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Source / Izvornik: **United European Gastroenterology Journal, 2021, 9, 307 - 331**

Journal article, Published version

Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

<https://doi.org/10.1002/ueg2.12061>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:184:727357>

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Download date / Datum preuzimanja: **2024-07-27**



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# United European Gastroenterology (UEG) and European Society for Neurogastroenterology and Motility (ESNM) consensus on functional dyspepsia

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#### Funding information

United European Gastroenterology, Grant/Award Number: no number

#### Abstract

**Background:** Functional dyspepsia (FD) is one of the most common conditions in clinical practice. In spite of its prevalence, FD is associated with major uncertainties in terms of its definition, underlying pathophysiology, diagnosis, treatment, and prognosis.

**Methods:** A Delphi consensus was initiated with 41 experts from 22 European countries who conducted a literature summary and voting process on 87 statements. Quality of evidence was evaluated using the grading of recommendations, assessment, development, and evaluation (GRADE) criteria. Consensus (defined as >80% agreement) was reached for 36 statements.

**Results:** The panel agreed with the definition in terms of its cardinal symptoms (early satiation, postprandial fullness, epigastric pain, and epigastric burning), its subdivision into epigastric pain syndrome and postprandial distress syndrome, and the presence of accessory symptoms (upper abdominal bloating, nausea, belching), and overlapping conditions. Also, well accepted are the female predominance of FD, its impact on quality of life and health costs, and acute gastrointestinal infections, and anxiety as risk factors. In terms of pathophysiological mechanisms, the consensus supports a role for impaired gastric accommodation, delayed gastric emptying, hypersensitivity to gastric distention, *Helicobacter pylori* infection, and altered central processing of signals from the gastroduodenal region. There is consensus that endoscopy is mandatory for establishing a firm diagnosis of FD, but that in primary care, patients without alarm symptoms or risk factors can be managed without endoscopy. There is consensus that *H. pylori* status should be determined in every patient with dyspeptic symptoms and *H. pylori* positive patients should receive eradication therapy. Also, proton pump inhibitor therapy is

considered an effective therapy for FD, but no other treatment approach reached a consensus. The long-term prognosis and life expectancy are favorable.

**Conclusions and Inferences:** A multinational group of European experts summarized the current state of consensus on the definition, diagnosis and management of FD.

#### KEYWORDS

consensus, endoscopy, evidence-based medicine, functional dyspepsia, proton pump inhibitors

#### Key summary

##### Current knowledge

- Functional dyspepsia is one of the most common conditions encountered in clinical practice.
- There is a lack of guidance for clinicians in guiding diagnosis and treatment of this prevalent condition.
- No treatments are currently approved for the treatment of functional dyspepsia in Europe.

##### What is new here

- A Delphi panel consisting of 41 experts from 22 European countries established the level of consensus on 87 statements regarding functional dyspepsia.
- The statements reaching consensus serve to guide clinicians in recognizing, diagnosing and treating FD in clinical practice.
- Endoscopy is mandatory for establishing a firm diagnosis of functional dyspepsia D, but in primary care patients without alarm symptoms or risk factors can be managed without endoscopy.
- *Helicobacter pylori* status should be determined in every patient with dyspeptic symptoms and *H. Pylori* positive patients should receive eradication therapy.
- Proton pump inhibitor-therapy is considered an effective therapy for FD, but no other treatment approach reached consensus support.

## INTRODUCTION

Functional dyspepsia (FD), defined by the presence of recurrent or chronic epigastric symptoms in the absence of organic disease likely to explain them, is one of the most common conditions seen in clinical practice.<sup>1,2</sup> In spite of its prevalence, FD is associated with major uncertainties, as definitions and the symptom spectrum of FD have evolved over time,<sup>3</sup> the differential diagnosis is very broad,<sup>1</sup> the optimal diagnostic work-up has not been defined,<sup>4,5</sup> and there is a lack of available treatments with established efficacy.<sup>6,7</sup>

The aim of this project was to develop a European consensus on the definition, pathophysiological concepts, diagnosis, management, and prognosis of FD. The results of this consensus can offer the clinician guidance in diagnosing and managing FD patients to optimize clinical outcomes.

## METHODS

The European Society for Neurogastroenterology and Motility (ESNM) initiated a Delphi process, funded by United European Gastroenterology, to develop consensus statements on different aspects of FD in collaboration with other European societies. The Delphi approach, which combines the principles of evidence-based medicine, supported by systematic literature reviews and a voting

process, aims at determining consensus for complex problems in medicine for which evidence from controlled trials is lacking.<sup>8</sup>

The principal steps in the process were (1) selection of a working group of seven ESNM members with expertise in FD and/or Delphi consensus processes; (2) selection of a European Consensus Group consisting of experts in FD from different European countries, recruited through the ESNM board and through UEG Sister Societies; (3) drafting of statements allowing to evaluate the current knowledge on FD; (4) systematic literature reviews to identify evidence to support each statement; (5) two rounds of repeated voting of the statements and voting discussion until a stable level of consensus voting was reached; and (6) grading of the strength of evidence using accepted criteria.

For the Consensus Group, ESNM board members nominated experts from their respective national societies for participation, and the UEG Sister Societies (EAGEN, EHSMG, and ESPCG) nominated additional experts. A total of 41 experts from 22 European countries agreed to participate. The members had a background of expertise in gastroenterology, general practice, *Helicobacter pylori* infection or gastrointestinal motility. All members submitted a conflict of interest statement by December 2018.

The seven-member Core Group drafted and finalized a list of 75 statements covering several aspects of FD. The finalized list was evaluated in the first voting round by all members in the second quarter of 2019, where each member indicated the degree of agreement for the statement using a 6-point Likert scale (Table 1).

**TABLE 1** Six-point Likert scale

Point	Description
A+	Agree strongly
A	Agree with minor reservation
A-	Agree with major reservation
D-	Disagree with minor reservation
D	Disagree with major reservation
D+	Disagree strongly

Participants were blinded to the votes of other participants and also gave feedback on the clarity of the statement and made suggestions for adapting or splitting the statements into two or more questions, or for adding additional statements on a given topic. The Core Group adjusted the statement list, generating a total of 87 statements, and subdivided the Guideline Group members into 12 working groups with 3–4 members each. Each working group was allocated statements for which they needed to conduct a systematic literature search using several relevant keywords and provide narrative substantiation of the statements. The literature review and references were made available on a share-point server, accessible to all members. This was finalized by the Summer of 2019, followed by a voting round in which each statement was presented with the evidence summary. The available members of the Guideline Group met in September 2019 at the occasion of the ESNM meeting in Lisbon and in October 2019 at the UEG week in Barcelona to discuss statements and voting outcomes. A final voting round was conducted between both meetings, focusing on statements that were adapted based on the evaluation at the ESNM meeting. Throughout the process, all votes were mutually anonymous and blinded.

When 80% of the Consensus Group agreed (A+ or A) with a statement, this was defined as consensus. The strength of evidence for each statement was scored using the GRADE system (Table 2).<sup>9</sup> After the final voting round (summarized in Table 3), the manuscript was drafted and circulated for the final approval by the participants. The references cited in this chapter are only a selection of the articles reviewed in each area, chosen to clarify the discussion. A final meeting planned in October 2020 was canceled because of the COVID-19 pandemic.

## RESULTS

### 1. Definitions and symptom descriptors

1.1 Dyspepsia refers to a symptom or set of symptoms that is (are) considered to originate from the gastroduodenal region.

STATEMENT ENDORSED, overall agreement 98%: A+ 78%, A 20%, A- 0%, D- 2%, D 0%, D+ 0%. GRADE B

1.2 Early satiation, postprandial fullness, epigastric pain, and epigastric burning are the cardinal dyspeptic symptoms as defined by Rome IV.

STATEMENT ENDORSED, overall agreement 98%: A+ 83%, A 15%, A- 0%, D- 2%, D 0%, D+ 0%. GRADE B

1.3 Functional dyspepsia is a condition characterized by chronic dyspeptic symptoms in the absence of organic, systemic, or metabolic condition(s) that is (are) likely to explain symptoms  
STATEMENT ENDORSED, overall agreement 93%: A+ 68%, A 25%, A- 7%, D- 0%, D 0%, D+ 0%. GRADE A

1.4 The vast majority of patients with dyspeptic symptoms and no alarm symptoms in the general population are identified as functional dyspepsia after investigation (if this would be done).

STATEMENT ENDORSED, overall agreement 93%: A+ 66%, A 27%, A- 2%, D- 0%, D 5%, D+ 0%. GRADE A

1.5 Two main subtypes of functional dyspepsia are distinguished which may overlap: postprandial distress syndrome (PDS) characterized by meal-induced symptoms (early satiation, postprandial fullness) and epigastric pain syndrome (EPS), with epigastric pain and/or epigastric burning not necessarily associated with a meal.

STATEMENT ENDORSED, overall agreement 98%: A+ 78%, A 20%, A- 2%, D- 0%, D 0%, D+ 0%. GRADE B

1.6 Dyspeptic symptoms often coexist with other symptoms such as bloating in the upper abdomen, nausea, and belching.

STATEMENT ENDORSED, overall agreement 98%: A+ 73%, A 25%, A- 0%, D- 2%, D 0%, D+ 0%. GRADE A

1.7 Bloating or visible distention in the upper abdomen is a dyspeptic symptom.

STATEMENT NOT ENDORSED, overall agreement 61%: A+ 27%, A 34%, A- 29%, D- 0%, D 5%, D+ 5%. GRADE B

1.8 The use of pictograms helps to characterize the presence and nature of dyspeptic symptoms.

STATEMENT NOT ENDORSED, overall agreement 76%: A+ 27%, A 49%, A- 24%, D- 0%, D 0%, D+ 0%. GRADE C

1.9 Typical reflux symptoms (heartburn, regurgitation) often coexist with dyspeptic symptoms in the general population:

STATEMENT ENDORSED, overall agreement 98%: A+ 56%, A 42%, A- 2%, D- 0%, D 0%, D+ 0%. GRADE A

1.10 Gastroesophageal reflux disease may be distinguished from functional dyspepsia using dedicated questionnaires or good history taking.

STATEMENT NOT ENDORSED, overall agreement 46%: A+ 14%, A 32%, A- 24%, D- 10%, D 17%, D+ 2%. GRADE C

1.11 Irritable bowel syndrome often coexists with functional dyspepsia.

STATEMENT ENDORSED, overall agreement 95%: A+ 73%, A 22%, A- 5%, D- 0%, D 0%, D+ 0%. GRADE A

The definition of dyspepsia and FD has seen major evolutions over time. While early definitions included esophageal symptoms such as heartburn, as well as nausea, vomiting, and belching within the dyspeptic symptom complex, the Rome III and Rome IV consensus have significantly narrowed the symptom profile.<sup>1,3,10</sup> The recent Rome IV consensus, which defined dyspepsia as the

**TABLE 2** Grading of recommendations assessment, development and evaluation system<sup>9</sup>

Code	Quality of evidence	Definition
A	High	Further research is very unlikely to change our confidence in the estimate of effect <ul style="list-style-type: none"> <li>• Several high-quality studies with consistent results</li> <li>• In special cases: one large, high-quality multicenter trial</li> </ul>
B	Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. <ul style="list-style-type: none"> <li>• One high-quality study</li> <li>• Several studies with some limitations</li> </ul>
C	Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. <ul style="list-style-type: none"> <li>• One or more studies with severe limitations</li> </ul>
D	Very low	Any estimate of effect is very uncertain. <ul style="list-style-type: none"> <li>• Expert opinion</li> <li>• No direct research evidence</li> <li>• One or more studies with very severe limitations</li> </ul>

presence of chronic symptoms thought to originate from the gastroduodenal region, is well accepted.<sup>1</sup> According to this consensus, the four cardinal dyspeptic symptoms are troublesome postprandial fullness, early satiation, epigastric pain, and non-radiating epigastric burning.<sup>1</sup>

FD is defined as the presence of chronic dyspeptic symptoms in the absence of organic disease that readily explains the symptoms.<sup>1</sup> Symptoms do not reliably distinguish between functional and organic dyspepsia.<sup>1,12</sup> Consequently, in clinical practice, upper endoscopy is regularly performed to rule out organic causes. The prevalence of clinically significant endoscopic findings in subjects with uninvestigated dyspepsia is low, but the high number of affected patients is relevant. Less than 10% of patients have a peptic ulcer, and less than 1% have gastroesophageal cancer.<sup>4</sup> Thus, based on the endoscopic findings, a systematic review and meta-analysis found that more than 70% of subjects with dyspeptic symptoms qualify for a diagnosis of FD.<sup>4</sup>

Besides the four cardinal symptoms, nausea, belching, and upper abdominal bloating are often found in FD patients and are considered adjunctive features of the FD spectrum.<sup>1</sup> Their presence may reflect common pathophysiological mechanisms such as altered motility or hypersensitivity.<sup>1,7</sup>

The Rome IV criteria stress that heartburn is not a dyspeptic symptom but may often coexist with FD and that the presence of heartburn should not lead to the exclusion of FD as diagnosis.<sup>1,3</sup> Overall, one-third of FD patients also experience typical symptoms of gastroesophageal reflux disease (GERD).<sup>13</sup> It seems that, in cases of overlap between FD and GERD, FD is often underestimated, favoring the diagnosis of GERD.<sup>14</sup> The substantial overlap of core symptoms of GERD and FD persists, regardless of the use of objective tools or

evidence from upper endoscopies or esophageal pH studies.<sup>12,14</sup> Thus, separating out GERD and FD based on questionnaires and history taking alone can be quite difficult, if not impossible.<sup>13,15</sup> In addition, non-acid-related conditions such as functional heartburn frequently overlap with FD.<sup>13,16</sup> Irritable bowel syndrome (IBS) is another symptomatic condition which frequently overlaps with FD.<sup>17</sup> The high rate of overlap between FD and conditions like IBS or GERD may be explained by common etiological risk factors (e.g., acute infectious gastroenteritis, psychological disturbances) and pathophysiological mechanisms (e.g., visceral hypersensitivity, altered motility, etc.).<sup>13,15-17</sup> Severity and impact of symptoms are higher in those with overlapping conditions.<sup>40</sup>

Over time, several subdivisions of the dyspeptic symptom pattern have also been proposed.<sup>1,3,10</sup> According to the Rome III consensus, and refined in Rome IV, two subgroups are identified within FD: the PDS and the EPS.<sup>1,10</sup> The PDS subgroup is characterized by symptom triggered or aggravated by a meal and includes postprandial fullness, early satiation, and other postprandial symptoms. The EPS subtype is defined by meal-unrelated symptoms, such as epigastric pain and epigastric burning.<sup>1</sup> The existence of these subtypes in the general population is supported by epidemiological data.<sup>3</sup> With the Rome III definitions, a major overlap between EPS and PDS was found, but this is substantially decreased with the Rome IV update.<sup>1,3,10,11,40</sup>

Assessing the presence of cardinal and accessory symptoms requires an accurate understanding of symptom descriptors by the patient. It may be difficult for patients to distinguish upper gastrointestinal symptoms based on verbal descriptors alone, but adding pictograms to verbal descriptors significantly improves the accuracy of symptom reporting by FD patients.<sup>18</sup> However, as this was done in

**TABLE 3** All statements with endorsement and references

Statement	Endorsement	Grade of Evidence	References
1.1. Dyspepsia refers to a symptom or set of symptoms that is (are) considered to originate from the gastroduodenal region.	Yes	B	1-4
1.2. Early satiation, postprandial fullness, epigastric pain, and epigastric burning are the cardinal dyspeptic symptoms as defined by Rome IV.	Yes	B	1-4
1.3. Functional dyspepsia (FD) is a condition characterized by chronic dyspeptic symptoms in the absence of organic, systemic or metabolic condition(s) that is (are) likely to explain symptoms.	Yes	A	1-4
1.4. The vast majority of patients with dyspeptic symptoms and no alarm symptoms in the general population is identified as FD after investigation (if this would be done).	Yes	A	1,4
1.5. Two main subtypes of FD are distinguished which may overlap: postprandial distress syndrome (PDS) characterized by meal-induced symptoms (early satiation, postprandial fullness) and epigastric pain syndrome (EPS), with epigastric pain and/or epigastric burning not necessarily associated with a meal.	Yes	B	1,3,10,11
1.6. Dyspeptic symptoms often co-exist with other symptoms such as bloating in the upper abdomen, nausea and belching.	Yes	A	1,7
1.7. Bloating or visible distention in the upper abdomen is a dyspeptic symptom.	No	B	1,10,11
1.8. The use of pictograms helps to characterize the presence and nature of dyspeptic symptoms.	No	C	18
1.9. Typical reflux symptoms (heartburn, regurgitation) often co-exist with dyspeptic symptoms in the general population.	Yes	A	12-16
1.10. Gastro-esophageal reflux disease may be distinguished from FD using dedicated questionnaires or good history taking.	No	C	12-16
1.11. Irritable bowel syndrome often coexists with FD.	Yes	A	17
2.1. (Functional) dyspepsia occurs at all ages but the highest incidence is in the middle age.	No	B	2,19-22
2.2.(Functional) dyspepsia is more prevalent in women than men	Yes	A	2,19-22
2.3. Acute GI infection is a risk factor for development of FD.	Yes	A	23-27
2.4. NSAID intake is a risk factor for development of FD.	No	C	28-31
2.5. Antibiotic therapy is a risk factor for development of FD.	No	C	32
2.6. Anxiety is a risk factor for development of FD	Yes	A	33-48
2.7. Depression is a risk factor for development of FD.	No	B	33-48
2.8. Smoking is a risk factor for development of FD.	No	C	49-54
3.1. FD is a major source of healthcare costs.	Yes	A	55-58
3.2. FD is a major source of self-costs to patients.	Yes	B	55
3.3. FD is an important source of loss of work productivity.	Yes	B	56,57,59
3.4. FD is associated with a significant decrease in quality of life.	Yes	A	60-62
3.5. FD is associated with psychosocial co-morbidities such as anxiety and depression	Yes	A	33-46,48
3.6. Weight loss can be consequence of FD	Yes	B	63-67
3.7. In case of weight loss, eating disorders must be ruled out.	No	C	63-67
3.8. Healthcare consulting behavior in FD is driven by symptom severity and impact.	Yes	B	57,68-70
3.9. Healthcare consulting behavior in FD is driven by psychosocial comorbidity.	Yes	B	36,71
3.10. Healthcare consulting behavior in FD is driven by access to the healthcare system.	No	B	68,70,72
4.1. Dietary factors underlie symptom generation in FD.	No	C	57,73-79
4.2. <i>H. pylori</i> is a cause of symptoms in a subgroup of patients with dyspepsia and normal endoscopy.	Yes	B	80-82

TABLE 3 (Continued)

Statement	Endorsement	Grade of Evidence	References
4.3. Impaired gastric accommodation is a pathophysiological mechanism in FD.	Yes	B	63,67,83–93
4.4. Delayed gastric emptying is a pathophysiological mechanism in FD.	Yes	B	91,93–102
4.5. Rapid gastric emptying is a pathophysiological mechanism in FD.	No	C	99,101,102
4.6. Hypersensitivity to gastric distention is a pathophysiological mechanism in FD.	Yes	B	64,91,100–108
4.7. Duodenal mucosal alterations are a pathophysiological mechanism in FD.	No	B	109–117
4.8. Altered gastric acid secretion is a pathophysiological mechanism in FD.	No	C	118–120
4.9. Altered release of peptide hormones is a pathophysiological mechanism in FD.	No	C	121–124
4.10. Increased sensitivity to duodenal luminal content is a pathophysiological mechanism in FD.	No	C	127–130
4.11. Altered duodenal microbiota composition is a pathophysiological mechanism in FD.	No	C	131,132
4.12. Impaired vagus nerve function is a pathophysiological mechanism in FD.	No	C	133–138
4.13. Anxiety and stress are pathophysiological mechanisms in FD.	No	B	33–48
4.14. Depression is a pathophysiological mechanism in FD.	No	B	33–46,48
4.15. Disordered central processing of incoming signals from the gastroduodenal region is a pathophysiological mechanism in FD.	Yes	C	139–144
4.16. Genetic factors determine the susceptibility to FD.	No	C	145–148
5.1. Upper GI endoscopy is mandatory for establishing a diagnosis of FD.	Yes	A	1,10,149–151
5.2. In primary care, uninvestigated dyspepsia can be managed without endoscopy if there are no alarm of risk factors.	Yes	A	149–151
5.3. Upper GI endoscopy is mandatory if there are alarm symptoms or risk factors.	Yes	A	1,10,149–151
5.4. Screening blood test are useful when considering a diagnosis of FD.	No	B	152
5.5. Every patient with dyspeptic symptoms should be tested for <i>H. pylori</i> (non-invasively or at gastroscopy).	Yes	A	1,10,81,149, 150,153,154
5.6. Patients with dyspepsia and <i>H. pylori</i> positive gastritis should be considered to have FD just if symptoms persist 6 to 12 months after <i>H. pylori</i> eradication.	Yes	B	1,81,155
5.7. Patients with dyspepsia and HP negative gastritis should be considered to have FD.	Yes	B	1,81,155
5.8. FD should be subdivided into EPS and PDS for further diagnostic and therapeutic approach.	Yes	B	3,11,40,156–162
5.9. Upper abdominal ultrasound is useful when considering a diagnosis of FD.	No	B	1,150,165,166
5.10. A gastric emptying test is useful when considering a diagnosis of FD.	No	B	1,91,150,167,168
5.11. Esophageal pH monitoring is useful in FD to rule out GERD.	No	B	13,169–171
5.12. Increased duodenal eosinophil count is a marker of FD.	No	C	172
5.13. Impaired nutrient volume tolerance is a marker of FD.	No	B	63,67,86,173–176
6.1. Dietary adjustment improves symptoms in FD.	No	C	57,73–79
6.2. <i>H. pylori</i> positive FD patients should receive eradication therapy.	Yes	A	1,81,150,160,177
6.3. PPI therapy is the most appropriate initial therapy for FD.	No	B	150,178–186
6.4. PPI therapy is an effective therapy for FD.	Yes	A	150,178–186
6.5. PPI therapy is most effective for EPS.	No	C	150,177,186
6.6. Prokinetic therapy is the most appropriate initial therapy for FD.	No	C	150,187–189
6.7. Prokinetic therapy is an effective therapy for FD.	No	B	150,187–189
6.8. Prokinetic therapy is most effective for PDS.	No	B	150,187–189

(Continues)



TABLE 3 (Continued)

Statement	Endorsement	Grade of Evidence	References
6.9. Efficacy of prokinetics is not related to their enhancement of gastric emptying rate.	No	B	150,187–189
6.10. Itopride is effective for FD patients.	No	C	190–193
6.11. Tricyclic antidepressants are effective for epigastric pain syndrome (EPS).	No	B	194–197
6.12. Tricyclic antidepressants are effective for post-prandial distress syndrome (PDS).	No	B	194–197
6.13. Tricyclic antidepressants are not effective for post-prandial distress syndrome (PDS).	No	B	150,194–197
6.14. Serotonin reuptake inhibitors are effective for FD.	No	B	195,198
6.15. Serotonin reuptake inhibitors are not effective for FD.	No	B	195,198
6.16. Serotonin noradrenaline reuptake inhibitors are effective for FD.	No	C	199
6.17. Serotonin noradrenaline reuptake inhibitors are not effective for FD.	No	C	199
6.18. Mirtazapine is effective for post-prandial distress syndrome patients with weight loss.	No	B	200,201
6.19. 5-HT1A agonists (tandospirone, buspirone, ...) are effective for PDS.	No	B	202–206
6.20. Herbal therapies are effective for FD patients.	No	B	209,210
6.21. Iberogast (STW-5) is effective for FD patients.	No	B	192,206,207
6.22. Rifaximin is effective for FD patients.	No	C	211
6.23. Hypnotherapy is effective for FD patients.	No	B	212
6.24. Cognitive-behavioral therapy (CBT) is effective for FD patients.	No	B	213,214
6.25. Acupuncture is effective for FD patients.	No	B	215–218
6.26. Mindfulness is effective for FD patients.	No	B	219
6.27. In case of severe weight loss in FD, nutritional support may be needed.	Yes	B	220
7.1. The long-term prognosis is favorable in the majority of patients with FD.	Yes	B	49,221,222
7.2. Life expectancy in FD is similar to the general population.	Yes	A	224,225

a specific context (tertiary care, Belgium), confirmatory studies in a different medical and cultural-linguistic setting are needed.

## 2. Epidemiology and risk factors

2.1 (Functional) Dyspepsia occurs at all ages but the highest incidence is in the middle age.

STATEMENT NOT ENDORSED, overall agreement 73%: A+ 24%, A 49%, A– 24%, D– 2%, D 0%, D+ 0%. GRADE B

2.2 (Functional) Dyspepsia is more prevalent in women than men.

STATEMENT ENDORSED, overall agreement 83%: A+ 51%, A 32%, A– 15%, D– 0%, D 3%, D+ 0%. GRADE A

2.3 Acute gastrointestinal infection is a risk factor for development of functional dyspepsia.

STATEMENT ENDORSED, overall agreement 90%: A+ 54%, A 36%, A– 5%, D– 0%, D 5%, D+ 0%. GRADE A

2.4 NSAID intake is a risk factor for development of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 61%: A+ 20%, A 41%, A– 20%, D– 0%, D 17%, D+ 2%. GRADE C

2.5 Antibiotic therapy is a risk factor for development of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 37%: A+ 5%, A 32%, A– 32%, D– 7%, D 24%, D+ 0%. GRADE C

2.6 Anxiety is a risk factor for development of functional dyspepsia.

STATEMENT ENDORSED, overall agreement 93%: A+ 34%, A 59%, A– 7%, D– 0%, D 0%, D+ 0%. GRADE A

2.7 Depression is a risk factor for development of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 76%: A+ 27%, A 49%, A– 20%, D– 2%, D 2%, D+ 0%. GRADE B

2.8 Smoking is a risk factor for development of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 37%: A+ 7%, A 30%, A– 46%, D– 2%, D 15%, D+ 0%. GRADE C

Approximately 10% of the adult population fulfills symptom-based Rome IV criteria for (uninvestigated) FD, and its prevalence appears to disappear with increasing age.<sup>2,19</sup> In several studies, the peak incidence of FD seems to occur in the forties or fifties age segment.<sup>19–22</sup> A recent meta-analysis including 55 studies revealed a slightly higher pooled prevalence of dyspepsia in women compared with men.<sup>19</sup> The Rome Global Epidemiology Study, which used the most uniform criteria and approach, showed a significantly higher prevalence of (uninvestigated) Rome IV FD in women compared to men.<sup>2</sup>

Acute gastroenteritis is associated with an increased risk of FD, with an estimated mean prevalence of 9.6% in adults.<sup>23</sup> Among pathogens suggested to be associated with post-infectious FD (PI-FD) are Norovirus, Giardia lamblia, Salmonella spp., Escherichia coli O157, and Campylobacter spp.<sup>24-26</sup> *H. pylori* does not seem to be a cause of PI-FD.<sup>23,27</sup>

Nonsteroidal anti-inflammatory drug (NSAID) use has been identified as a risk factor for dyspepsia in two population-based studies.<sup>28,29</sup> It has been suggested that the development of dyspeptic symptoms during treatment with NSAIDs could be linked to alterations in gastric mechanosensory function.<sup>30</sup> However, NSAID intake appears to be most relevant to uninvestigated dyspepsia.<sup>31</sup> Data supporting the role of drugs other than NSAIDs in the pathogenesis of dyspepsia in the general population are lacking. A nested case-control study in Olmsted County suggested that treatment with antibiotics for a non-gastrointestinal infection was associated with the development of functional gastrointestinal disorders (FGIDs), but this needs confirmation in other cohorts.<sup>32</sup>

Several cross-sectional and population-based studies have observed that anxiety is frequently associated with FD.<sup>33-46</sup> Some longitudinal studies have shown that mood disorders may precede dyspeptic symptoms and thus predispose to FD.<sup>39,41-43</sup> Similarly, cross-sectional and population-based studies have observed that depression is frequently encountered in patients with FD.<sup>33,35-40,43-45,47,48</sup> However, the Kalixanda study, an important cross-sectional study carried out in a large sample of patients and its longitudinal 10-year follow-up investigation, failed to find a clear association between depression and the risk for development of FD.<sup>41,42</sup>

Population- and endoscopy-based studies suggested an association between smoking and FD.<sup>20,49-51</sup> In contrast, other population-based studies failed to find an association after adjustment for confounders such as age, gender, and drugs.<sup>52-54</sup>

### 3. Impact of functional dyspepsia

- 3.1 Functional dyspepsia is a major source of healthcare costs.  
STATEMENT ENDORSED, overall agreement 98%: A+ 78%, A 20%, A- 2%, D- 0%, D 0%, D+ 0%. GRADE A
- 3.2 Functional dyspepsia is a major source of self-costs to patients.  
STATEMENT ENDORSED, overall agreement 93%: A+ 64%, A 29%, A- 7%, D- 0%, D 0%, D+ 0%. GRADE B
- 3.3 Functional dyspepsia is an important source of loss of work productivity.  
STATEMENT ENDORSED, overall agreement 88%: A+ 46%, A 42%, A- 10%, D- 2%, D 0%, D+ 0%. GRADE B
- 3.4 Functional dyspepsia is associated with a significant decrease in quality of life.  
STATEMENT ENDORSED, overall agreement 100%: A+ 80%, A 20%, A- 0%, D- 0%, D 0%, D+ 0%. GRADE A
- 3.5 Functional dyspepsia is associated with psychosocial comorbidities such as anxiety and depression.  
STATEMENT ENDORSED, overall agreement 100%: A+ 61%, A 39%, A- 0%, D- 0%, D 0%, D+ 0%. GRADE A

- 3.6 Weight loss can be consequence of FD.  
STATEMENT ENDORSED, overall agreement 90%: A+ 43%, A 47%, A- 8%, D- 0%, D 2%, D+ 0%. GRADE B
- 3.7 In case of weight loss, eating disorders must be ruled out.  
STATEMENT NOT ENDORSED, overall agreement 73%: A+ 36%, A 37%, A- 19%, D- 0%, D 7%, D+ 0%. GRADE C
- 3.8 Healthcare consulting behavior in functional dyspepsia is driven by symptom severity and impact.  
STATEMENT ENDORSED, overall agreement 93%: A+ 42%, A 51%, A- 7%, D- 0%, D 0%, D+ 0%. GRADE B
- 3.9 Healthcare consulting behavior in functional dyspepsia is driven by psychosocial comorbidity.  
STATEMENT ENDORSED, overall agreement 80%: A+ 29%, A 51%, A- 20%, D- 0%, D 0%, D+ 0%. GRADE B
- 3.10 Healthcare consulting behavior in functional dyspepsia is driven by access to the healthcare system.  
STATEMENT NOT ENDORSED, overall agreement 71%: A+ 17%, A 54%, A- 19%, D- 0%, D 7%, D+ 0%. GRADE B

Studies conducted in several parts of the world have shown that FD is associated with significantly elevated health expenses related to medical consultations, diagnostic tests, and therapeutic measures.<sup>55-58</sup> In addition, FD patients incur both direct and indirect costs driven by over-the-counter medications, alternative therapies, medical consultations, and co-financed treatments, as well as the cost of dietary modifications.<sup>55</sup> Studies conducted in several parts of the world report that FD patients have increased absenteeism, and reduced productivity at work compared to healthy subjects.<sup>56,57,59</sup>

Multiple studies have shown that FD is associated with a reduction in quality of life. Factors found to be related to a greater reduction in quality of life are anxiety and depression, advanced age, female sex, severity of symptoms, and low or intermediate cultural level.<sup>60-62</sup>

Several cross-sectional studies have shown that FD frequently coexists with anxiety and depression and that the severity of symptoms correlates with scores on psychopathology questionnaires.<sup>33-46</sup> Furthermore, psychosocial factors, such as depression, history of childhood abuse, and somatization, have shown to contribute to symptom severity more than the degree of gastric sensorimotor dysfunction.<sup>38</sup>

Weight loss occurs in a large subset of subjects with dyspeptic symptoms and is closely associated with symptoms of early satiation as well as epigastric pain, both at the population level and in tertiary care patients.<sup>63-66</sup> Important determinants of weight loss in FD are impaired accommodation and decreased nutrient volume tolerance.<sup>63,67</sup>

Although dyspepsia affects approximately 10% of the general population, only half of these ever consult a doctor for their symptoms. Dyspeptic subjects who seek healthcare attention have more severe, frequent, and persistent dyspepsia symptoms.<sup>57,68-70</sup> In addition, dyspeptic patients with high scores on anxiety and depression questionnaires report higher consultation rates than

those with lower scores, indicating that psychosocial factors also influence healthcare-seeking behavior.<sup>36,71</sup> A longitudinal study also found that anxiety or depression precedes dyspepsia among consulters in a larger proportion than in non-consulters, confirming that basal psychosocial comorbidity is associated with healthcare seeking.<sup>71</sup> Consultation rates for dyspepsia vary widely between countries and regions, suggesting that access to the healthcare system may influence healthcare-seeking behavior.<sup>70</sup> However, differences in healthcare-consulting behavior are also modulated by socioeconomic status. Several studies have shown that low socioeconomic status is associated with higher consultation rates for dyspepsia.<sup>68,72</sup>

#### 4. Pathophysiology of functional dyspepsia

##### 4.1 Dietary factors underlie symptom generation in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 51%: A+ 24%, A 27%, A- 34%, D- 2%, D 10%, D+ 2%.  
GRADE C

##### 4.2 *H. pylori* is a cause of symptoms in a subgroup of patients with dyspepsia and normal endoscopy.

STATEMENT ENDORSED, overall agreement 81%: A+ 37%, A 44%, A- 17%, D- 2%, D 0%, D+ 0%.  
GRADE B

##### 4.3 Impaired gastric accommodation is a pathophysiological mechanism in functional dyspepsia.

STATEMENT ENDORSED, overall agreement 93%: A+ 51%, A 42%, A- 7%, D- 0%, D 0%, D+ 0%.  
GRADE B

##### 4.4 Delayed gastric emptying is a pathophysiological mechanism in functional dyspepsia.

STATEMENT ENDORSED, overall agreement 85%: A+ 39%, A 46%, A- 12%, D- 0%, D 2%, D+ 0%.  
GRADE B

##### 4.5 Rapid gastric emptying is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 32%: A+ 2%, A 30%, A- 46%, D- 5%, D 15%, D+ 2%.  
GRADE C

##### 4.6 Hypersensitivity to gastric distention is a pathophysiological mechanism in functional dyspepsia.

STATEMENT ENDORSED, overall agreement 93%: A+ 63%, A 30%, A- 7%, D- 0%, D 0%, D+ 0%.  
GRADE B

##### 4.7 Duodenal mucosal alterations are a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 76%: A+ 17%, A 59%, A- 20%, D- 2%, D 0%, D+ 2%.  
GRADE B

##### 4.8 Altered gastric acid secretion is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 29%: A+ 7%, A 22%, A- 32%, D- 7%, D 32%, D+ 0%.  
GRADE C

##### 4.9 Altered release of peptide hormones is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 24%: A+ 7%, A 17%, A- 49%, D- 12%, D 12%, D+ 2%.  
GRADE C

##### 4.10 Increased sensitivity to duodenal luminal content is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 68%: A+ 17%, A 51%, A- 29%, D- 0%, D 0%, D+ 2%.  
GRADE C

##### 4.11 Altered duodenal microbiota composition is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 34%: A+ 10%, A 24%, A- 39%, D- 12%, D 15%, D+ 0%.  
GRADE C

##### 4.12 Impaired vagus nerve function is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 46%: A+ 15%, A 31%, A- 37%, D- 5%, D 10%, D+ 2%.  
GRADE C

##### 4.13 Anxiety and stress are pathophysiological mechanisms in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 66%: A+ 20%, A 46%, A- 24%, D- 2%, D 7%, D+ 0%.  
GRADE B

##### 4.14 Depression is a pathophysiological mechanism in functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 54%: A+ 15%, A 39%, A- 24%, D- 7%, D 12%, D+ 2%.  
GRADE B

##### 4.15 Disordered central processing of incoming signals from the gastroduodenal region is a pathophysiological mechanism in functional dyspepsia.

STATEMENT ENDORSED, overall agreement 85%: A+ 39%, A 46%, A- 12%, D- 0%, D 2%, D+ 0%.  
GRADE C

##### 4.16 Genetic factors determine the susceptibility to functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 37%: A+ 22%, A 15%, A- 42%, D- 5%, D 15%, D+ 2%.  
GRADE C

Several studies, both in community-based and in-patient cohorts, have shown that food is a major trigger for FD symptoms.<sup>57,73,74</sup> Whether alterations in content or timing of meals in FD contributes to this triggering effect has been evaluated in only a few studies. A number of studies reported intake of a lower number of meals in FD patients compared to controls, in some cases with a tendency for more snacks between meals.<sup>75-77</sup> In terms of macronutrient intake, reduced fat intake has been reported in FD,<sup>77</sup> but also reduced carbohydrate has been reported in a mixed FD/IBS population.<sup>78</sup> A recent systematic review of 16 studies failed to show a consistent link between symptoms and dietary intake.<sup>79</sup> Taken together, there are not enough data to confirm that dietary habits induce symptoms in FD patients, but patients are likely to have adapted their food intake patterns in an attempt to decrease symptom occurrence and severity.

In FD patients with otherwise normal macroscopic findings at endoscopy, microscopic *H. pylori* infection has been considered a factor potentially involved in symptom generation. A cause-effect relationship between *H. pylori* infection and FD is supported by evidence that *H. pylori* eradication may lead to sustained symptom improvement in a subset of patients.<sup>80</sup> The Kyoto consensus proposed that *H. pylori* infection is associated with dyspepsia in a subset of patients, with a strong grade of recommendation and high evidence level, and referred to this entity as *H. pylori*-associated dyspepsia.<sup>81</sup> The Rome IV consensus has adopted this view.<sup>1</sup>

However, there is a possibility of intermittent peptic ulcer disease, missed at endoscopy for dyspeptic symptoms.<sup>81,82</sup> Furthermore, symptomatic improvement after eradication therapy may also be due to an effect of antibiotics on microbiota other than *H. pylori* infection since *H. pylori* eradication therapy has never been attempted in *H. pylori*-negative FD patients.

Several studies have reported impaired gastric accommodation in 15%–50% of FD patients,<sup>63,83–90</sup> without differences according to Rome III subgroups.<sup>91</sup> The impairment of gastric accommodation was associated with reduced drinking capacity and symptoms such as early satiety, fullness, and weight loss.<sup>63,67,92</sup>

Several studies reported delayed gastric emptying in FD for solids as well as liquids<sup>93–100</sup> without differences in the emptying times between Rome III subgroups.<sup>91</sup> A meta-analysis described gastric emptying in patients with FD to be 1.46 times slower than in controls.<sup>96</sup> Delayed gastric emptying was associated with female sex, postprandial fullness, nausea, vomiting, bloating, and early satiety.<sup>97–100</sup> In spite of the presence of delayed emptying in a subset of patients, the association with symptoms is weak. The severity of gastric emptying delay is not a good determinant of symptom severity or pattern.<sup>94,97,99,100</sup> Few studies also reported an acceleration of gastric emptying in FD,<sup>101,102</sup> but this was not confirmed in others.<sup>99</sup>

Hypersensitivity to gastric distention has been reported in 34%–65% of FD patients by several studies,<sup>64,100–106</sup> without difference between Rome III subgroups,<sup>91</sup> and postprandial sensitivity to gastric distention was even greater than fasting sensitivity.<sup>107</sup> Hypersensitivity to gastric distention was associated with a higher prevalence of postprandial pain, belching, and weight loss,<sup>64</sup> and an increase in gastrointestinal symptom severity was observed with increasing visceral sensitivity.<sup>108</sup>

Several studies from around the world have reported increased numbers of activated eosinophils and mast cells in the duodenal mucosa of FD patients.<sup>109–115</sup> In addition, Ussing chamber experiments demonstrated that this is correlated with impaired duodenal integrity and changes in the expression of cell-to-cell adhesion proteins, as well as functional and structural submucosal neuronal changes.<sup>110,112</sup> Although the cause–consequence relationship of the barrier defect and immune activation is still unknown, persisting changes in duodenal mucosal immune cells in PI-FD and systemic immune activation in acute compared to unspecified-onset FD suggest the inability of the immune system to handle a triggering (infectious) insult in FD.<sup>116,117</sup>

Although gastric acid secretion is reported as normal,<sup>118</sup> FD patients displayed increased spontaneous duodenal acid exposure during the daytime and the late postprandial phase with higher symptom severity in patients with high duodenal acid exposure.<sup>119</sup> However, the correlation between acid exposure and symptom severity was weak, and the increased duodenal acid exposure could be, at least in part, attributable to delayed duodenal acid clearance as FD patients display decreased duodenal motor activity in response to acid perfusion.<sup>119,120</sup>

A number of studies suggest the implication of gut hormones in the pathophysiology of FD, but the studies are small and findings are heterogeneous.<sup>121</sup> Early studies focused on cholecystokinin (CCK), as a subset of FD patients had elevated plasma levels, intravenous administration of CCK worsened dyspeptic symptoms, and the selective CCKA antagonist dexloxiglumide reduced symptoms during gastric distention and duodenal lipid infusion.<sup>122–124</sup> In PDS, ghrelin plasma levels were reported to be reduced.<sup>125,126</sup> Further studies are needed to elucidate the potential implication of other gut hormones including gastrin, somatostatin, glucagon-like peptide-1, and peptide YY in FD symptom generation.<sup>121</sup>

Duodenal hypersensitivity to luminal acid and lipids has been reported in FD,<sup>127,128</sup> with induction of nausea and decreased duodenal motor responses in response to acid infusion.<sup>129</sup> These alterations were found to be chemospecific as they did not occur during saline or dextrose infusion.<sup>130</sup> However, the number of studies and the sample size are generally low in the available studies.

Data on the duodenal mucosa-associated microbiome in FD are limited to one pilot study involving nine patients, with an increase in *Streptococcus* and a decrease in the anaerobic genera *Prevotella*, *Veillonella*, and *Actinomyces* compared to healthy controls.<sup>131</sup> Interestingly, the total mucosal bacterial load correlated with meal-related symptom severity and quality of life, indicating the potential of targeting the duodenal microbiome in FD.<sup>131</sup> Studies on the gastric microbiome in FD have shown a significant inverse correlation between the abundance of *Prevotella* in the gastric fluid and the severity of PDS.<sup>132</sup>

Mucosal vagal sensory nerve endings are involved in the initiation of satiety, nausea, and vomiting by chemical and osmotic stimuli. The vagus nerve is also a major contributor to control upper gastrointestinal motility.<sup>133</sup> An early study in seven FD patients, using an insulin hypoglycemia test and plasma levels of pancreatic polypeptide, suggested a disturbed efferent vagal function.<sup>134</sup> The gastric response to sham feeding, a marker for vagal activity, was lower in PDS compared to controls.<sup>135</sup> Conversely, sham feeding was reported to improve the suppressed response to a liquid nutrient meal in FD.<sup>136</sup> Slow deep breathing, which is thought to activate the vagus nerve, was associated with improvement of nutrient volume tolerance and quality of life in FD.<sup>137</sup> Using spectral analysis of cardiac R-R intervals to evaluate vagal tone, Guo et al. showed a decreased vagal tone that was associated with delayed gastric emptying.<sup>138</sup> Taken together, a number of observations suggest decreased vagal activity in FD, but the studies all occurred in laboratory settings in small groups of patients.

As mentioned above, there is an association of anxiety with FD, and anxiety may precede FD. Moreover, FD is associated with altered brain processing of gastrointestinal (GI) stimuli, altered central nervous system connectivity, and structure and altered expression of neurotransmitter pathways.<sup>139–143</sup> However, a causal relation between anxiety and FD has not been established. As mentioned above, depression is also associated with FD, but also in this case, there is a lack of evidence for a causal relation.

Numerous studies have shown that FD patients report more symptoms or earlier symptoms following gastroduodenal stimulation with either balloon, liquid volume, or food compared to healthy controls. A systematic review evaluated studies on central processing of signals from the gastroduodenal region in FD patients and controls, mostly by balloon distention of the stomach, using PET or fMRI technology.<sup>144</sup> The results show that FD is associated with functional abnormalities in sensory and pain modulation, emotion, saliency, and homeostatic processing regions, suggesting that disordered central processing of incoming signals from the gastroduodenal region is indeed a relevant pathophysiological mechanism at least in a subgroup of FD patients. However, this does not exclude an involvement of peripheral mechanisms as well.

Family studies support a genetic component in FD susceptibility.<sup>145</sup> A meta-analysis of eight studies indicated that the GN $\beta$ 3 C825T polymorphism is significantly associated with FD, and susceptible to racial variation.<sup>146</sup> However, a meta-analysis based on 12 studies has failed to confirm a significant association.<sup>147</sup> Several additional gene polymorphisms including serotonin transporter promoter, interleukin-17F, migration inhibitory factor, cholecystokinin-1 intron 1, cyclooxygenase-1, catechol-o-methyltransferase, transient receptor potential vanilloid 1 receptor, regulated upon activation normal T cell expressed and secreted, p22PHOX, Toll-like receptor 2, SCN10A, CD14, adrenoreceptors, and others have been investigated in relation to FD; however, the results are contradictory.<sup>148</sup>

## 5. Diagnosis

5.1 Upper gastrointestinal endoscopy is mandatory for establishing a diagnosis of functional dyspepsia.

STATEMENT ENDORSED, overall agreement 80%: A+ 51%, A 29%, A- 15%, D- 0%, D 2%, D+ 2%. GRADE A

5.2 In primary care, uninvestigated dyspepsia can be managed without endoscopy if there are no alarm symptoms or risk factors.

STATEMENT ENDORSED, overall agreement 93%: A+ 32%, A 61%, A- 5%, D- 0%, D 2%, D+ 0%. GRADE A

5.3 Upper gastrointestinal endoscopy is mandatory if there are alarm symptoms or risk factors.

STATEMENT ENDORSED, overall agreement 93%: A+ 73%, A 20%, A- 5%, D- 0%, D 2%, D+ 0%. GRADE A

5.4 Screening blood tests are useful when considering a diagnosis of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 46%: A+ 10%, A 36%, A- 24%, D- 2%, D 24%, D+ 2%. GRADE B

5.5 Every patient with dyspeptic symptoms should be tested for *Helicobacter pylori* (non-invasively or at gastroscopy).

STATEMENT ENDORSED, overall agreement 81%: A+ 39%, A 42%, A- 12%, D- 0%, D 7%, D+ 0%. GRADE A

5.6 Patients with dyspepsia and *H. pylori*-positive gastritis should be considered to have functional dyspepsia just if symptoms persist 6 to 12 months after *H. pylori* eradication.

STATEMENT ENDORSED, overall agreement 83%: A+ 34%, A 49%, A- 12%, D- 0%, D 2%, D+ 2%. GRADE B

5.7 Patients with dyspepsia and *H. pylori*-negative gastritis should be considered to have functional dyspepsia.

STATEMENT ENDORSED, overall agreement 85%: A+ 34%, A 51%, A- 10%, D- 5%, D 0%, D+ 0%. GRADE B

5.8 Functional dyspepsia should be subdivided into EPS and PDS for further diagnostic and therapeutic approach.

STATEMENT ENDORSED, overall agreement 83%: A+ 34%, A 49%, A- 15%, D- 0%, D 2%, D+ 0%. GRADE B

5.9 Upper abdominal ultrasound is useful when considering a diagnosis of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 27%: A+ 12%, A 15%, A- 24%, D- 10%, D 32%, D+ 7%. GRADE B

5.10 A gastric emptying test is useful when considering a diagnosis of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 34%: A+ 2%, A 32%, A- 27%, D- 20%, D 15%, D+ 5%. GRADE B

5.11 Esophageal pH monitoring is useful in functional dyspepsia to rule out GERD.

STATEMENT NOT ENDORSED, overall agreement 37%: A+ 7%, A 30%, A- 29%, D- 7%, D 24%, D+ 2%. GRADE B

5.12 Increased duodenal eosinophil count is a marker of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 20%: A+ 3%, A 17%, A- 37%, D- 15%, D 27%, D+ 2%. GRADE C

5.13 Impaired nutrient volume tolerance is a marker of functional dyspepsia.

STATEMENT NOT ENDORSED, overall agreement 63%: A+ 14%, A 49%, A- 22%, D- 5%, D 7%, D+ 2%. GRADE B

A distinction should be made between the management of uninvestigated dyspeptic symptoms and the diagnosis of FD. The Rome IV definition of FD implies that potential underlying organic disorders have been ruled out by endoscopy.<sup>1</sup> In a patient presenting with dyspeptic symptoms, all guidelines recommend a prompt upper GI endoscopy in patients aged over 45–60 years to rule out neoplasia, and to take biopsies to establish *H. pylori* status.<sup>1,10,149,150</sup> Endoscopy is also mandatory in younger patients presenting with alarm features,<sup>1,10</sup> although alarm symptoms have a limited value in predicting an organic disease.<sup>5,151</sup> In younger patients without alarming symptoms, guidelines agree that there is no need to perform a gastroscopy to detect malignancy, which is rare. Empiric therapy, either with proton pump inhibitors (PPIs), prokinetics or *H. pylori* eradication (“test and treat strategy”), is valuable for the management of uninvestigated dyspepsia. When considering the actual diagnosis of FD, endoscopy is mandatory to rule out not only malignancies, but also benign organic disorders which may explain the symptoms such as peptic ulcer (prevalence 8%), esophagitis (20%), or *H. pylori*-associated gastritis.<sup>6</sup> The cutoff between young and old is now considered to be 60 years in the West, adjusted to additional risk factors and local incidence age of gastric cancer.<sup>150</sup>

Overall, there is a lack of data on cost-benefit utility of laboratory testing in patients presenting with dyspeptic symptoms. A study from India found that apart from warning signs, blood tests for hemoglobin and albumin could discriminate functional from organic disease when placed in a risk model,<sup>152</sup> but the results have not been replicated in Western populations.

Most Western guidelines advocate testing for *H. pylori* in dyspeptic subjects and eradication in case of a positive test. In younger patients (<60), the most cost-effective way to manage dyspeptic patients is to reduce or stop NSAID medication and/or to have a non-invasive test for *H. pylori*.<sup>153,154</sup> Especially in high prevalence areas, the positive subjects should be considered for follow-up surveillance of early gastric cancer.<sup>81</sup> If an endoscopy is performed, biopsies should be obtained to test for *H. pylori* status.<sup>1,10,81,149,150</sup>

*H. pylori* eradication may improve symptoms in a subset of patients with investigated dyspepsia, that is, with normal macroscopic upper GI endoscopy, but studies suggest that the symptomatic benefit is only reached after 6–12 months.<sup>1,81</sup> This subgroup of patients, referred to as *H. Pylori*-associated dyspepsia, is relatively small, since meta-analysis of randomized controlled trials has shown a 10% relative risk reduction of persisting symptoms in the *H. Pylori* eradication group compared to placebo, with a number needed to treat (NNT) of 12.5 to cure one case of dyspepsia.<sup>150</sup>

Although chronic superficial gastritis might affect a variety of gastric functions, there is no evidence to consider that the presence of gastric mucosal inflammation (with or without atrophy) may cause symptoms.<sup>1,81,155</sup> Therefore, if no *H. Pylori* infection can be demonstrated, a patient with dyspeptic symptoms and normal endoscopy should be considered to have FD even if gastritis is present, whatever its severity.<sup>1</sup>

In population-based symptom analyses, dyspeptic symptoms were shown to group around clusters, representing EPS and PDS.<sup>3,156</sup> The literature is divided on the usefulness of distinguishing PDS and EPS for patient management. When the Rome III subdivision is used, a major overlap is found between both, which is largely corrected with the Rome IV subdivision as a good separation between both subtypes is now found both in epidemiological studies and in clinical practice.<sup>3,11,40,156–158</sup> While some studies report different treatment responses,<sup>159,160</sup> others do not.<sup>161,162</sup> To date, no fully published study has evaluated differential pathophysiological mechanisms or treatment outcomes according to the Rome IV subdivision.<sup>163,164</sup>

Kraag et al. performed a meta-analysis of 21 controlled studies on the association between gallstones and dyspeptic symptoms and found no reasonable association between gallstones and “classical” dyspeptic symptoms other than upper abdominal pain.<sup>165</sup> In a systematic review of 24 publications, biliary colic was the only single symptom associated with gallstones.<sup>166</sup> Hence, guidelines do not recommend upper abdominal ultrasound for exclusion of biliary pathology in the diagnosis of FD.<sup>1,150</sup>

The prevalence of delayed gastric emptying in FD ranges between 20% and 50%, but its association with symptoms and response to therapy has shown inconsistent results.<sup>1,91,167,168</sup> The American College of Gastroenterology and Canadian Association of

Gastroenterology, as well as the Rome IV consensus did not recommend the use of gastric emptying testing in the diagnosis or management of FD.<sup>1,150</sup>

Abnormal esophageal acid exposure on pH monitoring can be found in 20%–30% of patients presenting with dyspeptic symptoms without heartburn as a predominant symptom, and in up to 50% in the subgroup of patients with epigastric burning.<sup>13,169–171</sup> Randomized placebo-controlled studies have shown a small but significant benefit of acid-suppressive therapies.<sup>1,150</sup> However, there is no evidence that esophageal pH monitoring would help to identify patients who may respond to acid-suppressive therapy. In addition, there is no evidence that pH monitoring would be useful in patients with dyspeptic symptoms refractory to acid-suppressive therapy.

In a systematic review and meta-analysis of 37 studies, both mast cell and eosinophil counts in the duodenum were increased in FD compared to controls, both in PDS and EPS.<sup>172</sup> Nevertheless, as there is overlap with health and as other conditions may also be associated with increased eosinophil numbers, this cannot be used as a diagnostic marker.

Several studies have reported decreased volume tolerance in FD compared to health, using liquid nutrients but also water intake.<sup>63,67,86,173–175</sup> A large drinking test study in secondary care FD patients confirmed decreased nutrient volume tolerance, and this is reproducible and correlates with symptom pattern and severity.<sup>176</sup> However, the use of different substances (water vs. nutrients) and different rates of ingestion and levels of blinding to the ingested nutrient volume have hampered the development of a standardized protocol that can be useful in the clinical setting.

## 6. Treatment

### 6.1 Dietary adjustment improves symptoms in FD.

STATEMENT NOT ENDORSED, overall agreement 73%: A+ 22%, A 51%, A– 24%, D– 2%, D 0%, D+ 0%. GRADE C

### 6.2 *H. pylori* positive FD patients should receive eradication therapy.

STATEMENT ENDORSED, overall agreement 95%: A+ 59%, A 36%, A– 5%, D– 0%, D 0%, D+ 0%. GRADE A

### 6.3 PPI therapy is the most appropriate initial therapy for FD.

STATEMENT NOT ENDORSED, overall agreement 73%: A+ 27%, A 46%, A– 12%, D– 2%, D 12%, D+ 0%. GRADE B

### 6.4 PPI therapy is an effective therapy for FD.

STATEMENT ENDORSED, overall agreement 83%: A+ 25%, A 58%, A– 15%, D– 2%, D 0%, D+ 0%. GRADE A

### 6.5 PPI therapy is the most effective therapy for EPS.

STATEMENT NOT ENDORSED, overall agreement 59%: A+ 20%, A 39%, A– 22%, D– 2%, D 17%, D+ 0%. GRADE C

### 6.6 Prokinetic therapy is the most appropriate initial therapy for FD.

STATEMENT NOT ENDORSED, overall agreement 30%: A+ 18%, A 12%, A– 15%, D– 12%, D 38%, D+ 5%. GRADE C

### 6.7 Prokinetic therapy is an effective therapy for FD.

STATEMENT NOT ENDORSED, overall agreement 54%: A+ 17%, A 37%, A– 34%, D– 5%, D 7%, D+ 0%. GRADE B

- 6.8 Prokinetic therapy is the most effective therapy for PDS.  
STATEMENT NOT ENDORSED, overall agreement 54%: A+ 22%, A 32%, A- 22%, D- 5%, D 17%, D+ 2%. GRADE B
- 6.9 Efficacy of prokinetics is not related to their enhancement of gastric emptying rate.  
STATEMENT NOT ENDORSED, overall agreement 56%: A+ 7%, A 49%, A- 24%, D- 7%, D 10%, D+ 2%. GRADE B
- 6.10 Itopride is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 56%: A+ 12%, A 44%, A- 30%, D- 7%, D 7%, D+ 0%. GRADE C
- 6.11 Tricyclic antidepressants (TCAs) are effective for EPS.  
STATEMENT NOT ENDORSED, overall agreement 78%: A+ 20%, A 58%, A- 15%, D- 0%, D 5%, D+ 2%. GRADE B
- 6.12 TCAs are effective for PDS.  
STATEMENT NOT ENDORSED, overall agreement 32%: A+ 5%, A 27%, A- 24%, D- 12%, D 27%, D+ 5%. GRADE B
- 6.13 TCAs are not effective for PDS.  
STATEMENT NOT ENDORSED, overall agreement 39%: A+ 10%, A 29%, A- 25%, D- 17%, D 17%, D+ 2%. GRADE B
- 6.14 Serotonin reuptake inhibitors are effective for FD.  
STATEMENT NOT ENDORSED, overall agreement 20%: A+ 5%, A 15%, A- 17%, D- 12%, D 44%, D+ 7%. GRADE B
- 6.15 Serotonin reuptake inhibitors are not effective for FD.  
STATEMENT NOT ENDORSED, overall agreement 54%: A+ 7%, A 47%, A- 29%, D- 7%, D 10%, D+ 0%. GRADE B
- 6.16 Serotonin noradrenaline reuptake inhibitors are effective for FD.  
STATEMENT NOT ENDORSED, overall agreement 17%: A+ 0%, A 17%, A- 27%, D- 12%, D 39%, D+ 5%. GRADE C
- 6.17 Serotonin noradrenaline reuptake inhibitors are not effective for FD.  
STATEMENT NOT ENDORSED, overall agreement 49%: A+ 5%, A 44%, A- 24%, D- 5%, D 17%, D+ 5%. GRADE C
- 6.18 Mirtazapine is effective for post-prandial distress syndrome patients with weight loss.  
STATEMENT NOT ENDORSED, overall agreement 68%: A+ 12%, A 56%, A- 27%, D- 0%, D 5%, D+ 0%. GRADE B
- 6.19 5-HT<sub>1A</sub> agonists (tandospirone, buspirone, ...) are effective for PDS.  
STATEMENT NOT ENDORSED, overall agreement 56%: A+ 5%, A 51%, A- 37%, D- 2%, D 5%, D+ 0%. GRADE B
- 6.20 Herbal therapies are effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 37%: A+ 12%, A 25%, A- 34%, D- 10%, D 17%, D+ 2%. GRADE B
- 6.21 Iberogast (STW-5) is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 54%: A+ 12%, A 42%, A- 34%, D- 0%, D 12%, D+ 0%. GRADE B
- 6.22 Rifaximin is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 19%: A+ 2%, A 17%, A- 27%, D- 10%, D 37%, D+ 7%. GRADE C
- 6.23 Hypnotherapy is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 29%: A+ 5%, A 24%, A- 22%, D- 17%, D 32%, D+ 0%. GRADE B
- 6.24 Cognitive-behavioral therapy (CBT) is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 42%: A+ 10%, A 32%, A- 39%, D- 5%, D 14%, D+ 0%. GRADE B
- 6.25 Acupuncture is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 27%: A+ 0%, A 27%, A- 27%, D- 15%, D 22%, D+ 10%. GRADE B
- 6.26 Mindfulness is effective for FD patients.  
STATEMENT NOT ENDORSED, overall agreement 27%: A+ 3%, A 24%, A- 12%, D- 10%, D 49%, D+ 2%. GRADE B
- 6.27 In case of severe weight loss in FD, nutritional support may be needed.  
STATEMENT ENDORSED, overall agreement 90%: A+ 36%, A 54%, A- 7%, D- 0%, D 2%, D+ 0%. GRADE B

Although the majority of FD patients indicate that their symptoms are triggered by nutrient ingestion, there is a lack of controlled dietary intervention studies. It is reasonable to advise frequent small-size meals and avoiding high-fat food items, but the supporting evidence for this strategy is rather limited. Large-scale randomized studies are required to evaluate the impact of dietary factors on symptoms of FD and the role of diet as a therapeutic strategy.

A review of 22 trials involving 4896 *H. pylori*-positive FD patients showed that *H. pylori* eradication determined a small but statistically significant improvement of symptoms when compared with placebo (RR dyspepsia remaining = 0.91; 95% CI = 0.88–0.94;  $p < 0.00001$ ). The observation period in most of the trials included in the review was 12 months, and the NNT was 12.5.<sup>150</sup> Although the overall therapeutic effect is modest, additional benefits of eradication therapy are the elimination of a putative pathogenic factor with prevention of peptic ulcer and possibly gastric cancer.<sup>181</sup> Pre-Rome IV evidence suggests that eradication of *H. pylori* infection could be beneficial in both predominant epigastric pain and predominant dysmotility-type symptoms, although a more recent study showed the main benefit in EPS.<sup>160,177</sup>

Several guidelines recommend standard, once-daily PPI therapy during 4–8 weeks as the first-line treatment for patients with FD who remain symptomatic after eradication of *H. pylori* or who are negative for *H. pylori*.<sup>150,178–180</sup> A recent Cochrane meta-analysis, including 6172 patients from 18 randomized controlled trials, confirmed that PPIs are more effective than placebo in the reduction of global symptoms of FD (RR of remaining dyspeptic 0.88; 95% CI 0.82–0.94; NNT 11).<sup>181</sup> There were no differences between low- and high-dose PPI, type of PPI, and *H. pylori* status.<sup>150,181,182</sup> In a meta-analysis of two studies including 740 FD patients, directly comparing PPI and histamine-2 receptor antagonists, there was no difference between both treatments.<sup>181</sup> However, both studies are older, possibly including GERD patients, and one is only available in abstract form.<sup>183,184</sup> In areas of low (<20%) prevalence of *H. pylori*, a course of PPI has been suggested as the preferred first-line option before a test-and-treat approach.<sup>185</sup> The Rome IV consensus stated that PPIs are ineffective in relieving PDS symptoms, based on older data.<sup>1</sup> Two Japanese studies that investigated the effect of PPI in the

Rome III/IV subgroups found no significant difference between subgroups.<sup>177,186</sup> The ACG/CAG guidelines, based on an updated meta-analysis, propose PPI as first-line therapy, irrespective of the Rome IV subgroups.<sup>150</sup>

A recent meta-analysis of 29 studies involving 10,044 patients with FD demonstrated a significant effect of prokinetics in reducing dyspeptic symptoms (RR of ongoing dyspeptic symptoms 0.81; 95% CI [0.74–.89]) with an NNT of 7.<sup>187</sup> However, the studies showed significant heterogeneity and the funnel plot was asymmetrical, suggesting publication bias. Moreover, 12 studies involved cisapride, which has been withdrawn from the market because of cardiac adverse events.<sup>188</sup> When cisapride was removed from the meta-analysis, the overall effect was still significant, but the NNT increased to 12.<sup>187</sup>

The rationale for prokinetic therapy in FD is the presence of motor abnormalities such as delayed gastric emptying, especially in PDS, but in a large study, similar prevalence of gastric motor abnormalities was found in PDS, EPS, and the overlap group.<sup>91</sup> In the 2019 meta-analysis, prokinetics demonstrated similar efficacy in PDS and EPS subgroups, although only two studies included a total of 124 EPS patients,<sup>187</sup> one of which is a study on cisapride from 1989.<sup>189</sup> The evidence supporting the use of prokinetics in FD is rather poor and no target subgroup can be defined based on the available evidence. Moreover, many prokinetics such as domperidone and acotiamide, are not widely available. Adverse effects, such as extrapyramidal syndrome for many dopamine-2 (D2) receptor antagonists and QTc prolongation with domperidone, are limiting chronic use in FD. This has led the ACG/CAG guideline to recommend treatment with a TCA in patients refractory to PPI treatment before prokinetics.<sup>150</sup>

A systematic analysis of 34 studies failed to demonstrate a correlation between the acceleration of gastric emptying and symptom improvement.<sup>167</sup> One possible explanation is the heterogeneous pathophysiology of FD, involving not only delayed gastric emptying but also impaired gastric accommodation and hypersensitivity to gastric distention which are often not taken into account. However, in a recent meta-analysis by Vijayvargiya et al., the authors found that when optimal test methods were used, a selection of promotility agents significantly accelerated gastric emptying and produced significant symptom improvement in gastroparesis patients.<sup>168</sup> Nevertheless, it has not been established that the effect of prokinetics in FD depends on baseline emptying rate or improvement of emptying rate with therapy.

*Itopride* is a combined D2 antagonist and acetylcholinesterase inhibitor and is available in Asia and several countries in Eastern Europe. A phase IIb placebo-controlled trial found significantly more responders to itopride, based on a global efficacy measure.<sup>190</sup> However, no significant improvement over placebo in reduction of FD symptoms was observed in two subsequent Phase III trials.<sup>191</sup> These trials suffered from issues with patients and endpoint selection,<sup>192</sup> but their negative outcome stopped further development of itopride in the West. In a recent controlled trial in Belgium, itopride seemed more effective in Rome IV PDS compared to Rome III PDS.<sup>193</sup>

Psychotropic drugs appear to be an effective treatment for FD, as demonstrated by a systematic review and meta-analysis, with an NNT of 6 when data from all studies were pooled (1241 patients, 673 assigned to psychoactive drugs, and 568 to placebo). However, this beneficial effect appeared to be limited to TCAs and antipsychotics.<sup>194</sup> In a randomized placebo-controlled trial including 292 FD patients assigned to either placebo, 50 mg amitriptyline or 10 mg escitalopram for 12 weeks, subjects with “ulcer-like” FD (likely equivalent to EPS) receiving amitriptyline reported more adequate relief of symptoms than those receiving placebo or escitalopram ( $p = 0.06$ ).<sup>195</sup> There were adverse events in 30% ( $n = 29$ ) individuals in the amitriptyline arm, leading to discontinuation of treatment in two of them. Those with delayed gastric emptying were less likely to report adequate relief on amitriptyline compared with FD patients with normal emptying, but this was not related to an amitriptyline-induced delay in gastric emptying.<sup>194</sup> Amitriptyline appeared to derive its benefit predominantly through improving abdominal pain, since no change in psychological distress measures nor gastric emptying rates was found.<sup>195,196</sup> In the subset of patients with PDS, little evidence exists so far supporting the use of TCA's. A double-blind, randomized controlled trial including 107 patients with refractory FD, treated with either imipramine or placebo for 12 weeks, showed efficacy in symptom relief ( $p = 0.0051$ ), but 18% of the patients on imipramine discontinued the study due to adverse effects. In this study, no conclusion was made regarding efficacy in FD subtypes.<sup>197</sup> The ACG and CAG clinical guidelines on dyspepsia considered that FD patients failing to respond to PPI and *H. pylori* eradication treatment, should be offered TCA before prokinetics based on the superior evidence for TCA in this indication. No consideration was done based on FD subtypes EPS and PDS.<sup>150</sup>

The systematic review and meta-analysis on the efficacy of psychotropics in FD included two studies of selective serotonin reuptake inhibitors (sertraline 50 mg o.d. and escitalopram 10 mg o. d.), containing almost 400 patients, which were negative.<sup>194,195,198</sup> Thus, it seems reasonable to assume that these drugs are of no benefit in FD.

A double-blind clinical trial randomly assigned 160 FD patients to 8 weeks of treatment with venlafaxine or placebo.<sup>199</sup> At none of the measurement times there was a statistically significant difference in symptom severity, quality of life or anxiety, and depression scores between venlafaxine and placebo.<sup>199</sup> The dropout rate among venlafaxine-treated patients was high due to side effects. While this single study with venlafaxine in FD was negative, it remains to be elucidated whether certain groups of patients might benefit from treatment with serotonin/noradrenaline reuptake inhibitors with a more potent analgesic effect at lower doses, for example, duloxetine.

In FD, weight loss is normally considered an alarming symptom, but may be present in up to 40% of tertiary care FD patients.<sup>10,65,66</sup> A controlled trial to assess mirtazapine's efficacy in FD and weight loss randomly assigned 34 patients to placebo or mirtazapine 15 mg daily for 8 weeks.<sup>200</sup> Mirtazapine significantly improved early satiation scores and nutrient tolerance compared to placebo. A trend was



found for overall dyspepsia symptom score at week 4 in the mirtazapine group, but not at week 8. Nevertheless, this was associated with significant recovery of weight loss, improvement of quality of life, and visceral specific anxiety score. Another trial treated 60 FD patients with depression and weight loss with either mirtazapine 30 mg daily, paroxetine 20 mg daily or conventional therapy, and showed that mirtazapine did not only alleviate symptoms associated with dyspepsia and depression linked to FD with weight loss, but also significantly increased body weight.<sup>201</sup> In summary, two limited size trials showed the efficacy of mirtazapine in FD, one in patients without and one in patients with coexisting depression.

Tandospirone citrate, a serotonin 1A receptor (5-HT<sub>1A</sub>) agonist, was shown to improve abdominal symptom scores in FD patients.<sup>200</sup> However, R-137696, another 5-HT<sub>1A</sub> agonist, failed to improve symptoms or visceral hypersensitivity in FD patients.<sup>203</sup> In a small cross-over controlled trial, buspirone significantly reduced the overall severity of symptoms of dyspepsia and individual symptoms of postprandial fullness, early satiation, and upper abdominal bloating, whereas placebo had no significant effect.<sup>204</sup> The presumed mechanism of action was an enhancement of gastric accommodation.<sup>205</sup> A meta-analysis of the three available studies with 5-HT<sub>1A</sub> agonists in FD showed no overall beneficial effect.<sup>194</sup>

Meta-analyses pooling data from different small clinical trials that fall under the FD category indicate that the European herbal combination drug STW-5 and peppermint oil are superior compared to placebo in the treatment of FD symptoms.<sup>192,206,207</sup> A meta-analysis of five controlled trials found superiority over placebo of an encapsulated peppermint/caraway oil preparation in FD for overall symptoms and epigastric pain and discomfort.<sup>208</sup>

A meta-analysis including 24 clinical trials evaluated the efficacy of the Japanese herbal KAMPO preparation Rikkunshito in FD.<sup>209</sup> No significant benefit was found when evaluating upper gastrointestinal symptoms based on the Gastrointestinal Symptom Rating Scale, but Rikkunshito was superior to placebo in improving symptoms based on a five-point scale and in improving appetite, although the authors identified risk of bias for the majority of available studies.

Meta-analyses of numerous controlled trials of low quality and small numbers of participants show that different Chinese Herbal Medicines, alone or in combination with variable prokinetic medications, may be effective and superior to prokinetic medication alone when evaluated with variable FD symptom scores. Effects of Chinese Herbal Medicines on individual FD symptoms are largely unreported.<sup>210</sup>

A single double-blind, placebo-controlled randomized study examined the efficacy of rifaximin in subjects with Rome III criteria defined FD who were *H. pylori* negative.<sup>211</sup> The authors found that rifaximin was superior to placebo for the relief of global dyspeptic symptoms, postprandial fullness/bloating, and belching. Additional future trials are needed to examine the efficacy of rifaximin in FD and to elucidate the underlying mechanism of action.

In a 2017 review, a total of 12 controlled trials of psychological therapies involving 1563 FD patients were identified.<sup>150</sup> All trials

reported a statistically significant benefit of psychological therapies over control, which was most commonly usual management. Information on individual types of psychological therapies is variable. For hypnotherapy in FD, only one small randomized controlled study reported benefit.<sup>212</sup> For CBT, two studies showed positive short-term effects on FD symptoms.<sup>213,214</sup>

Meta-analyses of numerous low-quality randomized, controlled studies suggest manual and electric acupuncture being effective in the treatment of FD, as shown by improved symptom scores and health-related quality-of-life scores.<sup>215-217</sup> Effects are most pronounced in sham-controlled trials and less pronounced in trials comparing to prokinetic medication or traditional Chinese medicine. A recent sham-controlled trial adds that the effect of acupuncture, following 20 treatment sessions in a 4-week episode, is sustained for 24 weeks.<sup>218</sup> Besides the overall small number of patients included and the different acupuncture protocols followed, selection bias, performing bias, reporting bias, attrition bias, and blinding difficulties remain the major concerns when interpreting findings in the meta-analyses.

In a meta-analysis, the quality and effectiveness of mindfulness-based therapy in FGIDs was evaluated.<sup>219</sup> However, studies evaluating the effectiveness of mindfulness specifically in FD have not been found in the literature.

While severe weight loss may occur in FD patients, especially in those with PDS and food avoidance, few studies have addressed its management. The antidepressant mirtazapine seems to help with weight gain in these patients<sup>200,201</sup> and to improve FD symptoms, so the conclusion that other clinical management strategies for weight-gain support may also be effective, is plausible but has not been tested. This holds true specifically for enteral and parenteral feeding. In one preliminary report of 19 FD patients with delayed gastric emptying and severe weight loss ( $15.8 \pm 2.8$  kg), enteral feeding through a percutaneous endoscopic gastrojejunostomy (PEG/J) generated weight gain in 63% of subjects, but there were many non-life-threatening complications. The PEG/J was electively removed after  $19.9 \pm 5.6$  months and a mean weight gain of  $6.1 \pm 0.8$  kg<sup>220</sup>

## 7. Prognosis of FD

7.1 The long-term prognosis is favorable in the majority of patients with FD.

STATEMENT ENDORSED, overall agreement 85%: A+ 29%, A 56%, A- 12%, D- 0%, D 2%, D+ 0%. GRADE B

7.2 Life expectancy in FD is similar to the general population.

STATEMENT ENDORSED, overall agreement 100%: A+ 56%, A 44%, A- 0%, D- 0%, D 0%, D+ 0%. GRADE A

It is well established that symptoms in FD vary over time. Based on a cohort study, 1 year after initial diagnosis, 24% of patients reported their symptoms as unimproved, and these patients were younger and had higher symptom severity at the first diagnosis.<sup>219</sup> In a tertiary care cohort, half of the FD patients improved or became asymptomatic after a mean follow-up of

**TABLE 4** Summary of the ESNM consensus on FD

Recommendations	Based on statement(s)
Dyspepsia refers to a symptom or set of symptoms that are considered to originate from the gastroduodenal region. Early satiation, postprandial fullness, epigastric pain and epigastric burning are the cardinal dyspeptic symptoms.	1.1, 1.2
FD is a condition characterized by chronic dyspeptic symptoms in the absence of organic, systemic or metabolic condition (s) that is (are) likely to explain symptoms. The vast majority of patients with dyspeptic symptoms and no alarm symptoms in the general population would be identified as FD after investigation (if performed).	1.3, 1.4
Two main subtypes of FD are distinguished which may overlap: postprandial distress syndrome (PDS) characterized by meal-induced symptoms (early satiation, postprandial fullness) and epigastric pain syndrome (EPS), with epigastric pain and/or epigastric burning.	1.5
Dyspeptic symptoms often co-exist with other symptoms such as bloating in the upper abdomen, nausea and belching. Typical reflux symptoms and irritable bowel syndrome often coexists with FD.	1.6, 1.9, 1.11
(Functional) dyspepsia is more prevalent in women than men.	2.2
Acute GI infection and anxiety are risk factors for development of FD.	2.3; 2.6
FD is a major source of healthcare costs, self-costs to patients and loss of work productivity.	3.1, 3.2, 3.3
FD is associated with a significant decrease in quality of life and with psychosocial co-morbidities.	3.4, 3.5
Weight loss can be consequence of FD.	3.6
Healthcare consulting behavior in FD is driven by symptom severity and impact, and by psychosocial co-morbidities.	3.8, 3.9
<i>H. pylori</i> is a cause of symptoms in a subgroup of patients with dyspepsia and normal endoscopy.	4.2
Impaired gastric accommodation, delayed gastric emptying, hypersensitivity to gastric distention and disordered central processing of incoming signals from the gastroduodenal region are pathophysiological mechanisms in FD	4.3, 4.4, 4.6, 4.15
Upper GI endoscopy is mandatory for establishing a diagnosis of FD, but in primary care, dyspepsia can be managed without endoscopy if there are no alarm of risk factors. The endoscopy is mandatory if there are alarm symptoms or risk factors	5.1, 5.2, 5.3
Every patient with dyspeptic symptoms should be tested for <i>H. pylori</i> (Hp) (non-invasively or at gastroscopy). <i>H. pylori</i> positive FD patients should receive eradication therapy. Patients with dyspepsia and <i>H. pylori</i> positive gastritis should be considered to have FD if symptoms persist 6 to 12 months after <i>H. pylori</i> eradication. Patients with dyspepsia and <i>H. pylori</i> negative gastritis should be considered to have FD.	5.5, 5.6, 5.7, 6.2
FD should be subdivided into EPS and PDS for further diagnostic and therapeutic approach	5.8
PPI-therapy is an effective therapy for FD.	6.4
In case of severe weight loss in FD, nutritional support may be needed.	6.27
The long-term prognosis is favorable in the majority of patients with FD, whose life expectancy is similar to that of the general population.	7.1, 7.2

5 years, with anxiety and weight loss at presentation as unfavorable predictors.<sup>48</sup> Population-based reports of longer observation periods performed in Olmsted County, Minnesota, United States (12 years) and Iceland (10 years) report a favorable outcome with symptom resolution in 63%–67%, stable or persistent symptoms falling under the FD category in 16%–20%, and fluctuating or additional symptoms in 32%–35% confirming high symptom turnover among FGID patients.<sup>222,223</sup>

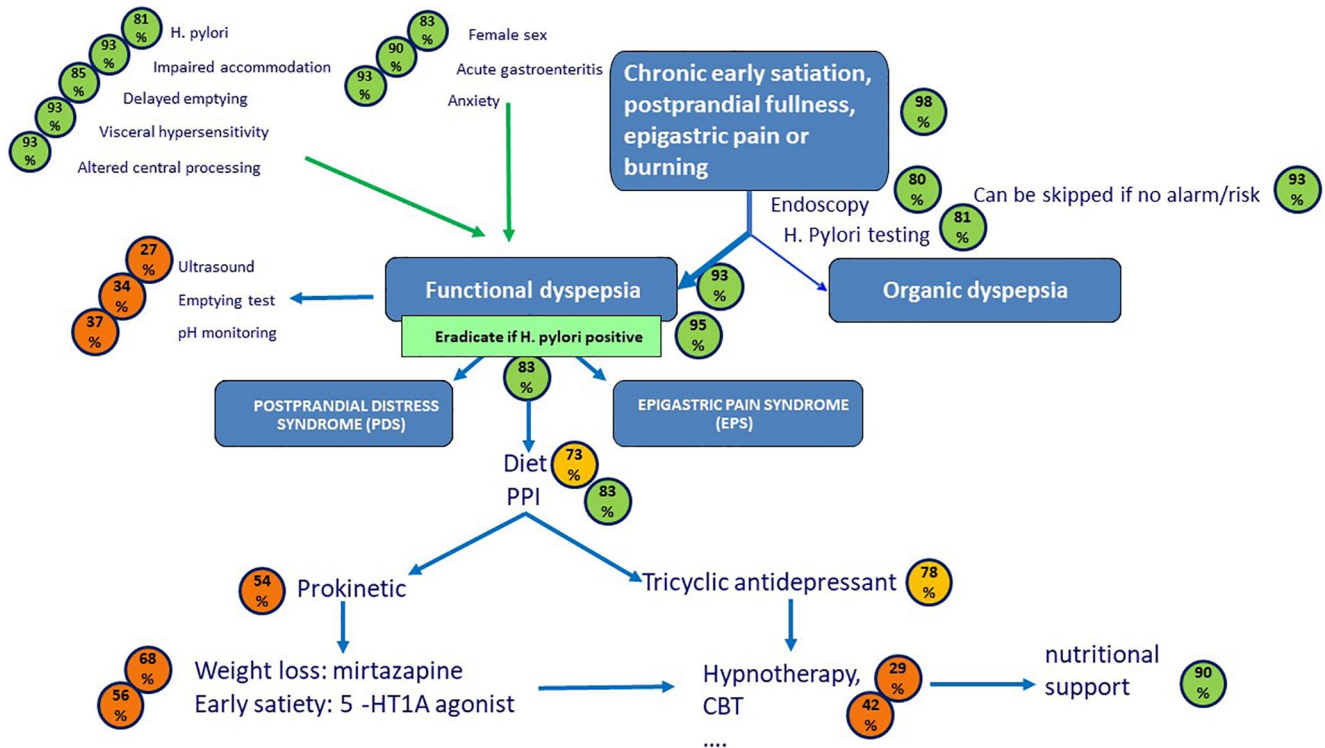
In a population-based cohort study, 5262 randomly selected subjects were screened. From 3933 eligible subjects included in the analysis, dyspepsia was diagnosed in 2% of subjects. No association with overall survival was detected for dyspepsia (HR = 1.08 (95% CI: 0.58–2.02)).<sup>224</sup> A 10-year long-term follow-up study included 8323 people, of whom dyspepsia was diagnosed in 3169 patients (38.1%). After multivariate analysis, there was no significant difference in the likelihood of death at 10 years in those with dyspepsia (HR: 0.94; 99%

CI: 0.58–1.54) compared to those who did not meet the criteria for FD.<sup>225</sup> Thus, available data show that life expectancy in FD is similar to life expectancy in the general population.

## RECOMMENDATIONS

Based on the statements that achieved consensus (Table 3), a number of recommendations for understanding and managing FD can be made, which are summarized in Table 4. The Delphi process also identified several areas of uncertainty, which require additional evidence or further research. Figure 1 schematically summarizes the findings.

The Rome IV definition with four cardinal symptoms (early satiation, postprandial fullness, epigastric pain, and epigastric burning), its subdivision into EPS and PDS, and accessory symptoms (upper



**FIGURE 1** Schematic representation, in an algorithm-like fashion, of the outcome of the consensus on functional dyspepsia management. The blue arrows depict the diagnostic and therapeutic flow of the patient. Green arrows refer to risk or pathophysiological factors. The circles depict the % of agreement, using a green color for  $\geq 80\%$  consensus, light orange for consensus between 70% and 80%, and dark orange for lower levels of consensus

abdominal bloating, nausea, belching) are well-accepted. There is also consensus that the majority of uninvestigated dyspepsia in the general population represents FD, if an investigation would be done. Overlap with GERD and IBS is acknowledged. Also well accepted are the female predominance of FD, and acute gastrointestinal infections and anxiety as risk factors for developing FD. There is a clear consensus on the impact of FD on the personal level (quality of life, self-cost), on healthcare costs, on the ability to work, and on psychosocial well-being.

In terms of pathophysiological mechanisms that are relevant to FD, consensus supports a role for impaired gastric accommodation, delayed gastric emptying, hypersensitivity to gastric distention, *H. pylori* infection, and altered central processing of incoming signals from the gastroduodenal region. There is no consensus on duodenal mucosal alterations, sensitivity to luminal contents, peptide release, or microbiota. Anxiety is a risk factor for the development of functional dyspepsia; however, anxiety, depression, or stress is not considered a pathophysiological mechanism that underlies FD symptom generation.

There is consensus that endoscopy is mandatory for establishing a firm diagnosis of FD, but that patients in primary care with dyspeptic symptoms and no alarm symptoms or risk factors can be managed without endoscopy. There is consensus that endoscopy is mandatory in case of alarm symptoms or risk factors, and that *H. pylori* status should be determined at endoscopy or non-invasively in every patient. There is no consensus on the benefit of additional

examinations including laboratory testing, abdominal ultrasound, gastric emptying testing, or esophageal pH monitoring.

The biggest area of lack of consensus is the section on treatment approaches for FD. There is an agreement to use to subdivision in PDS and EPS to guide management, but the vast majority of treatment options are not supported for a specific subgroup. There is consensus to eradicate every *H. pylori* positive FD patient, and PPI therapy is considered an effective therapy for FD, although there is no consensus that it is the preferred initial therapy. There is no consensus on the indication and efficacy of prokinetics or antidepressants, but an almost-agreement (78%) on the use of TCA in EPS. There is also no consensus on the use of other neuromodulators, herbal therapies, acupuncture, or psychological therapies in FD. There is agreement on the use of nutritional support in case of severe weight loss. Finally, there is consensus that the long-term prognosis of FD is favorable and that life expectancy is not shortened in FD.

The areas of uncertainty revealed by this consensus are multiple. Further unraveling of the FD symptom pattern is useful, and especially the concept of using pictograms deserves additional, preferably multilingual and multicultural studies. These may aid further diagnostic refinement, where the currently only supported tools are endoscopy and *H. pylori* status assessments, with their limited sensitivity and impact on management and outcome. While there is acceptance of a role for gastric sensorimotor dysfunction in

triggering FD symptoms, the role of duodenal luminal or mucosal alterations is not established, but the 76% amount of agreement is still considerable. The putative entity of *H. pylori*-associated dyspepsia is poorly described and needs further characterizing studies, especially in the West. The voting on the therapy statements clearly establishes the need for more therapeutic trials, preferably in a multi-center setting using validated endpoints. In the absence of a well-established path to regulatory approval, scientific or professional organizations such as the ESNM or the Rome Foundation may consider taking the lead here.

## CONCLUSION

FD is a highly prevalent and impactful clinical condition. This Delphi process used a multinational and multidisciplinary group of European experts to summarize the current state of consensus on definition, symptom characteristics, pathophysiology, diagnosis, treatment, and prognosis of this condition. The Consensus Group voted on several statements that may guide clinicians in recognizing, diagnosing, and treating FD in clinical practice, whereas the statements without consensus identify areas in need of future research.

## ACKNOWLEDGEMENT

This consensus was supported by a grant from United European Gastroenterology.

## AUTHOR CONTRIBUTIONS

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**How to cite this article:** Wauters L, Dickman R, Drug V, et al. United European Gastroenterology (UEG) and European Society for Neurogastroenterology and Motility (ESNM) consensus on functional dyspepsia. *United European Gastroenterol J*. 2021;9:307–331. <https://doi.org/10.1002/ueg2.12061>