional therapy. This is also in line with the results from our studies with physical, psychological and biochemical examinations and treatment of the ‘whole person’ with body awareness therapy. Jones et al. showed that IBS patients had lower quality of life and less interpersonal support and greater reliance on passive coping strategies. IBS patients show in our study lower quality of life and lower body awareness which could be connected to passive coping strategies. The disparities seen in our study of the subtypes of IBS are in agreement with these studies mentioned and may be different expressions of the functional gastrointestinal disorder.

In conclusion, this study has shown that the D-IBS patients, with a higher proportion of men, scored less body awareness, less psychological symptoms, better sense of coherence and showed higher C-peptide values, possibly indicating an adrenergic drive representing unconscious mental stress. The C-IBS and A-IBS patients expressed higher body awareness, more depression and anxiety with impaired sense of coherence. The raised prolactin levels in C-IBS patients may reflect an increased vagal tone and emotional strain. The importance of the differences seen between the IBS subtypes in the present study and its implications for future treatment of IBS will have to be elucidated in further investigations.

**COMMENTS**

**Background**

Irritable Bowel Syndrome (IBS) is the most common of all gastrointestinal disorders, affecting around 15% of the population at least in the Western societies. The division of IBS into subgroups is based on the fact that these patients behave in dissimilar ways. IBS subgroups building on stool and defecation patterns can be divided into diarrhoea predominant (D-IBS), constipation predominant (C-IBS) and alternating (A-IBS) subtypes.

**Research frontiers**

The understanding of IBS and especially the interaction between the central and enteric nervous systems has grown considerably over the last years. Therefore, in recent year’s research has focused more and more on the psychosomatic (body and mind) aspect of the disease. IBS patients are therefore examined more comprehensible with gastrointestinal symptoms, psychological symptoms, biochemical stress markers, quality of life and body awareness. Thus, psychosomatic remedies like hypnotherapy, psychotherapy and body awareness therapy have been applied.

**Innovations and breakthroughs**

Subgroups of IBS as shown in this study differ in body awareness, quality of life, psychological symptoms and biochemical stress markers.

**Applications**

Treatment like Body Awareness Therapy (BAT) which is a physiotherapeutic approach, to adjust and reduce pathological tension in the body may in the future also be applied and streamlined for these subgroups in order to get a more optimal treatment.

**Peer review**

This manuscript reports results of a study of differences in body awareness, pain scores, psychological symptoms and blood levels for prolactine, triglycerides and morning cortisol between healthy controls and patient diagnosed by Rome criteria with either D-IBS, C-IBS and A-IBS. The manuscript is well constructed and written.
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