ORIGINAL PAPER

Diet and Irritable Bowel Syndrome

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Abstract

Background & Aims. Recent papers highlight the role of the diet in irritable bowel syndrome (IBS), but very few population-based studies have evaluated this. The aim of the study was to determine the prevalence of IBS in the general urban population and to evaluate the type of diet associated with IBS symptoms. **Methods**.A randomized sample of subjects (n=300) from a general urban population in Romania selected from family doctors' patient lists was invited for interview in the doctor's office. Selected subjects were evaluated for the diagnosis of IBS using Rome III criteria and for their eating habits and diet using a food frequency questionnaire. Socio-demographic factors and general medical history were also included in the interview together with standard weight measurements. Results from logistic regression were presented as odd ratio and 95 % confidence intervals. **Results**. From the selected sample, 193 subjects (80 males, 113 women, mean age 50.8±16.2) agreed to participate (rate 64.3%). Prevalence of IBS was 19.1 % (19.4% for females and 18.7 % for males). IBS was associated with older age (1.05, 1.02-1.08, p<0.001) and past history of digestive diseases (5.0, 2.0-12.7, p<0.01). IBS subjects eat significantly more frequently canned food (23.74, 3.17-177.7, p<0.01), processed meat (4.7, 1.6-14.1, p<0.01), pulses (legumes) (4.0, 1.3-16.3, p<0.01), whole cereals (8.7, 2.0-37.8, p<0.01), confectionary (5.7, 1.8-23.2, p<0.01), fruit compotes (canned or not) (7.4, 2.5-23.1, p<0.001) and herb teas (4.0, 1.3-16.3, p<0.001). **Conclusions**. This study updates prevalence data and reveals a possible association between diet and irritable bowel syndrome.

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Key words

Irritable bowel syndrome – food – diet – eating behavior – prevalence – odds ratio.

Introduction

Functional bowel disorders are highly prevalent among people worldwide and are considered to represent up to 50% of medical consultations in gastroenterology [1]. Irritable Bowel Syndrome (IBS) is a common cause for medical referral and has a clear impact on the patient quality of life and also on the medical system costs. Over the years, the definition criteria for IBS have evolved from Manning and Kruise's criteria to Rome I and Rome III criteria. However, clear conclusions are difficult when comparing studies with different definitions for IBS. The worldwide prevalence of IBS varies according to the location and design of the study from 1.1% [2, 3] - to 22% [4]. Most western studies have revealed figures between 15-20% [5]. IBS seems to be more prevalent in women, independently of age [6], and ethnic groups. However, IBS is somehow more frequently present in western European than in Asia Pacific countries [7] and in the white population compared with Afro-Americans [8].

Although many patients recognize the impact of specific food in symptom occurrence, very few population-base studies have evaluated the importance of diet in IBS and its role remains uncertain [9, 10]. Even though many patients have reported that food may precipitate or aggravate their symptoms, only one population-based study has evaluated its role in IBS and the results suggested that food sensitivity rather than different diet composition may be related to IBS [4].

The single study conducted on the general population in Romania, using Rome I criteria, revealed IBS prevalence of 14.49% (8.4% man and 17.7% women) with no significant difference between the age groups [11]. The study was conducted in 1998 in the same area as the present study, on 338 subjects (220 women, 118 men), mean age 44 (standard

deviation 14.8, range 17 to 80 years old) and had a home visiting design.

Aim

The aim of the study was to determine the prevalence of IBS in the general urban population and to evaluate the type of diet associated with IBS symptoms.

Methods

Population

The study included a sample of 300 subjects (>18 years old) from a population of 18,000 subjects living in the Pacurari urban area, Iasi, Romania. The sample size and demographic characteristics were estimated to be representative for the general population of the geographic area using Epi Info™ 3.5.2 (CDC) software. According to an expected frequency of 14 %, and a worst acceptable value of 8 %, the minimum sample size would be 128 for a confidence interval (CI) of 95 % and 219 for a CI of 99%. The inclusion criteria were: age over 18 years and residency in this urban area, with no exclusion criteria. The selection of subjects was randomized, using a function in Microsoft Excel™ software, from family doctors' patient lists. The family doctors invited the selected subjects by phone for interview and measurement in their offices.

Measurements

Two interview-based questionnaires were delivered to all subjects: a Rome III questionnaire [12-14] for diagnosis of IBS and a food-frequency questionnaire (FFQ) for evaluation of eating habits and frequency of food intake for the last six months. General medical history (overweight / obesity, diabetes mellitus, hypertension, cancer, cardiovascular, liver, digestive, endocrine, loco-motor system, skin, respiratory, neuro-psychiatric diseases and sleep disorders) was also included in the interview together with an objective evaluation of obesity (weight and height were measured by doctors, in their offices).

Age, gender and educational level were studied as demographic factors. Educational level was categorized into three classes: low (no school or elementary school only), medium (high school) and high (college or university). Health-related conditions were investigated: smoking (dichotomized as "current smokers" and "non-smokers"), physical activity (dichotomized as "physically active" if exercise moderate to vigorous at least weekly and "physically inactive" for less) and general well-being (using a 5 point scale "very good – good - acceptable - poor – very poor condition"). Body mass index (BMI) was also calculated and subjects were grouped into four categories: underweight (<18.5 kg/m2), normal weight (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2), and obese (≥30.0 kg/m2)[15].

A FFQ was designed to reveal habitual intake over a six month period. This questionnaire was based on a FFQ developed for use among adults in Romania, but was modified to include more dietary questions. We asked about the main categories of foods consumed in our region, detailing the foods considered of interest to our study. Consumption frequencies were noted: "never or rarely", "monthly", "once a week", "several times a week", "once a day" and "several times a day". We also investigated individual eating habits (including daily breakfast, number of meals and snacks a day, use of home prepared food, meal with family, eating in a hurry as subjective perception).

Descriptive statistics were performed with SPSS 17.0. Mean was used for parametric characteristics and median for non-parametric or ordinal variables. The median was used to characterize the frequency of food consumption in the studied population and subjects were divided into two categories of consumers (less than median frequency and equal or more than median frequency). Spearman's correlation and cross-tabulation analysis (chi square test) was used initially to reveal any association between medical personal history, eating habits, food consumption frequency and other associated conditions. Finally, we used logistic regression (binary, univariate) and calculated odd ratios (ORs) and 95 % confidence interval (95% CI) for significant predictors of IBS derived from initial analysis. A value of $p<0.05$ in both analyses was considered to be statistically relevant.

The study was approved by the Ethics Committee of the University of Medicine and Pharmacy "Grigore T. Popa" Iasi, and a patient informed consent was obtained from all subjects.

Results

During a period of four months (January – April 2011) 300 persons were invited to enroll in the study. 193 subjects (80 males and 113 women) agreed to participate. Participation rate was 64.3%, with no socio-demographic differences between participants and non-participant subjects (for gender, age and educational level, $p>0.05$). The mean age of the sample was 50.8±16.2 years (range: 20-85).

The prevalence study

The prevalence of IBS was 19.17 % (19.47% for females and 18.75 % for males) (Fig. 1). Evaluation of the age distribution indicated increased prevalence of IBS in subjects above the mean age of sample, with a maximum in the decade 60-69 years (37.5%, $p <0.01$) (Fig. 2). Educational level of subjects influenced the prevalence of IBS in the studied population, but not significantly ($p=0.066$). The trend showed higher prevalence of IBS symptoms toward low educated people (12.5% among high-educated people, 23.0% in medium and 30.3 % in low-educated people). Profession did not reveal any difference between subject; with and without IBS. A history of digestive diseases was more common in subjects with IBS versus non-IBS subjects (29.7% vs. 7.7%, $p<0.01$). Also, patients with IBS had more commonly cardio-vascular diseases (64.9% vs. 18.6%, $p<0.01$), including arterial hypertension (75.7 % vs. 31.4%, $p<0.01$). Obesity (59.5% vs. 24.4%, $p<0.01$) and diseases of the loco-motor system (27% vs. 12.2%, $p<0.05$) were

more common in IBS subjects. History of other diseases, including psychiatric disorders, did not feature often in IBS subjects (p>0.05).

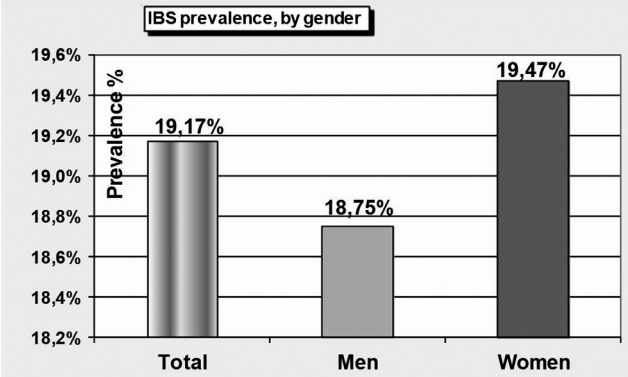

Fig 1. IBS prevalence, by gender.

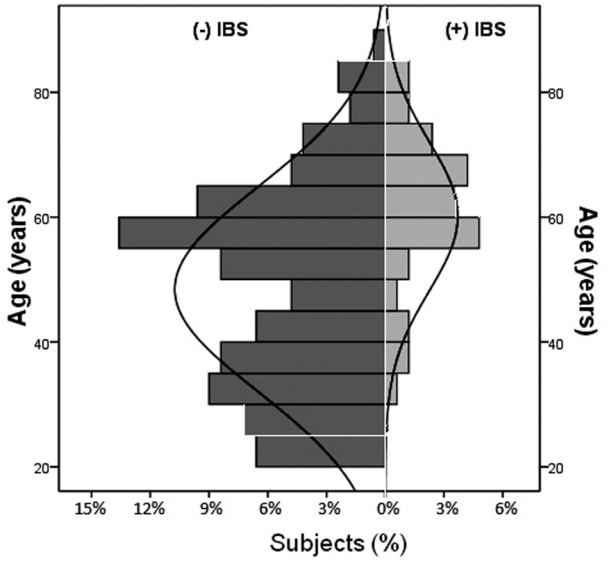

Fig 2. Age distribution of IBS and non-IBS subjects.

IBS and health-related behaviors / conditions

Smoking was not associated with IBS: 13.5 % of IBS subjects were smokers, vs. 29.5% non-IBS subjects (p>0.05). Alcohol (beer, wine or spirits) was also not associated with IBS symptoms (p>0.05). 10.9 % participants had an alcoholic beverage daily. However, 86.5% of IBS subjects and 60.2% of non-IBS subjects were physically inactive (p<0.01). IBS vs. non-IBS subjects perceived their well being status to be poor: 13.3% versus 7.6% (p>0.05), acceptable (50% vs. 34.7%, p>0.05), good (36.7% vs. 40.7%, p>0.05). No IBS subjects and 16.9% of non-IBS subjects perceived themselves as in very good condition while no subject perceived themselves to be in a very poor condition of well-being. In the sample studied, 49.5% were overweight and 20.8% obese. Presence of obesity was not significantly different in IBS (21.6%) and non-IBS subjects (20.6%) (p>0.05).

IBS and diet

Median frequency of food consumption in the studied population is presented in Figure 3. Using median as the cut-off point, the IBS subjects ate significantly more frequently the following foods (chi square test and OR derived from logistic regression, Table I): canned food (p<0.001), processed meat (p<0.01), beef (p<0.001), milk (p<0.05), pulses (legumes)(p<0.05), cereals or grain bread /pasta (p<0.01), cafeteria products (p<0.01), fruit compotes (canned or not) (p<0.001), herb teas (p<0.001). The difference between IBS and non-IBS subjects was not significantly different (p>0.05) for the consumption of the following type of foods: fish, eggs, fats, vegetables with 5% carbohydrate (lettuce, spinach, tomatoes, peppers), white bread, sugar and sweets, alcoholic beverages and coffee. Using the Spearman correlation test we found an association between IBS and several types of food consumption frequency (Table II).

Table I. Associations of IBS with frequency of food consumption

Food categories Frequency of food consumption	Chi square test	OR (95% CI) derived from logistic regression
Canned food		
No, rarely	18.662***	1
At least monthly		23.74 (3.17-177.7)**
Processed meat		
Less than once a week	9.158**	1
At least once a week		4.75 (1.60-14.09)**
Milk		
Once a week or less	7.343**	1
At least several times a week		10.03 (1.55-418.93)*
Vegetables (10% CH)		
Once a week or less	5.143*	1
At least several times a week		7.53 (1.15-316.93)*
Pulses (legumes)		
Less than once a week	7.027**	1
At least once a week		4.01 (1.31-16.31)**
Grain bread /pasta / cereals		
Once a week or less	11.576***	1
At least several times a week		8.75 (2.03-37.8)**
Confectionary (Cakes, cream, ice-cream)		
Rarely	11.965***	1
At least monthly		5.74 (1.89-23.22)**
Fruits compotes		
Less than once a week	19.578***	1
At least once a week		7.47 (2.59-23.11)***
Herb teas		
Less than once a day	12.465***	1
At least once a day		4.78 (1.77-13.59)***

OR: odds ratio; ci: confidence interval; CH: carbohydrates; *p<0.05; **P<0.01; ***P<0.001

Eating habits and IBS

Subjective perception of eating in a hurry was more frequent among the IBS patients (41.6 %) than non-IBS subjects (22 %) (p<0.05). Other eating habits (daily breakfast, number of meals per day, meals with the family or

frequent use of home-prepared food) were not significantly different (Table III).

Table II. Associations of IBS with frequency of food consumption – Spearman test

Food categories	Correlation coefficient (r)
Canned food	0.279 ***
Processed meat	0.218 **
Potatoes	0.216 **
Cereals	0.208 **
Grain bread /pasta	0.162 *
Fruits compotes	0.337 ***
Herb teas	0.220 **

*p<0.05; **p<0.01; ***p<0.001

Discussion

The recent literature using Rome III criteria reports a mean prevalence for IBS of 12-15 % (range 1 to 33 %) [2, 16-19]. The only IBS prevalence study in the Romanian general population revealed an IBS prevalence of 14.49% (8.4% men and 17.7% women) [11]. Comparing the two studies a modest, not significant increase of the prevalence (19.47 %: 95% CI) in the present study can be seen (p>0.05). Although the geographic area was the same, the design was somehow different and this could have influenced the results.

In the present study, the subjects were invited to the doctor's office and the population sample had a higher mean age. It is recognized that inviting the subjects to the doctor's office may influence the selection. Recruitment by invitation may select primarily subjects with a higher availability, more free time or possible co-morbidities. This may explain the high prevalence of IBS subjects in our sample.

The prevalence of IBS was higher in women (as most studies have found), but it did not reach statistical significance [6, 20]. The prevalence was also increased in older people. Even if the IBS incidence was shown to decrease with age [16], the prevalence was high in elderly [5] making it an overlooked problem [21]. Female gender and increasing age are associated with higher consultation rates in most studies in both western and developing countries, although not all are in agreement [4].

Education level and profession did not influence the prevalence of IBS. In different populations those with higher educational levels or professional people were more likely to be physically active [22] and have a healthy diet [23]. However, no association with socioeconomic class or education has been reported [16, 24]. Also, low socioeconomic status in childhood may carry an increased risk of suffering with IBS in adulthood [4].

Similar with other data, IBS subjects in our study had more commonly gastrointestinal co-morbidities in their past history, but not psychiatric disorders [25]. Higher mean age in IBS subjects may explain the increased prevalence of cardiovascular and loco-motor diseases in the IBS subjects.

Comparable with other studies, smoking and alcohol was not more common in IBS subjects. The general self-perceived well being of IBS subjects was worse than in non-IBS. In a 10-year longitudinal study, poor quality of life at baseline was a strong predictor for the new onset of IBS [24]. We used a food frequency questionnaire (FFQ) to capture habitual intake over a long period [26]. The FFQ is appropriate for exploring dietary patterns based on frequencies, but has not been validated for estimating total intakes of energy or nutrients [27]. The FFQ did not include portion sizes, and calculating energy and nutrient intakes was not feasible. However, the reproducibility and validity of major dietary patterns assessed using FFQs have previously been found to be satisfactory for studying diet-disease relationships [28]. In our study, certain categories of food (canned food, processed meat, milk, high carbohydrates vegetables, pulses, whole cereals, confectionary, compotes or herb teas) were significantly related to IBS. Food may contribute to symptom onset through several mechanisms including food allergy and intolerance. Also, certain food may alter the composition of the luminal milieu, either directly or indirectly through effects on bacterial metabolism. Finally, IBS symptoms may develop following exposure to food-borne pathogens [10].

Table III. Eating habits among IBS and non-IBS subjects

Eating habits	Answers	Non- IBS		IBS		Significance
		No.	%	No.	%	
Breakfast	Not daily	55	35.3	14	37.8	p>0.05
	Daily	101	64.7	23	62.2	
Number of meals and snacks/day	1-2/day	57	42.2	18	51.4	p>0.05
	3/day	48	35.6	14	40.0	
	More than 3/day	30	22.2	3	8.6	
Home cooked food	1 /day or less	65	42.2	16	43.2	p>0.05
	2 /day or more	89	57.8	21	56.8	
Meal with family / day	1 /day or less	101	66.0	22	59.5	p>0.05
	2 /day or more	52	34.0	15	40.5	
Eating in a hurry (subjective perception)	No	117	78.0	21	58.3	p<0.05
	Yes	33	22.0	15	41.7	

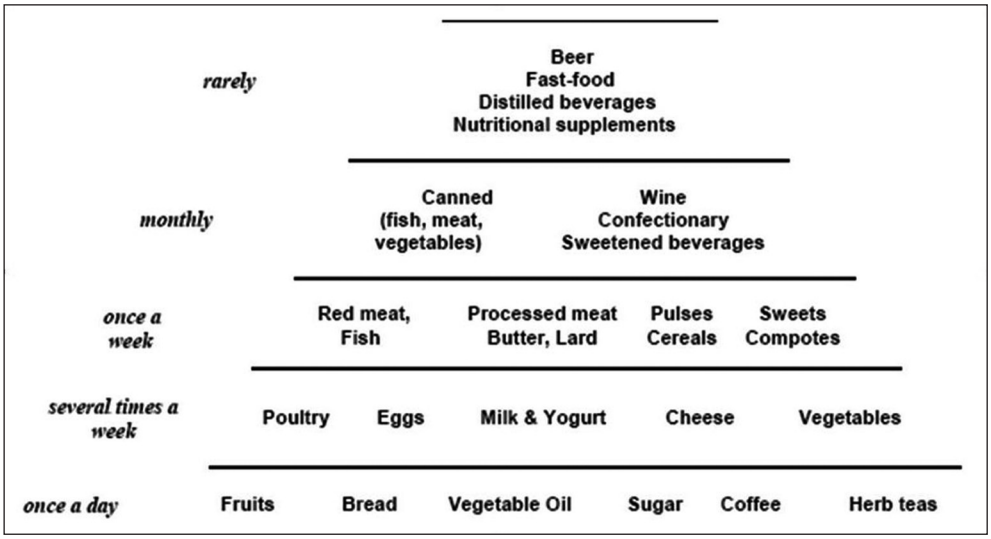

Fig 3. Median frequency of food consumption

A specific food intolerance (for example, lactase deficiency) may explain the symptoms for a part of the patients [20, 29-32]. Our study did not explore this kind of association: observational or interventional longitudinal studies are necessary for this [33, 34].

A cross-sectional study such as the present one may only reveal association and not causality between the studied elements. A correlation between the studied elements may have several explanations in our case. Frequent consumption of a particular food may positively or negatively influence the presence of disease – for example, canned food, processed meat, milk, or fibre-rich products - 10% carbohydrate vegetables (carrots, onions, beets), pulses (beans, peas, soybeans, lentils), grain cereals/ bread/ pasta or sweet foods - confectionary (cakes, cream, ice-cream), compotes - may affect digestive transit, gas production, gut biota and also may cause abdominal discomfort or pain. The presence of IBS may lead, on the other hand to a specific lifestyle or diet, which may possible explain the increased use of herb teas in IBS subjects. The relationship between dietary factors and IBS independent of other potential confounding factors (for example, socioeconomic status) could not be evaluated without a multivariate modelling. A further study using a larger sample may permit a multivariate analysis and consequently may reduce the confounding factors.

Conclusions

This survey, conducted in a general urban population and using Rome III criteria revealed that IBS may be associated with a higher consumption of canned food, processed meat, legumes, whole cereals, confectionary, fruit compotes and herb tea. Further studies are needed to explore the mechanisms that may explain the association.

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