Randomized Controlled Trial

Self-reported dietary fructose intolerance in irritable bowel syndrome: Proposed diagnostic criteria

Leif Kyrre Berg, Erik Fagerli, Arnt-Otto Myhre, Jon Florholmen, Rasmus Goll

Abstract

AIM: To study the criteria for self-reported dietary fructose intolerance (DFI) and to evaluate subjective global assessment (SGA) as outcome measure.

METHODS: Irritable bowel syndrome (IBS) patients were randomized in an open study design with a 2 wk run-in on a habitual IBS diet, followed by 12 wk with/without additional fructose-reduced diet (FRD). Daily registrations of stool frequency and consistency, and symptoms on a visual analog scale (VAS) were performed during the first 4 wk. SGA was used for weekly registrations during the whole study period. Provocation with high-fructose diet was done at the end of the registration period. Fructose breath tests (FBTs) were performed. A total of 182 subjects performed the study according to the protocol (88 FRD, 94 controls).

RESULTS: We propose a new clinically feasible diagnostic standard for self-reported fructose intolerance. The instrument is based on VAS registrations of symptom relief on FRD combined with symptom aggravation upon provocation with fructose-rich diet. Using these criteria 43 of 77 patients (56%) in the present cohort of IBS patients had self-reported DFI. To improve the concept for clinical evaluation, we translated the SGA scale instrument to Norwegian and validated it in the context of the IBS diet regimen. The validation procedures showed a sensitivity, specificity and $\kappa$ value for SGA detecting the self-reported DFI group by FRD response within the IBS patients of 0.79.
INTRODUCTION

The self-reported intolerance to fructose intake has been described as fructose malabsorption (FM) due to small intestinal dysfunction. This was first reported in four patients with chronic diarrhea and colic in 1978\(^1\), in healthy subjects in 1983\(^2\), and in populations with irritable bowel syndrome (IBS) in 1986\(^3\). Fructose is absorbed from the intestinal lumen by facilitated diffusion through the GLUT5 transporter protein in the mucosa, which is a type of glucose-dependent transport\(^4\). The exact mechanisms leading to incomplete fructose absorption are unknown, and in the literature, they are described as ranging from a true condition to a variance of normality\(^5\). Moreover, it is well established that factors such as dietary sorbitol\(^6-7\) and dietary non-hydrolysable fructans\(^8\) aggravate IBS symptoms\(^9\). The amount of sorbitol needed to provoke IBS symptoms appears to be \(\geq 10\) g\(^10\).

The current diagnostic test for FM, the fructose breath test (FBT), is suboptimal due to the many variations in the normal capacity of fructose absorption\(^5\). There are numerous factors that give false-negative and false-positive results, as reviewed by Kyaw and Mayberry\(^5\). These include factors such as colonization by non-hydrogen-producing bacteria and gastrointestinal dysmotility\(^5\). In a recently published report we have described a discrepancy between the FBT and the effects of a fructose-reduced diet (FRD)\(^11\).

Due to the lack of an accurate and valid test for diagnosing FM, there is an increasing interest to use self-reported responses to FRD as a diagnostic tool for FM. Goldstein et al\(^6\) reported that in patients with IBS or functional abdominal complaints, 56%-60% improved their symptoms when on a low-fructose diet; a finding also reported in some observational studies\(^12\)-\(^14\). Therefore, as advocated by Fernández-Bañares et al\(^14\), the use of FRD is a simple and feasible test that should be utilized more in clinical practice. So far, there is no standardized procedure for performing FRD tests. This includes no standardized level for the upper load of fructose to be used per meal, as well as a lack of a clinical tool to assess the effects of FRD in IBS patients.

The aims of the present study were: (1) to define criteria for self-reported dietary fructose intolerance (DFI) in a cohort of patients with IBS defined by Rome II criteria; and (2) to evaluate subjective global assessment (SGA) registration as an alternative to a diary-based symptom registration (VAS scale) as an outcome measure. This is a follow-up report of the open multicenter randomized controlled trial, Fructose Malabsorption in Northern Norway\(^11\).

MATERIALS AND METHODS

Enrolment and patient flow

The study outline has been published earlier\(^11\). In brief, during the period July 2008 and July 2011, patients who met the Rome II criteria for diagnosis were recruited. The IBS patients were registered according to their subtypes: constipation or diarrhea. An individual diagnostic workup was performed including, but not mandatory, blood tests, stool samples, breath tests, endoscopy and histological examination, and X-ray or ultrasound investigations to ensure the exclusion of organic disease or other malabsorption diseases such as lactose intolerance or celiac disease. Exclusion criteria were patients with severe chronic disease, severe chronic constipation (defined as laxative users), patients taking antibiotics or nonsteroidal anti-inflammatory drugs (NSAIDs), and patients whom had previously had performed an FBT or used an FRD.

Study design

As previously described\(^11\), the study was designed with a pre-registration period of 2 wk in which the patients followed their individual habitual IBS diet (HID). The patients were then randomized without stratification to continue HID with or without additional
Table 1 Fructose-reduced diet (according to definition < 2 g fructose/meal)

<table>
<thead>
<tr>
<th>Food item</th>
<th>In moderation</th>
<th>Use sparingly</th>
<th>Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit/berries</td>
<td>Lemon, raspberries,</td>
<td>All other types of</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td></td>
<td>blueberries</td>
<td>fruit and berries</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Most vegetables,</td>
<td>Tomato pureé</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td></td>
<td>avocado</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat/fish/eggs</td>
<td>100% ground beef</td>
<td>Caviar, mackerel in</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td></td>
<td>and fish with no</td>
<td>tomato sauce</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td></td>
<td>additives</td>
<td>Anchovies and herring</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td>Milk products</td>
<td>White/brown cheese</td>
<td>Cheeses with fruit added</td>
<td>Carrots, legumes, boiled potatoes</td>
</tr>
<tr>
<td></td>
<td>cream and sour</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain products</td>
<td>Bread, pasta, rice</td>
<td>Sweet bakery and cereals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and white flour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Margarine, oils,</td>
<td>Dressings, ketchup</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mayonnaise, nuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinks</td>
<td>Water, milk, tea,</td>
<td>Light orange juice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>coffee, light soda</td>
<td>Juice, nectar, sodas and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and light fructose</td>
<td>fructose drinks, milk with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>drinks</td>
<td>sugar or fructose added</td>
<td></td>
</tr>
</tbody>
</table>

FRD (< 2 g fructose per meal) for 12 wk.

The randomization was assisted by The Scientific Department, University Hospital of North Norway, Tromsø.

Individual instructions for the FRD were given both verbally and through written information that included a table in Norwegian showing the fructose content in 91 common food ingredients (a similar table can be found at web site given in reference 15). For a short version of the table of instructions see Table 1.

In addition to daily VAS registrations of abdominal pain/discomfort, bloating, stool frequency and consistency for 4 wk, an SGA registration was completed once weekly for 12 wk. Early dropouts (defined as patients who registered for < 3 wk of the main 12-wk period) were replaced but late dropouts were not replaced. Data from patients that registered for > 3 of the 4 wk were included in the total registration. The main reason for choosing a 4-wk VAS registration was concern about compliance because the subject would have to perform daily registrations throughout the study. After the main registration period, the patients delivered their diaries, underwent FBT, and were instructed in the fructose-rich provocation test for a maximum of 7 d, or for a shorter time if the test provoked IBS symptoms. For the provocation test, patients were told to choose sucrose-rich food and to include ≥ 200 mL of fruit juice with only small amounts of sorbitol in each daily meal[15,16] (e.g., 200 mL orange juice, 8-9 g fructose with no sorbitol content/200 mL apple juice, 15 g fructose and 1 g sorbitol). Study patients were instructed to use the same information table as a guide for both reducing fructose load and ensuring a sufficient intake of fructose (30 g) during the provocation test[15]. The VAS and SGA scores (as compared to the last week of main registration[11]) were logged in a separate provocation diary.

Symptom score of IBS

The subjects filled in a symptom registration diary. Each day they marked on a VAS form (0-100 mm) the degree of pain and bloating experienced (0 mm for no symptoms, and 100 mm for maximal symptom score). In addition, they counted the number of stools and gave a description of the stool quality on a scale of 1–7 (Bristol scale)[13].

Self reported fructose intolerance: Diagnostic criteria

Based on the experiences from our first study[11], a diagnostic test based on a self-reported (subjective) intolerance to fructose in IBS was constructed. We defined fructose-related food intolerance as a combination of symptom relief associated with dietary fructose restriction and symptom exacerbation following a fructose provocation test. In our previous study[11] the Bland-Altman analysis showed that the technical detection limits (corresponding to 1.96 SD of mean bias) were 18 mm (18% on VAS scale of 100 mm) for pain/discomfort and 17 mm for bloating. Based on these boundaries a response to FRD was defined as > 25 mm relief, whereas > 25 mm worsening of the VAS score during provocation was considered a positive test[11].

SGA score of IBS

Patients determined the SGA of abdominal relief once during every weekend of the study period by entering their assessment in their personal diary. The assessment was completed by answering the following question: Please consider how you have felt the past week with regards to your IBS, in particular your overall wellbeing, symptoms of abdominal discomfort, pain and altered bowel habit compared to how you felt before entering the study). How do you rate your relief (or worsening) of symptoms during the past week? The scale contained five possible answers: (1) completely relieved; (2) considerably relieved; (3) somewhat relieved; (4) unchanged; or (5) worse[17]. Using the SGA score, patients who were somewhat relieved in week 3 and 4, or completely/considerably relieved in at least 1 wk were considered to have responded to the FRD.

Breath tests

Hydrogen (H2) and methane (CH4) were measured by a Microlyzer (Quintron Instrument Co. Inc., Milwaukee, WI, United States) in end-expiratory breath samples. After an overnight fast, H2 and CH4 levels were measured before drinking 15 mL solution (corresponding to 50 g fructose). Measurements were performed every 30 min until a gas peak was reached,
or up to 4 h. A high load of fructose was used to minimize false-negative results as indicated by Choi et al. Incomplete absorption was defined as an increase of H₂ > 20 ppm or CH₄ > 12 ppm, or a sum of combined peak increase > 15 ppm. Symptoms during and after the test were recorded.

**Statistical analysis and validation**

The statistical analysis included all randomized patients (intention to treat). Patients where split into the two predefined groups according to the study protocol; either a normal IBS diet alone or combined with FRD. A test-retest analysis of SGA was performed by comparing scores at pre-registration with those at 1, 4 and 12 wk in the control group; Δ values were run using a Wilcoxon signed rank test vs 0. Internal consistency was explored by analysis of variance (ANOVA) and Spearman’s correlation on ΔVAS (week 0 vs week 4) vs SGA score at 4 wk in all included patients. The former analysis also yielded information regarding scale linearity and precision of the SGA measure. Finally, the face validity denoting whether the questions made sense was performed in all of the patients and 10 healthy volunteers.

**RESULTS**

**Enrollment of patients**

Patient inclusion in this multicenter study is described in detail in a previous publication. In brief, 310 patients admitted to hospital with IBS symptoms were screened, and 108 did not meet the inclusion criteria. The 202 patients included were randomized, and 182 completed the main registration period of 12 wk. All early dropouts were replaced. All patients reported a combination of constipation and diarrhea. A total of 88 patients were randomized to FRD. Among these, we experienced missing data from 11 patients; nine due to a missing provocation diary and two that missed markings for SGA change in week 4 of the main diary. The remaining 77 patients reported complete VAS and SGA data both during the pre- and main registration periods, as well as a complete registration during the provocation test. We found no significant differences in age, sex ratio, abdominal pain/discomfort, bloating, stool frequency or Bristol scale stool consistency between the FRD + HID and HID groups (Table 2).

**Validation analysis of SGA**

Internal consistency was tested by calculating the VAS change for each of the 182 patients by comparing status at 4 wk with pre-registration. These Δ values were compared to SGA scores at week 4 using the Spearman Rank correlation test. The analysis yielded ρ values of 0.59 (SGA vs pain/discomfort, $P < 0.0005$); 0.58 (SGA vs bloating, $P < 0.0005$); and 0.84 (bloating vs pain/discomfort, $P < 0.0005$). The graph for the control group illustrated in Figure 1 shows that SGA is a stable measure throughout the 3-mo study period. A test-retest analysis was performed by analyzing the control group SGA values in pairs. For each record, the differences between pre-registration week 0 and weeks 1, 4 and 12 were calculated. These delta values were analyzed with a Wilcoxon signed rank test using zero as the median for the null-hypothesis. The three Δ values were not significantly different from zero ($P = 0.41, 0.13, \text{and } 0.42$ for pre-registration vs week 1, 4, and 12, respectively). Figure 1 shows the raw data distribution of VAS change registrations in the five SGA categories at 4 wk for all 182 study participants. The SGA scale is not linear; it discriminates best between the span of somewhat relieved and towards completely relieved. Two-way ANOVA of this dataset (VAS by SGA × Diet group) was performed and pairwise comparison is presented in Table 3. The traces for the control

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**Table 2**

<table>
<thead>
<tr>
<th>included</th>
<th>Demographic and baseline variables for patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (77)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, yr (median range)</td>
<td>43 (18-73)</td>
</tr>
<tr>
<td>Female/male ratio (%)</td>
<td>61/16</td>
</tr>
<tr>
<td>Abdominal pain/discomfort (mm)</td>
<td>53 (3-89)</td>
</tr>
<tr>
<td>Bloating (mm)</td>
<td>55 (20-84)</td>
</tr>
<tr>
<td>Stool frequency [median (range)]</td>
<td>1.5 (0-4)</td>
</tr>
<tr>
<td>Boston scale stool consistency</td>
<td>4.4 (1.9-6.0)</td>
</tr>
</tbody>
</table>

¹Independent samples t-test; ²Mann-Whitney U. IBS: Measures are mean preregistration values (95% CI) unless otherwise stated. Treatment group differences were tested. SRFI: Self reported fructose intolerance; NS: Not significant.

Figure 1. Scale and precision of the subjective global assessment measure. At 4 wk, the change in VAS registration (compared to pre-registration values) was calculated. Box and whiskers plot of VAS change in the different subcategories of SGA at 4 wk. It is noted that the scale is not entirely linear, with best discrimination in the left part of the plot, while the right part shows smaller VAS differences between groups. SGA: Subjective global assessment; VAS: Visual analog scale.
### Table 3 Pairwise comparisons of visual analog scale readings by ANOVA

<table>
<thead>
<tr>
<th>SGA week 4</th>
<th>Model: ( F = 30.5; P &lt; 0.0005 )</th>
<th>VAS difference, mean ± SE</th>
<th>( P ) value</th>
<th>SGA week 4</th>
<th>Model: ( F = 32.6; P &lt; 0.0005 )</th>
<th>VAS difference, mean ± SE</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS bloating</td>
<td>( \text{Adj } R^2 = 0.47 )</td>
<td>Unchanged vs Complete relieved</td>
<td>46.1 ± 6.1</td>
<td>&lt; 0.0005</td>
<td>Unchanged vs Complete relieved</td>
<td>41.1 ± 5.5</td>
<td>&lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Considerably relieved</td>
<td>23.5 ± 3.0</td>
<td>&lt; 0.0005</td>
<td>Considerably relieved</td>
<td>20.8 ± 2.7</td>
<td>&lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Somewhat relieved</td>
<td>7.6 ± 2.8</td>
<td>0.066</td>
<td>Somewhat relieved</td>
<td>5.9 ± 2.5</td>
<td>0.202</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
<td>-7.4 ± 3.3</td>
<td>0.275</td>
<td>Worse</td>
<td>-9.4 ± 3.0</td>
<td>0.024</td>
</tr>
<tr>
<td>VAS pain/discomfort</td>
<td>( \text{Adj } R^2 = 0.46 )</td>
<td>Unchanged vs Complete relieved</td>
<td>20.8 ± 3.0</td>
<td>&lt; 0.0005</td>
<td>Unchanged vs Complete relieved</td>
<td>19.6 ± 2.7</td>
<td>&lt; 0.0005</td>
</tr>
</tbody>
</table>

Results for two-way ANOVA: VAS by SGA × Diet. Mean differences in VAS change of SGA categories compared to unchanged, adjusted for diet type. \( P \) values were adjusted by Bonferroni correction. SGA: Subjective global assessment; VAS: Visual analog scale.

### Table 4 Testing new diagnostic criteria of self-reported fructose intolerance in irritable bowel syndrome (for definition, see text) against fructose breath test and response of subjective global assessment test

<table>
<thead>
<tr>
<th>Predictive</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive predictive value</th>
<th>Negative predictive value</th>
<th>Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBT</td>
<td>0.57</td>
<td>0.34</td>
<td>0.58</td>
<td>0.29</td>
<td>0.13</td>
</tr>
<tr>
<td>SGA week 3-4</td>
<td>0.79</td>
<td>0.75</td>
<td>0.82</td>
<td>0.71</td>
<td>0.53</td>
</tr>
<tr>
<td>SGA week 4-5</td>
<td>0.84</td>
<td>0.76</td>
<td>0.83</td>
<td>0.79</td>
<td>0.61</td>
</tr>
</tbody>
</table>

1Without result provocation; 2With result provocation. SGA: Subjective global assessment; FBT: Fructose breath test.

#### DISCUSSION

In this open label, unstratified, randomized multicenter study of FRD in patients with IBS, we proposed new diagnostic criteria for FM based on the combination of effects from FRD and a positive provocation test. This is based on symptom registration (using a VAS scale) as the outcome measure. The FBT shows poor characteristics for identifying these patients. An alternative SGA registration, as an outcome measure for FRD, showed a good agreement with the new diagnostic criteria. Our study opens a new approach in the management of DFI in IBS patients. A fructose-restricted diet of < 2 g fructose per meal, together with a standardized method for SGA registration, can be used as the first step in the management of IBS patients in clinical practice. Using these new diagnostic criteria, the prevalence of self-reported fructose intolerance in the IBS cohort admitted to a gastroenterology unit was as high as 56%.

In this study, the criteria for the diagnosis of fructose intolerance are based on self-reported symptoms of relief, whilst on FRD, and symptom aggravation.

As shown in Table 4, for SGA, there was good sensitivity and specificity of 0.84 and 0.74, respectively, for identifying self-reported DFI. The inclusion of a provocation test in the diagnostic criteria improved the quality of the test criteria; especially the negative predictive value (Table 4). The sensitivity and specificity parameters for the FBT were low (Table 4).

#### Self-reported DFI: Agreement with breath tests

Using our new criteria for the diagnosis of self-reported DFI, we established a diagnostic tool for fructose intolerance based on the results from the agreement testing (frequency analysis) (Table 4). As described in our earlier report[11], a discrepancy was found between the self-reported fructose intolerance and FBT. This was confirmed in the frequency analysis that gave a \( \kappa \) value of -0.13. There was a good agreement between the diagnosis of self-reported DFI and the SGA responses to FRD according to the criteria used (see methods) with a \( \kappa \) value of 0.61 (Table 4). When results from the provocation test were excluded from the diagnostic criteria, the \( \kappa \) value was less precise (\( \kappa = 0.53 \)).

#### Prevalence of self-reported fructose intolerance

The prevalence of self-reported fructose intolerance, defined as a combination of response to FRD and a positive provocation test, was 56% (43 of 77 patients).

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In this study, the criteria for the diagnosis of fructose intolerance are based on self-reported symptoms of relief, whilst on FRD, and symptom aggravation.
Mean registration (95%CI) for somewhat relieved-unchanged and unchanged-worse.

clearly differentiate between the category transitions scale is not linear, and the VAS recordings do not as indicated a substantial change in VAS recordings. The categories completely relieved agreement with VAS measures - and in particular, the of SGA, used in IBS patients on an FRD, showed good performed. The validation of the Norwegian translation for IBS, described by Müller-Lissner a 5-degree scoring system of a validated questionnaire to assess the effects of FRD.

In this study, we used SGA as a clinical tool to assess the effects of FRD. A translated modification of the categories completely relieved and considerably relieved indicated a substantial change in VAS recordings. The scale is not linear, and the VAS recordings do not as clearly differentiate between the category transitions somewhat relieved-unchanged and unchanged-worse.

Considering our earlier study on VAS recordings for this patient group, these transitions represent VAS differences that are lower than the technical discrimination limits of 17 and 18 mm for bloating and pain/discomfort, respectively\cite{21}. In contrast, the categories completely relieved and considerably relieved both represent a mean VAS change above the technical discrimination limit. Thus, a single SGA rating should reliably identify an improvement in symptoms when rated as completely relieved or considerably relieved. The test-retest analysis showed no significant time-related bias, which was also demonstrated in the graph for the control group in Figure 3. Face validity was evaluated in healthy volunteers, and revealed no problems in the interpretation of the questions. Finally, good sensitivity and specificity for identifying self-reported DFI was found for SGA.

According to the proposed diagnostic criteria, the prevalence of self-reported fructose intolerance in a cohort of IBS patients admitted to a gastrointestinal unit was 56%. Among the few studies reporting the prevalence of FM, defined according to FBT, Goldstein et al\cite{6} reported that 44% of patients with IBS or functional abdominal complaints had the condition. This was based on a consumption of 50 g fructose and 56%-60% improved on a low-fructose diet\cite{4}, whereas Barrett et al\cite{7} found FM as high as 34% in healthy volunteers. Finally, in the recently published FODMAP diet studies, representing a diet reduced in fructose and other carbohydrate types, about 50% of the IBS patients improved their symptoms and VAS scores\cite{23}. Our prevalence data must be interpreted with some caution. Including only those who reported complete relief of their symptoms by FRD, the prevalence was reduced to about 20%. Moreover, based on the individual normal variation for the capacity of fructose absorption\cite{5}, the prevalence of self-reported fructose intolerance in IBS has to be compared with the reference population, including potential factors such as genetics and the fructose content in daily food intake.

The strength of this study was that we performed a prospective randomized study with validation of the SGA as a tool for assessing IBS-related symptoms during dietary treatment. The FBT was performed after 12 wk observation, which prevented potential bias during registration of symptoms. There were some limitations to the study. First, the intervention could not be blinded for obvious reasons. Second, a more exact diary registration of the amount of fructose, glucose, and sorbitol intake in each meal during the FRD\cite{7}, could have given valuable information. Finally, based on our knowledge of normal variations with regards to fructose absorption capacity\cite{5}, a more detailed background registration of the fructose/sucrose content in the daily food intake of the IBS patients and in the reference population would have given more comprehensive data. A substantial increase in the prevalence of IBS has
been observed in the past 20 years. During the same period, consumption of fructose as well as processed food and additives has increased in the general population[24]. It is tempting to speculate that the increased fructose ingestion may explain the observed increase in IBS. If so, an FRD could be an appropriate option for diagnosis and treatment of patients with IBS. If this diet induces symptom relief, according to SGA registrations, a subsequent simple provocation test, two glasses of fruit juice with low sorbitol content at each meal, in combination with an augmented intake of fructose-rich food, could be performed.

New diagnostic criteria for self-reported fructose intolerance, based on FRD are proposed. SGA appears to be a valid outcome measure, which is a feasible alternative to daily VAS registrations; both in daily routine management of these patients and for future studies of IBS.

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