

# Constipation: Prevalence in the Portuguese community using Rome IV—Associated factors, toilet behaviours and healthcare seeking

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## Abstract

**Background:** Chronic constipation (CC) is a major public health condition and CC management remains challenging.

**Objective:** We aimed to evaluate the CC (and subtypes) prevalence in a Southern Europe Mediterranean country using Rome IV criteria, and to assess related factors, toilet and healthcare seeking behaviours.

**Methods:** Cross-sectional epidemiological survey, conducted in general community and representing the Portuguese population according to sex and age. The questionnaire covered bowel habits, factors potentially associated with CC (demographic, health/lifestyle, toilet behaviours) and data regarding healthcare seeking.

**Results:** From the study data of 1950 individuals were analyzed. The answer rate was 68% and 1335 questionnaires were available for calculation. The CC prevalence was 17.8%, with respectively 9.3% of Functional Constipation (FC) and 8.5% of Irritable Bowel Syndrome - subtype constipation (IBS-C). The likelihood of constipation was significantly higher in younger (OR 1.01; 95% confidence interval [CI], 1.007–1.031), solo (OR 2.48; 95% CI, 1.7–3.47) and low-income (OR 2.40; 95% CI, 1.77–3.47) individuals. Constipated individuals spent more time at defecation, longer than 5 min ( $p = 0.001$ ), and had particular toilet behaviours (absence of a morning pattern [ $p = 0.008$ ], the use of triggers [ $p = 0.001$ ] and reading/technological material [ $p = 0.006$ ]) to facilitate the evacuation. Only 39% of affected individuals sought medical advice, mainly IBS-C patients ( $p = 0.018$ ).

**Conclusion:** Chronic constipation seems to impact 1 in each 5 Portuguese. Constipated patients are younger, solo, less active and with low income. They develop a clear toilet behaviour profile. FC and IBS-C patients assume particular behaviours.

## KEYWORDS

chronic constipation, healthcare, prevalence, Rome IV, toilet behaviours

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## INTRODUCTION

Chronic constipation (CC) is a symptom-based disorder that includes a broad set of complaints as decreased stool frequency, straining, incomplete evacuation and sense of anorectal blockage for more than 3 months. CC is either a secondary condition (due to other disease, medications or anatomic alterations) or, more frequently, a primary disorder without an evident underlying cause (related to neuromuscular or sensory-motor dysfunction).<sup>1</sup> This is one of the most frequent gastrointestinal diagnoses made in ambulatory medicine clinics, in addition, economic cost and adverse implications on the quality of life make CC a major public health issue.<sup>1-3</sup>

The worldwide prevalence of CC among adults is estimated to be around 15%.<sup>1</sup> However, when looking at three large systematic reviews including studies of community samples, we realize that the prevalence varies widely.<sup>4-6</sup> This wide variation may be in part due to differences in populations as age groups, culture, diet and environment.<sup>7</sup> For instance, in Southern Europe or Mediterranean countries, Soares et al.<sup>5</sup> describes a CC prevalence between 5% and 20%. Nevertheless, in the last 20 years there is only 1 study with more than 1000 participants, reporting the CC epidemiology in the general population, from France.<sup>8</sup>

Another important aspect that may contribute to the prevalence variation is the difference in the definition of constipation in each study.<sup>7</sup> Many of these community surveys used either self-report constipation or questionnaires based on one or some of the symptoms described in previous iterations of the Rome criteria.<sup>5,7</sup>

The Rome criteria were developed for use as a standard definition of primary CC, its most recent edition – the Rome IV criteria – categorize patients as having functional constipation (FC), constipation-predominant irritable bowel syndrome (IBS-C) or defecatory disorders (DDs)<sup>9,10</sup> as described in Table 1.<sup>11,12</sup> but to our knowledge, it has not yet been properly applicate in adult national prevalence studies.

Associated factors such as gender, age, dietary habits, physical inactivity, socioeconomic level, psychological parameters and vaginal delivery were frequently implicated in the development of CC according to available literature.<sup>1,13,14</sup> Regarding dietary habits, there are data suggesting that the Mediterranean diet (MD) might be beneficial in ameliorating functional gastrointestinal symptoms in children and adolescents, through the increased fibre and antioxidant consumption and the low intake of saturated fats and oligosaccharides<sup>15</sup> but there is no information regarding adult population.

An additional interesting feature is that only a minority of patients, approximately 25% of those affected, seek specific medical advice, making the information regarding self-management and healthcare use scarce and not well understood.<sup>16,17</sup>

Thus, CC is an economic burden and is important to know its accurate prevalence in populations, moreover, the clarification of associated factors and patients' behaviours can be very important in enhancing clinical management.

### Key summary

#### 1. Summarise the established knowledge on this subject

- The worldwide prevalence of Chronic constipation (CC) varies significantly.
- High economic cost and low quality of life make CC a major public issue.
- Data regarding associated factors and patients' behaviours can enhance clinical management.

#### 2. What are the significant and/or new findings of this study?

- CC seems to impact 1 in each 5 European Mediterranean individuals.
- Constipated patients are younger, solo, less active and with low income.
- Constipated individuals develop a clear toilet behaviour profile.

## AIM

The aim of this study is to determine the prevalence of CC in a representative sample of a European Mediterranean population, using the recent Rome IV criteria. As secondary aims, we intend to analyse the association of a diversity of factors with CC, and to evaluate the patient self-management and his healthcare seeking behaviour in CC, and in its FC and IBS-C subtypes.

## METHODS

### Study design and population

This was a cross-sectional study with an epidemiological survey, conducted in the general community. It was carried out in the municipality of Braga located in the North Coast of Portugal, a Mediterranean country of Southern Europe. A total of 178,558 individuals constituted the eligible population older than 18 years (single inclusion criterion). For an expected prevalence of CC of 20%, an accuracy of 4% and a 95% confidence interval (CI), we calculated a sample size per strata. Using the central data of the region population, a systematic, stratified by age, random sampling was arbitrarily performed, considering three groups: 18–39, 40–64 and > 64 years. With an expected response of 60%, the global sample required totalled 1920 subjects. Using the local health authority registries from the resident population of Braga, our primary sample population was randomly selected after applying the criteria required to obtain a cohort that represents the adult Portuguese population. Inquiries were sent to each 13 Health Care Centres of urban and rural areas of the municipality of Braga. The General Practitioner excluded in advance potential responders who had a known medical history

**TABLE 1** Rome IV criteria of chronic constipation subtypes

<b>Diagnostic criteria (a) for functional constipation</b>
1. Must include 2 or more of the following:
a. Straining during more than one-fourth (25%) of defecations
b. Lumpy or hard stools (BSFS 1–2) more than one-fourth (25%) of defecations
c. Sensation of incomplete evacuation more than one-fourth (25%) of defecations
d. Sensation of anorectal obstruction more than one-fourth (25%) of defecations
e. Manual manoeuvres to facilitate more than one fourth (25%) of defecations
f. Fewer than 3 spontaneous bowel movements per week
2. Loose stools are rarely present without the use of laxatives
3. Insufficient criteria for irritable bowel syndrome
<b>Diagnostic criteria (a) for irritable bowel syndrome with constipation</b>
1. Recurrent abdominal pain at least 1 day a week with 2 or more of the following:
a. Related to defecation
b. Related to change in frequency of stools
c. Related to change in form of stools
2. Lumpy or hard stools (BSFS 1–2) more than one-fourth (25%) of defecations
<b>Diagnostic criteria (a) for functional defecation disorders</b>
1. The patient must satisfy diagnostic criteria for functional constipation and/or irritable bowel syndrome with constipation
2. During repeated attempts to defecate, there must be features of impaired evacuation, as demonstrated by 2 of the following 3 tests:
a. Abnormal balloon expulsion test
b. Abnormal anorectal evacuation pattern with manometry or anal surface EMG
c. Impaired rectal evacuation by imaging

Note: (a) Criteria fulfilled for the last 3 months with symptom onset at least 6 months before diagnosis.

Abbreviations: BSFS, bristol stool form scale; EMG, electromiography.

involving or influencing bowel functioning (bowel surgery, inflammatory bowel diseases, endocrine and neurological disorders, and medications like opioids and antipsychotics) considered exclusion criteria. The participants were invited to fulfil the written or the online form of the questionnaire, between September 2020 and May 2021.

## Questionnaire

A questionnaire with 25-items divided in several sections was developed. The first section included demographic information as age and gender. Social class was evaluated according to professional

occupation and activity, income (dichotomized in high and low income using the cut-off of 1000 euros per month) and level of completed education. Marital status was dichotomized in solo (single, divorced and widow) and couple (marriage and common-law marriage).

The second section included medical and lifestyle data. Medical history (dichotomized into healthy when no disorders was described and disease status when one or more disorders were described) surgical history and medication use was collected as well. Physical activity, smoking habits and diet were also evaluated. Diet was assessed by means of a validated food frequency questionnaire regarding MD.<sup>18</sup> Adherence to the traditional MD was assessed by a 10-point scale, as described by Trichopoulou et al.<sup>18</sup> - range of score from 0 (minimal adherence) to 9 (maximal adherence). The cut-off of six points was defined to differentiate MD adherents and MD non-adherents, as proposed previously by several authors for this purpose.<sup>18–20</sup>

The third section included data regarding bowel habits that allowed us to define the study population in terms of regular bowel function (control group) and FC or IBS-C (constipated group). The diagnostic criteria used to define the constipated group were the consensus criteria of Rome IV as detailed in Table 1. Some patients satisfied criteria for FC and IBS-C, in this case according to the Rome criteria specifications, the patients who had symptoms of IBS-C and FC were classified as IBS-C.

Questions regarding self-management and healthcare seeking were included in the last section of the questionnaire - descriptive healthcare seeking, the use of over-the-counter and/or prescribed laxatives and other complementary techniques, proctological conditions, as well as some toilet behaviours (evacuation pattern, squatting device, triggers as coffee or cigarette, the use of reading or technological material in the toilet).

A pilot study was conducted with this questionnaire, administering it to 10 subjects from a socio-cultural setting similar to that of the study population. The questionnaire was found to be easy to understand and answer.

## Ethical considerations

The study project was approved by the Ethic Commissions of Braga Hospital and School of Medicine of Minho University and by the North Region Health Administration. Informed consent was obtained from all participants, and Portuguese regulations applicable to the management of personal data was followed at all times.

## Data analysis

Descriptive statistics for continuous variables were reported as median (interquartile range, IQR) while for categorical variables were reported as frequency (%). The Pearson chi square test was used to compare categorical variables and the Wilcoxon test to compare

continuous data. A Multiple Linear Regression Model was performed for each of the significant variables previously calculated when considered adequate. All statistical tests were two-sided and a probability level of 0.05 was used to indicate statistical significance. All the statistical analyses were conducted using the software SPSS 27.0 (IBM).

## RESULTS

A total of 1950 questionnaires were delivered, and overall, 1382 subjects replied. Despite the initial exclusion criteria, additional 47 responders were excluded due to colorectal disease or surgical history ( $N = 10$ ), chronic use of opioids ( $N = 4$ ) and lack of more than 50% of the information ( $N = 33$ ), making 1335 questionnaires available for analysis (68%).

### General demographic data

Regarding the study population and following the items order of subsequent analysis in Table 3: 895 (67%) were female with median age of 45 (IQ 19) years; 34.2% with low qualified professions, 12.1% professionally not active and 21.9% with low income; the level of education was low (up to ninth grade/middle school) in 17.7%, median (up to 12th grade/high school) in 31.1% and superior in 51.3% of participants; 68% lived as a couple.

There was a slightly higher proportion of female responders compared with global population (66% vs. 54%) but there were no other statistically significant differences in the baseline characteristics of individuals in the study population and in the Portuguese population.<sup>21</sup>

### Prevalence of CC and subgroups (FC and IBS-C)

The prevalence of CC (FC plus IBS-C) in the study sample was 17.8% ( $N = 237$ ). Ninety-nine patients satisfy criteria for FC and IBS-C, but according to the Rome criteria 113 patients were classified as IBS-C and 124 as FC. The subgroup prevalence was 9.3% for FC and 8.5% for IBS-C.

Regarding the items of Rome IV criteria that establish the diagnosis of constipation (displayed in Table 2), as expected they were all also more frequent in both subgroups of individuals. Besides the known criteria another item stood up: time at defecation  $>5$  min. Time at defecation  $>5$  min was more frequent in constipated individuals (56.4% vs. 31.9%  $p = 0.001$ ) and that was also true for both FC (59.5% vs. 30.8%  $p = 0.001$ ) and IBS-C (55.9% vs. 39.2%  $p = 0.002$ ) subgroups.

Another unexpected data was the reported use of laxative (although unfrequently) by 20 individuals with no bowel complaints.

## CC related factors and behaviours

Table 3 describes the main characteristics of the constipated group and the control group.

### 1. CC related factors (demography and health/lifestyle):

*Demography* - Constipated individuals were younger (49 vs. 51 years old,  $p = 0.014$ ), professionally not active (32.2% vs. 35.1%  $p = 0.001$ ), single (49.6% vs. 28.5%  $p = 0.001$ ) and with low-income (37.9% vs. 18.3%  $p = 0.001$ ) in comparison to the control group.

*Lifestyle* - Constipated individuals reported more frequently comorbidities (91.2% vs. 66.7%  $p = 0.001$ ), and less practice of physical activity (51.5% vs. 60.7%  $p = 0.049$ ). There were no differences regarding other items, including MD score and MD adherence.

On evaluation of these CC factors, the univariate analyses revealed that age, professional activity, marital status and income had a significant influence on the likelihood of constipation, but professional activity was not sustained in the multivariate analysis subsequently performed (Table 4). There were no significant interactions between the remaining variables used. The likelihood of constipation was significantly higher in younger population (OR 1.0019; 95% CI, 1.007–1.031). The solo and low-income responders were also more likely to suffer from constipation (OR 2.48; 95% CI, 1.77–3.47 and OR 2.40; 95% CI, 1.7–3.38 respectively).

### 2. Toilet behaviours

The less frequent morning evacuation habit (66.1% vs. 79.2%  $p = 0.008$ ), the use of triggers to facilitate evacuation (51.7% vs. 15.3%  $p = 0.001$ ) and the use of reading or technological material in the toilet (64.7% vs. 52.3%  $p = 0.006$ ) were more frequent in the constipated group.

### 3. Healthcare seeking

Constipated patients were more concerned about their bowel habits (67.1% vs. 28.9%  $p = 0.001$ ) and sought more frequently any form of healthcare advice (61.1% vs. 29.7%  $p = 0.001$ ) - specified in absolute numbers as medical (93 vs. 64), pharmaceutical (69 vs. 34), alternative (24 vs. 12) and psychological (3 vs. 2) advice. Constipated patients use more laxatives (27% vs. 6.5%  $p = 0.001$ ) and suffer more frequently from proctological conditions as haemorrhoidal disease (61.2% vs. 39.5%  $p = 0.001$ ) and anal fissure (23.5% vs. 15.4%  $p = 0.03$ ). When calculating specifically the medical seeking behaviour of this CC population we find the rate of 39%.

## FC and IBS-C subgroup evaluation

Comparing FC and IBS-C patients, no differences were found in demographic or health/lifestyle characteristics. Considering the toilet and healthcare seeking behaviours, some differences were raised (Table 5). Only FC patients reported an evacuation (absence of) regularity, and the use of triggers and squatting devices for evacuation. IBS-C patients were more concerned about their bowel habits

**TABLE 2** Individualized Rome IV criteria in constipated patients and controls

	FC + IBS-C (n = 237)	Control (n = 1098)	P value
1. CC related factors			
Demography			
Female	167 (70.5%)	728 (66.3%)	0.216
Age (median years/interquartile range)	49/28	51/26	<b>0.014</b>
Low qualification profession	58 (32.2%)	319 (35.1%)	0.195
Professionally not active	47 (19.8%)	115 (10.5%)	<b>0.001</b>
Low income	81 (37.9%)	173 (18.3%)	<b>0.001</b>
Scholarity			
9th grade	37 (15.9%)	193 (18%)	0.735
12th grade	75 (32.3%)	330 (30.8%)	
Superior	120 (51.7%)	548 (51.2%)	
Marital status			
Couple (married and common law)	115 (50.4%)	767 (71.5%)	<b>0.001</b>
Single (single, divorced, widow)	113 (49.6%)	307 (28.5%)	
Lifestyle			
Healthy status	136 (66.7%)	964 (91.2%)	
BMI	24.5/4.4	24/4.5	0.702
Water intake (<1,5 L)	170 (85.4%)	227 (82.2%)	0.356
MD adherence (>5 points)	137 (67.8%)	192 (69.6%)	0.684
Physical activity	102 (51.5%)	167 (60.7%)	<b>0.049</b>
Smoking habits	89 (44.7%)	109 (39.6%)	0.268
2. Toilet behaviours			
Morning evacuation	72 (66.1%)	210 (79.2%)	<b>0.008</b>
At home evacuation	208 (98.6%)	267 (96.4%)	0.137
Squatting devices	9 (8.4%)	9 (3.6%)	0.068
Triggers	61 (51.7%)	163 (15.3%)	<b>0.001</b>
Digital or printed material toilet use	139 (64.7%)	149 (52.3%)	<b>0.006</b>
3. Healthcare seeking			
Concerns regarding bowel habits	139 (67.1%)	80 (28.9%)	<b>0.001</b>
Seek healthcare for bowel habits	124 (61.1%)	80 (29.7%)	<b>0.001</b>
Haemorrhoidal disease	123 (61.2%)	109 (39.5%)	<b>0.001</b>
Anal fissure	46 (23.5%)	41 (15.4%)	<b>0.03</b>

Abbreviation: BMI, Body mass index.

(74.7% vs. 60.7%  $p = 0.032$ ) and sought more frequently any form of healthcare advice (69.9% vs. 53.6%  $p = 0.018$ ).

## DISCUSSION

Our population presented a constipation rate of 17.8%, in accordance with other European demographic studies with prevalence between 19.8 and 20.2 per 100 inhabitants.<sup>6</sup> When considering

small and large available Mediterranean studies of the last 2 decades, we are close to the French (22.4%),<sup>8</sup> the Spanish (19.2%)<sup>22</sup> and in a less extent the Greek results (15%).<sup>23</sup> Most of these studies used self-reported information, which have identified bias limitations, but some applied simultaneously the previous Rome criteria.<sup>7,22,23</sup> It is remarkable that the prevalence of CC seems to remain consistent using the Rome IV criteria. Aside the criteria discussion, the similarity of constipation rates in the developed countries may partially be due to the similar lifestyle, physical

**TABLE 3** Main characteristics of the constipated group and the control group

	FC + IBS-C (n = 237)	Control (n = 1098)	P value
Less than 3 defecations per week	49 (21%)	3 (1%)	0.001
Use of laxatives	63 (27%)	20 (6.5%)	0.001
Time at defecation >5 min	132 (56%, 4%)	96 (31.9%)	0.001
Hard stools	212 (91%)	107 (38.9%)	0.001
Straining	187 (82.4%)	3 (1.3%)	0.001
Sensation of incomplete evacuation	178 (77.7%)	38 (15.8%)	0.001
Manual manoeuvres to evacuate	48 (28.1%)	2 (1%)	0.001
Abdominal pain related to defecation	114 (56.7%)	29 (13.1%)	0.001
Abdominal pain related to change in frequency of stools	107 (51%)	29 (12.7%)	0.001
Abdominal pain related to change in form of stools	133 (63.9%)	50 (21.9%)	0.001

**TABLE 4** Prevalence and likelihood of constipation

	Prevalence (%)	P value	Likelihood of constipation Multivariate logistic regression		P value
			OR	95% CI	
Age (median years)	49	0.014	1.019	1.007–1.031	0.001
Low income	37.9%	0.001	2.40	1.7–3.38	0.001
Marital status					
Solo (single, divorced, widow)	49.6%	0.001	2.48	1.77–3.47	0.001

**TABLE 5** Comparison of toilet behaviours and healthcare seeking in Functional Constipation (FC) and IBS-C individuals

	FC (n = 124)	IBS-C (n = 113)	P value	Missing data (%)
<b>Toilet behaviours</b>				
Morning evacuation	72 (66.1%)	97 (98%)	0.001	12%
At home evacuation	100 (100%)	108 (97.3%)	0.098	11%
Squatting devices	9 (8.4%)	2 (2%)	0.001	14%
Triggers	61 (51.7%)	21 (20%)	0.001	7%
Digital or printed material toilet use	73 (63.5%)	66 (66%)	0.7	9%
<b>Healthcare seeking</b>				
Concerns regarding bowel habits	68 (60.7%)	71 (74.7%)	0.032	13%
Seek healthcare for bowel habits	59 (53.6%)	65 (69.9%)	0.018	14%
Haemorrhoidal disease	68 (63%)	55 (59.1%)	0.579	15%
Anal fissure	24 (23.3%)	22 (237%)	0.953	17%

activity and socioeconomic level as well as common dietary habits of these populations. In fact, we hypothesized that MD could influence the prevalence rate in our Mediterranean population, but it was not confirmed as discussed below.

With the Rome IV criteria, we could discriminate the population prevalence of the two main subtypes of CC (FC - 9.3% and IBS-C - 8.5%) and this division also allowed us to evaluate the association of certain specific features. The Rome Foundation recently published their Global Study results and calculated a worldwide

prevalence of FC and IBS-C of 11.7% and 1.3% respectively in a combined Internet and household survey in 26 countries.<sup>24</sup> The most important limitation of their study was the lack of national representation, thus, our is the first European population survey using the Rome IV criteria to define constipation in an adult epidemiologic study. In the spectrum of the primary CC we were not able to categorize and calculate the prevalence for DD, which is around 50% in the constipated population according to other studies<sup>1,11</sup> and our own experience.<sup>12</sup>

A secondary aim was to identify factors related to CC. Female gender was not significantly associated with CC as described by other authors.<sup>5-8</sup> A reasonable explanation is the female preponderance of the survey responders, including the control group, a bigger study population would probably reveal that association. Constipated patients were slightly younger than controls as described by some authors but not by others.<sup>22-24</sup> Verkuil S et al. brilliantly explore these apparently contradictory conclusions by reporting different clinical patterns of constipation symptoms in different age groups and pointing several pathophysiological differences as the reason.<sup>25</sup> In our population, being solo and professionally not active were associated with constipation. This might be explained by less regularity of routines in these conditions. Individuals of lower social, economic and educational level have a tendency towards higher constipation rates according to Bytzer et al.<sup>14</sup> and Peppas et al.<sup>6</sup> but in our sample, only low-income was associated with constipation. Possibly educational, social and economic level are not so closely related in the Portuguese population as in other populations, explaining why we identify the association with low-income but not with educational or professional qualification. Although out of the scope of this manuscript, among these low-income responders, we found an associated behaviour pattern of lack of exercise, no smoking and poor adherence to MD. Constipated individuals report less frequently a healthy condition compared to controls in agreement with other studies, that state the well-known association with comorbidities as cardiovascular, digestive or psychological conditions.<sup>6,26</sup> Surprisingly there were no differences in terms of diet factors such as number of meals, water intake, food restrictions and adherence to a MD. MD was extensively studied in terms of cardiovascular benefit and overall survival, but regarding bowel habits, as far as we know only Agakidis et al.<sup>15</sup> concluded that good adherence to the MD in a younger population was associated to lower prevalence of functional gastrointestinal diseases.<sup>15</sup> Maybe a bigger sample could uncover some of these associations. However, poor diet habits are associated with low income<sup>27</sup> an important demographic factor identified in our CC population. Or else, perhaps our participants may not be keen at recalling the variation of their lifestyle behaviours. Physical inactivity was more frequent in constipated individuals as described by others.<sup>28</sup> In our opinion our data adds evidence pointing to the continuous effort in terms of patient education regarding exercise.

We confirm that all items of Rome IV criteria were associated with the diagnosis of FC and IBS-C showing that they are all strong and associated criteria. The time at defecation >5 min was more frequent in constipated individuals and in both subgroups. Could be this feature additionally important when we evaluate bowel habits?<sup>29</sup> In a study with 102 patients, Garg and Singh associate the 'TONE' mnemonic habits (T, 3 min at defecation; O, once-a-day defecation frequency; N, no straining during passing motions; E, enough fibre) with improvement in deranged defecation habits and haemorrhoidal disease.<sup>29</sup> Verkuil S et al. also identify straining of more than 5 min as well as daily failure to defecate as reliable indicators of CC<sup>25</sup> We think that time at defecation is probably underestimated and that it is

important to integrate this item in our clinical interview and to work it in our therapeutic plan with constipated patients.

Toilet behaviours associated with CC were the reduced morning evacuation habit, the use of reading or technological material, and the use of triggers (such as coffee, cigarette, gym) to help evacuation. The absence of the morning evacuation habit is probably explained by the pathophysiological mechanisms of constipation, making harder to control the time-scheduled bowel evacuation. Reading and technological material use, is described by more than 60% of the constipated subjects and that also is an echo of our times. As Goldstein et al. conclude in their study and we also infer from our survey, the use of reading or technological material seems to relax individuals but not help specifically the evacuation (at least not consciously).<sup>30</sup> When looking at subtype analysis, FC patients do not present an evacuation regularity, and this can explain the need for the more frequent use of triggers and squatting devices – the absence of an evacuation pattern pressures these patients for a rigid toilet commitment to improve the bowel habits in FC, not so demanding with the more intermittent nature of IBS complains.

Our study also examined the use of healthcare resources by constipated individuals. The seek for medical, pharmaceutical, alternative and psychological help was associated with constipation as well as the use of (over-the-counter and prescribed) laxatives. Similar to Galvez et al. that reported seeking of healthcare in over 40% of constipated subjects in their study population, we identify in our constipated individuals 39% of specific medical seeking and 67% of seeking for any form of help regarding their bowel habits.<sup>16</sup> Maybe the proximity to the pharmacist, herbalist or shopkeeper and ease of access to laxatives (even the controls described its occasional use) can explain the growing seek of any form of help regarding bowel habits. At this point, there was also a significant difference between our subgroups - the concern and healthcare for bowel habits are reported more frequently by IBS-C individuals compared to FC patients. This can be explained by the abdominal pain that characterizes IBS, a troublesome symptom that probably raises fears in these commonly anxious patients.<sup>31</sup>

Advantages of this study are its large size and its reliance on a sample of the general population. The systematic sampling and age stratification to define our study population reduced selection bias. Most epidemiological studies comprise sample selection based on recruitment of volunteers, occupational groups, commercial databases or student populations or are based on doctor-delivered questionnaires or hospital diagnoses upon admission and it increases the risk of information bias.<sup>16</sup> The main weakness of the study is the sample size that could be even larger and the use of recall information; by other hand, additional information could have been collected, for instance gynaecological background in this predominant female population.

As pointed out, this is the first epidemiological study regarding CC in an adult population of a European Mediterranean country using extended Rome IV Criteria. As far as we know, it is also the first time that an exhausting evaluation of associated factors, toilet

behaviours and healthcare seeking is achieved, helping us to understand better constipated individuals.

## CONCLUSION

Using Rome IV criteria, the prevalence of CC is 17.8% (FC - 9.3% and IBS-C - 8.5%) in this European survey. This condition was associated with younger age, being solo, professionally not active, having a low-income, and a reported unhealthy condition and less practice of exercise. Constipated individuals spent more time at defecation and have specific toilet behaviours (as the absence of morning pattern, the use of triggers, the use of laxatives and the use of reading/technological material). Although they seek for a diversity of healthcare support, only 39% of affected individuals seek for medical advice. The toilet behaviours seem more complex in FC, inversely the healthcare seeking behaviour looks more frequent in IBS-C.

## AUTHOR CONTRIBUTIONS

Ana Célia Caetano contributed for the conception and draft of this article; Dalila Costa contributed for the statistical analysis, Silva-Mendes Sofia contributed with data collection, Jorge Correia-Pinto and Carla Rolanda contributed for the critical revision and submission of this articles. There is no conflict of interest or disclosure to formulate. Study materials will be made available to other researchers upon request.

## CONFLICT OF INTEREST

We declare there is no conflict of interest or disclosure to formulate.

## DATA AVAILABILITY STATEMENT

Deidentified individual participant data and the study protocol can be included as a data supplement available with the online version of this article.

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**How to cite this article:** Caetano AC, Costa D, Silva-Mendes S, Correia-Pinto J, Rolanda C. Constipation: Prevalence in the Portuguese community using Rome IV—Associated factors, toilet behaviours and healthcare seeking. *United European Gastroenterol J.* 2022;10(4):376–84. <https://doi.org/10.1002/ueg2.12221>