Physicians' attitude and perception regarding celiac disease: A questionnaire-based study

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ABSTRACT

Background/Aims: Despite its high prevalence, affecting about 1% of the general population, celiac disease (CD) remains heavily underdiagnosed. Among the reasons for underdiagnosis, awareness among medical professionals has been little studied. The aim of this survey was to determine physicians' knowledge in regard to CD in adult patients.

Materials and Methods: An 18-items questionnaire pointing out general features, clinical presentation, diagnosis and management of CD patients was addressed to physicians from different medical specialties, in training or board-certified, from one universitary center.

Results: Altogether 153 physicians were invited to complete the survey (69.3% female, 35.9% gastroenterologists). Overall, 69.9% of the physicians questioned considered CD as a rare disorder. Lymphoma increased risk was highlighted in significant higher proportion by gastroenterologists when compared with physicians of other medical specialty. Chronic diarrhea, weight loss, iron-deficiency anemia, and abdominal pain were the first four conditions recognized as associated with CD, by 94.1%, 76.5%, 61.4%, and 54.2% study participants, respectively. About one-third of respondents (34.5%) affirmed to perform total serum IgA testing in all patients tested for CD. Intestinal biopsy confirmation of a positive celiac serology was reported by 65.4% physicians, with a higher proportion among gastroenterologists: 81.5% versus 56.6%. In regard to CD management, both groups concluded that referral to specialized centers should be recommended.

Conclusion: This study highlights poor awareness among the physicians' in regard to important CD features and diagnostic recommendations in adult patients. More efforts are warranted to improve awareness on CD features among physicians of different medical specialties.

Keywords: Physician, awareness, celiac disease, survey

INTRODUCTION

Celiac disease (CD) is now recognized as a common, multi-organ disease; it is an immune and autoimmune reaction to dietary gluten that occurs in patients with underlying genetic predisposition (1). Its diagnosis is currently based on serological screening and intestinal biopsy (1,2). Therapeutic management primarily implies a long-term, lifelong, gluten-free diet, and all serological determinations can be optimally performed only in patients under gluten-containing diet (1). Therefore, CD diagnosis should be always accurately sustained before the start of a specific therapy. Untreated CD can lead to bone and liver diseases, neurological disorders, and even malignancies, such as lymphoma.

The general prevalence of CD in screened European or American population is approximately 1% (1,2). Routine clinical diagnosis can be challenging because the disease frequently manifests with only mild gastrointestinal or extraintestinal symptoms. However, CD remains largely underdiagnosed (3,4) and as much as 10 times higher prevalence rates are observed in screened populations when compared with routinely declared diagnosed CD cases (5,6).

The lack or delayed positive diagnosis in patients with CD results in a delayed proper management of these patients, reflected by a lower than general population quality of life for these patients (7). Furthermore, unrecognized long-standing CD symptomatology is one factor in determining a low quality of life (8). A previous study concluded that lack of physicians' awareness regarding CD is one contributing factor to its underdiagnosis; therefore, further education is encouraged (9).

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In the present study, we aimed to assess physicians' attitude and perceptions regarding adult CD in one Romanian University center.

MATERIALS AND METHODS

Survey participants

Physicians from other medical specialties were asked to respond to a questionnaire regarding their awareness of CD in adult patients. The participants interviewed were physicians from medical specialties (e.g., internal medicine, gastroenterology, rheumatology, and pneumology) affiliated (residents in training or board-certified physicians) to hospital medical university centers in Bucharest, Romania. No physician from pediatric specialties was included. All data were prospectively collected, and all participants responded to the same 18-item questionnaire. All physicians voluntarily completed the study questionnaire after being informed about the research purpose of this process, giving full consent to participate in the study. The present study did not imply any contact with patients nor any intervention. The research was approved by the local ethics committee.

Application of questionnaire

The questionnaire asked physicians to identify the characteristics, diagnosis, and management of CD in order to determine the surveyed participants' attitude and perception regarding the pathology of celiac disease.

The authors involved in the questionnaire development are gastroenterologists and internal medicine specialists dedicated to CD research. Although research in CD epidemiology shows that this illness is not a rare occurrence, it remains heavily underdiagnosed (3-6). One possible cause of high rates of underdiagnosis is related to the physicians' lack of awareness (9). With this hypothesis, we formulated a questionnaire to determine the physicians' awareness regarding the important features of CD, from epidemiology and clinical manifestations to positive diagnosis and treatment.

The same 18-item questionnaire was assessed in all the study participants. The first items included the physicians' general characteristics such as gender, age, specialty, and medical degree. Annex I shows the following proposed items to assess the physicians' awareness regarding CD: epidemiology, clinical presentation, diagnosis, and management.

Each question presented between 2 and 14 choices. With the exception of the question referring to the clinical conditions possibly associated with CD, only one response was allowed for each query asked. Of these, the items where none or more than one answer was checked instead of only one were not considered in the study results presented. Data collected from all physicians who were successfully included in the study were then analyzed.

The survey questionnaire was proposed by the authors of the present study, and it is not a validated tool in CD. All survey physicians completed the questionnaires in Romanian language. The English translation was only done for the purpose of the present study (Annex I).

Statistical analysis

Data were presented as number (%) for all categorical variables. Two groups were then defined: physicians in gastroenterology specialty and physicians with a medical specialty other than gastroenterology (regardless if in training or board-certified). Chi-squared or Mann-Whitney U-test was used to assess the differences between the two groups; more than two variables were tested. A two-tailed p value <0.05 was considered statistically significant. Statistical analysis was performed using Statistical Package for Social Sciences Statistics 17.0 (SPSS Inc.; Chicago, IL, USA).

RESULTS

General characteristics of participants

In total, 153 physicians were included in the present study, and 69.3% were women. Almost half of the participants had <30 years (47.7%) at inclusion, and only 8.5% had >50 years. Overall, 46.4% of the surveyed physicians were board-certified physicians, and 21.6% had >5 years of medical practice. In addition, 55 (35.9%) of the study participants were in training or board-certified in gastroenterology, 54 (35.3%) in internal medicine, and the rest in another medical specialty (Table 1).

General features of celiac disease

The majority of the practitioners, 107 physicians (69.9%), questioned stated that CD is a rare pathology, whereas 26 physicians (17.0%) considered it a frequent disease. In total, 114 (74.5%) of the physicians surveyed indicated a moderate severity for CD, whereas the rest described it, in similar percentages, as mild or severe. Furthermore, most of the participants, 101 physicians (66.0%), identified CD as a moderately disabling pathology (Table 2).

When compared with gastroenterologists, more physicians from other medical specialties affirmed that the risk of cancer in CD is moderate or high, with 48.5% and 10.1% versus 37.0% and 3.7%, respectively (p=0.016). On the contrary, the percentage of physicians that recognized a moderate or high lymphoma risk in patients with CD was significantly higher among gastroenterologists, with 53.7% and 22.2% versus 36.4% and 13.1%, respectively. Additionally, in relation to lymphoma occurrence, a much larger proportion of physicians of specialties other than gastroenterology affirmed that they were not aware of the risk of lymphoma in CD, with 28.3% versus 1.9% (Table 2).

Celiac disease associated symptoms and syndromes

The four most frequent clinical symptoms recognized in possible relation with CD were as follows: chronic diarrhea (94.1%), weight loss (76.5%), unresponsive iron-deficiency anemia (61.4%), and abdominal pain of unknown origin (54.2%). Less than 10% of the gastroenterologists questioned would screen for CD in patients with constipation, Sjögren syndrome, or Turner syndrome. Further, significantly more physicians of specialties other than gastroenterology identified abdominal pain of unknown origin as necessitating CD screening, with 62.6% versus 38.9%. On the contrary, more than twice percent of gastroenterologists enrolled when compared to other medical specialties, identified unexplained hypertransaminasemia or derma-

Table 1. General characteristics of the physicians interviewed in the present survey on CD in adult patients.

Variables	n=153
Gender	
Female, n (%)	106 (69.3)
Male, n (%)	46 (30.0)
Not answered, n (%)	1 (0.7)
Age	
<30 years, n (%)	73 (47.7)
30-40 years, n (%)	50 (32.7)
40-50 years, n (%)	17 (11.1)
>50 years, n (%)	13 (8.5)
Specialty	
Gastroenterology, n (%)	55 (35.9)
Internal medicine, n (%)	54 (35.3)
Other, n (%)	44 (28.8)
Medical degree	
Resident, n (%)	82 (53.6)
Specialist, n (%)	38 (24.8)
Senior physician, n (%)	33 (21.6)

Table 2. Physicians' answers regarding the adult CD general features

Variables	Total n=153	Gastroenterology n1=54	Other specialty n2=99	p
CD occurrence				0.411
Frequent, n (%)	26 (17.0)	9 (16.7)	17 (17.2)	
Rare, n (%)	107 (69.9)	41 (75.9)	66 (66.6)	
Very rare, n (%)	12 (7.8)	4 (7.4)	8 (8.1)	
Do not know, n (%)	7 (4.6)	0 (0.0)	7 (7.1)	
Not answered, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	
CD severity				0.588
Mild, n (%)	21 (13.7)	9 (16.7)	12 (12.1)	
Moderate, n (%)	114 (74.5)	39 (72.2)	75 (75.8)	
High, n (%)	17 (11.1)	6 (11.1)	11 (11.1)	
Not answered, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	
CD-related disability				0.175
Less debilitating, n (%)	29 (19.0)	15 (27.8)	14 (14.1)	
Moderately disabling, n (%)	101 (66.0)	31 (57.4)	70 (70.7)	
Debilitating disease, n (%)	22 (14.3)	8 (14.8)	14 (14.1)	
Not answered, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	
Cancer risk in CD				0.016
Low, n (%)	45 (29.4)	23 (42.6)	22 (22.2)	
Moderate, n (%)	68 (44.4)	20 (37.0)	48 (48.5)	
High, n (%)	12 (7.8)	2 (3.7)	10 (10.1)	
Do not know, n (%)	27 (17.7)	8 (14.8)	19 (19.2)	
Not answered, n (%)	1 (0.7)	1 (1.9)	0 (0.0)	
Lymphoma risk in CD				0.028
Low, n (%)	33 (21.5)	12 (22.2)	21 (21.2)	
Moderate, n (%)	65 (42.5)	29 (53.7)	36 (36.4)	
High, n (%)	25 (16.3)	12 (22.2)	13 (13.1)	
Do not know, n (%)	29 (19.0)	1 (1.9)	28 (28.3)	
Not answered, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	

CD: celiac disease
Mann-Whitney U-test was used to compare differences in variables between the two groups

titis herpetiformis as conditions in which CD screening is mandatory, 27.8% versus 11.1% (p=0.013) and 31.5% versus 14.1% (p=0.019), respectively (Table 3).

Diagnosis in celiac disease

A significantly lower proportion of physicians of specialties other than gastroenterology frequently prescribed tests for CD serology, with 15.2% versus 27.8%. Moreover, 30.3% of the physicians from other medical specialties than gastroenterology affirmed never having demanded a CD serology.

The most frequently prescribed CD-related antibodies, regardless of the basis of medical specialty, were the anti-tissue transglutaminase antibodies (tTG). In this question, 18% of the physicians chose more than one answer, and therefore, these answers were not quantified.

Table 3. Clinical situations in which a serological screening for celiac disease in adult patients is recommended by the physicians interviewed.

	Total n=153	Gastroenterology n1=54	Other specialty n2=99	p
Chronic diarrhea, n (%)	144 (94.1)	53 (98.1)	91 (91.9)	0.161
Abdominal pain of unknown origin, n (%)	83 (54.2)	21 (38.9)	62 (62.6)	0.006
Weight loss, n (%)	117 (76.5)	44 (81.5)	73 (73.7)	0.323
Constipation, n (%)	14 (9.2)	5 (9.3)	9 (9.1)	0.973
Unresponsive iron-deficiency anemia, n (%)	94 (61.4)	39 (72.2)	55 (55.6)	0.056
Infertility, n (%)	29 (19.0)	14 (25.9)	15 (15.2)	0.131
Unexplained increase in transaminases, n (%)	26 (17.0)	15 (27.8)	11 (11.1)	0.013
Type 1 diabetes mellitus, n (%)	28 (18.3)	13 (24.1)	15 (15.2)	0.193
Autoimmune thyroiditis, n (%)	42 (27.5)	19 (35.2)	23 (23.2)	0.131
Osteoporosis, n (%)	20 (13.1)	7 (13.0)	13 (13.1)	0.977
Sjögren syndrome, n (%)	17 (11.1)	3 (5.6)	14 (14.1)	0.176
Turner syndrome, n (%)	7 (4.6)	2 (3.7)	5 (5.1)	0.704
Dermatitis herpetiformis, n (%)	31 (20.3)	17 (31.5)	14 (14.1)	0.019
Autoimmune hepatitis, n (%)	20 (13.1)	9 (16.7)	11 (11.1)	0.329

Data expressed as yes/no yes%
Chi-square test was used to compare the differences in variables between the two groups

The preferred recommendation of anti-endomysial antibodies (EMA) appeared to be significantly more encountered among physicians from other medical specialties than gastroenterology, with 10.1% versus 5.6%. Basically, none of the questioned gastroenterologists affirmed prescribing anti-deamidated gliadin peptide (DGP) antibodies as first intention in the serological screening of CD.

A significantly greater proportion of gastroenterologists than physicians from other medical specialty admitted performing small intestine biopsy to confirm CD diagnosis, p=0.001. Approximately 81.5% of the gastroenterology physicians frequently reported recommending diagnostic intestinal biopsy in CD.

Table 4. Diagnostic features of adult celiac disease as regarded by the survey participants

	Total n=153	Gastroenterology n1=54	Other specialty n2=99	p
Recommendation for CD serology				0.004
Never, n (%)	36 (23.5)	6 (11.1)	30 (30.3)	
Rare (< 5%), n (%)	87 (56.9)	33 (61.1)	54 (54.5)	
Frequent (>5%), n (%)	30 (19.6)	15 (27.8)	15 (15.2)	
Antibodies for CD screening				0.001
Anti-tTG, n (%)	75 (49.0)	32 (59.2)	43 (43.4)	
Anti-EMA, n (%)	13 (8.5)	3 (5.6)	10 (10.1)	
Anti-GA, n (%)	22 (14.4)	1 (1.9)	21 (21.2)	
Anti-DGA, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	
Not answered, n (%)	42 (27.4)	18 (33.3)	24 (24.3)	
Intestine biopsy when CD positive serology				0.001
Never, n (%)	15 (9.8)	2 (3.7)	13 (13.1)	
Rare, n (%)	34 (22.2)	6 (11.1)	28 (28.3)	
Frequent, n (%)	100 (65.4)	44 (81.5)	56 (56.6)	
Not answered, n (%)	4 (2.6)	2 (3.7)	2 (2.0)	
IgA screening in CD patients				0.940
Always, n (%)	53 (34.6)	17 (31.5)	36 (36.4)	
Sometimes, n (%)	64 (41.8)	28 (51.9)	36 (36.4)	
Never, n (%)	33 (21.6)	9 (16.6)	24 (24.2)	
Not answered, n (%)	3 (2.0)	0 (0.0)	3 (3.0)	

anti-GA: anti-gliadin antibodies; anti-DGA: anti-deamidated gliadin antibodies; anti-EMA: anti-endomysial antibodies; anti-tTG: anti-tissue transglutaminase antibodies; CD: celiac disease; IgA - immunoglobulin A
Mann-Whitney test was used to compare the differences in variables between the two groups

Only approximately one-third of the surveyed participants, regardless of their medical specialty, admitted performing total serum immunoglobulin A (IgA) screening in all patients with CD. Moreover, 16.7% of the gastroenterologists never prescribe an IgA testing in individuals clinically suspected with CD (Table 4).

Table 5. Interviewed physicians' opinion on celiac disease patients' management

	Total	Gastroenterology	Other specialty	
	n=153	n1=54	n2=99	p
Recommendation of gluten-free diet in CD patients				0.113
Always, n (%)	125 (81.7)	48 (88.9)	77 (77.8)	
Rare, n (%)	2 (1.3)	0 (0.0)	2 (2.0)	
Frequent, n (%)	23 (15.0)	6 (11.1)	17 (17.2)	
Never , n (%)	2 (1.3)	0 (0.0)	2 (2.0)	
Not answered, n (%)	1 (0.7)	0 (0.0)	1 (1.0)	
Criteria for a gluten-free diet recommendation				0.509
Digestive symptoms, n (%)	51 (33.3)	16 (29.6)	35 (35.4)	
Positives anti-GA, n (%)	9 (5.9)	3 (5.6)	6 (6.1)	
Positives auto-antibodies, n (%) (anti-tTG/ anti-EMA)	34 (22.2)	15 (27.8)	19 (19.2)	
Positive intestinal biopsy, n (%)	31 (20.3)	11 (20.4)	20 (20.2)	
Not answered, n (%)	28 (18.3)	9 (16.6)	19 (19.1)	
CD patients diagnosis				0.006
Specialized medical centers, n (%)	79 (51.6)	20 (37.0)	59 (59.6)	
Any medical center, n (%)	72 (47.1)	34 (63.0)	38 (38.4)	
Not answered, n (%)	2 (1.3)	0 (0.0)	2 (2.0)	
CD patients management				0.227
Specialized medical centers, n (%)	92 (60.1)	29 (53.7)	63 (63.6)	
Any medical center, n (%)	60 (39.2)	25 (46.3)	35 (35.4)	
Not answered, n (%)	1 (0.7)	0 (0.0)		1 (1.0)

CD: celiac disease

Mann-Whitney U-test was used to compare the differences in variables between the two groups

Management of celiac disease

Regarding CD management, a gluten-free diet was recommended (always or frequently) in patients with CD by almost all surveyed participants (96.7%). Further, when asked to decide which criteria are mainly used for prescribing a gluten-free diet, 29.6% of the gastroenterologists answered digestive symptoms, whereas 27.8% chose positive auto-antibodies (tTG or EMA). Only 20.4% of the interviewed gastroenterologists confirmed starting a gluten-free diet only after a positive intestinal biopsy.

Overall, 60.1% of the physicians included were more likely to refer patients for CD treatment in specialized medical centers. Furthermore, regarding the appropriate diagnosis approach, most of the enrolled gastroenterologists (63.0%) declared that CD diagnosis could be performed in any medical center. On the contrary, 59.6% of the physicians of specialty other than gastroenterology considered that patients with symptoms suggestive of CD should be referred to a specialized medical center (Table 5).

DISCUSSION

The current research is a questionnaire-based survey performed among physicians from other medical specialties to identify clinical practice patterns concerning the general features, clinical presentation, diagnostic tools, or therapeutic management of adult patients with CD. In total, 153 physicians from other medical specialties were enrolled, and 69% were women. Among the surveyed participants, approximately one-third were in gastroenterology, half of the enrolled participants were board-certified physicians, and the other half were residents in training.

Most of the physicians considered CD as a rare pathology that presents with moderate severity or organ impairment. This opinion might be due to the actually low rates of disease recognition in the general population, suggesting that CD still remains an underdiagnosed pathology (3-6).

Overall, patients with CD do not seem to carry any increased risk of respiratory or cardiovascular diseases and neither of neoplastic pathology, and CD could be eventually considered as a mild disabling disease (10). However, complications, such as severe osteomalacia, might occur in CD, and complicated cases might be associated with high rates of morbidity and mortality (11,12). Therefore, 7% to 30% of the patients with CD develop non-responsive CD regardless of >6 months of a gluten-free diet (1). Additionally, up to 2% of the patients with CD are subjective to refractory CD occurrence (13). While refractory type I CD resembles active CD, type II yields a more se-

vere prognosis (14). Evolution to enteropathy associated T cell lymphoma can occur, and in such cases, the 5-year survival is only 20% (15).

Chronic inflammation in CD despite a gluten-free diet appears to be the underlying mechanism of increased susceptibility for gastrointestinal neoplasia, such as intestinal lymphoma, but also of other cancers, such as squamous cell carcinoma (16,17). Even if the overall incidence of neoplasia is not increased in CD, risks of esophagus, pharynx, small-bowel, or colon cancers are increased in patients with CD (17,18).

In our study, chronic diarrhea and weight loss were the first two most recognized conditions in which a CD diagnostic work-up was considered necessary, by 94.1%, respectively 76.5% of the physicians questioned. Chronic diarrhea is a typical symptom at CD presentation (19). It is classically accompanied by malabsorption with secondary weight loss (20). Initially, it was identified in up to 80% of the patients with CD, from which 1 out of 4 patients continues to present diarrheic stools after the start of a gluten-free diet, even if of lower severity (21). More recently, when less common CD clinical features were recognized or population CD screening was performed, the atypical presentation of CD was more frequently recognized, whereas a decrease in the prevalence of chronic diarrhea was noted (22).

Furthermore, together with abdominal pain, iron-deficiency anemia, osteoporosis, elevated liver enzymes, dermatitis herpetiformis, thyroid impairment, and Down or Turner syndrome, the incidence of chronic diarrhea and weight loss is more than twice as frequent in patients with CD than in the general population (1). Therefore, anemia is the most frequent hematological impairment observed in CD and could also be the only presenting sign (23). Moreover, the association with thyroid autoimmune conditions is acknowledged in CD (24,25). Patients with type 1 diabetes mellitus were identified as a high risk CD population, and repeated CD screening is recommended during childhood and adulthood as up to two-thirds of these patients might be asymptomatic (26). In addition, dermatitis herpetiformis occurs secondary to gluten exposure, predominantly in males in the third and fourth decade of life. Interestingly, even if dermatitis herpetiformis responds to a gluten-free diet, it is accompanied by digestive involvement in only 10% of the cases (2).

Approximately 40% of the patients with newly diagnosed CD might have elevated liver blood enzymes, and, generally, their normalization is seen under a proper gluten-free diet (27). Occurrence of symptomatology dominated by constipation or complications, such as pulmonary hemosiderosis, infertility, or ataxia, is much less commonly encountered (1,28).

A previous survey that questioned physicians regarding CD symptoms, associated conditions, or complications presented that 90% of the study participants recognized chronic diarrhea, 45% iron-deficiency and osteoporosis, 23% thyroiditis, 13% type 1 diabetes mellitus, 8% infertility, and 4% Down syndrome (9). A good knowledge of CD in all its aspects is required as rare associated conditions or nonclassical clinical presentation is less likely to be correctly diagnosed (29). In patients with unexplained abdominal symptoms; unexpected weight loss; prolonged fatigue; unexplained iron, folate, or vitamin B12 deficiency; type I diabetes; or autoimmune thyroiditis at diagnosis, search for CD serology should be performed; Additionally, serology testing should be considered in patients with unexplained increases in transaminases and Down or Turner syndrome (30).

The tTG serotype IgA is the recommended test that should be first performed in cases of CD presumption since it has a sensitivity and specificity of approximately 95% (1,2,30). The AGA were used for a long time and were thought to have good accuracy. In time, however, better alternatives were developed (1). The successively use of DGP increased the traditional AGA performance (31). Determination of IgA and IgG DGP are still used as additional tests in children younger than 2 years with suggestive celiac symptomatology (32). The EMA, despite sensitivity lower than IgA-tTG, have a very good CD specificity, of almost 100% and could be used for IgA-tTG positivity confirmation (1,31).

IgA deficiency is more frequently encountered in CD than in the general population, approximately 2%, and therefore, screening for IgA serotype antibodies in these patients might determine false negative CD serology (33). In patients with known IgA deficiency, screening for tTG and DGP, both in IgG serotype, is recommended (1,2), with the remark that the IgG DGP might have a better sensitivity (31).

In our survey, tTG were recognized as the first serology diagnostic test in CD by most of the physicians who were questioned. On the contrary, the differences between AGA and DGP did not seem to be known even if the currently available tests in Romania are mostly

DGP-based and not AGA-based. Moreover, IgA screening does not appear to be routinely performed in case of suggestive CD as only 34.6% of the physicians who were questioned affirmed always referring their patients for total IgA testing. If the percent of gastroenterologists affirming to prescribe diagnostic intestinal biopsy in CD, 81.5%, could be considered satisfactory, it was significantly higher than in other medical specialties than gastroenterology. The lack of awareness regarding CD diagnosis was recognized by most of the physicians from other than gastroenterology specialties as they recommended that CD diagnosis should be addressed to specialized medical centers.

A gluten-free diet is often recommended based on a positive CD serology. The start of a gluten-free diet without performing intestinal biopsy has already been acknowledged to be a relatively frequent error in daily medical practice (34). The biopsy should sustain the positive serology diagnosis, and further, it has indication in patients with relevant digestive symptomatology, but with seronegative CD determinations. Therefore, 6% to 22% of biopsy proven CD cases could be seronegative (2). Performing intestinal biopsy, independently of the CD serology, is also cost efficient in patients with iron-deficiency anemia of unknown origin (35). One study showed that approximately 60% of the physicians are recommending diagnostic intestinal biopsy in patients with CD (9). Another study, a Canadian survey, identified that a routine follow-up with intestinal biopsy is the usual practice (36). Regarding intestinal biopsy in CD diagnosis, the exclusion of patients with biopsy contraindications, such as pregnant women or coagulation disorders, is the only contraindication (2).

A gluten-free diet is mandatory in patients diagnosed with CD. However, the patients' adherence to a gluten-free diet largely varies between 17% and 80% (37). For a better compliance to a gluten-free diet, which is often difficult, patients need a proper dietary education, explanations of all benefits, and close regular follow-up in specialized medical centers (1,38). Close follow-up of these patients with annual CD serology check is one of the satisfaction determinants in patients with CD (39). There is a need to increase awareness of CD features not only regarding rare clinical symptoms but also the appropriate CD treatment (8).

The present study has several limitations. First, the questionnaire used in the present study is not a validated tool but is a composed questionnaire strictly for the purpose of this research. However, there are no available validated tools on this research subject. In addition, the number or composition of the study group was randomly composed. Our results refer only to the physicians, specialists, or trainees from one university center and are not necessarily superimposable to all physicians.

In conclusion, the results of this survey show that there is still a need for further education regarding CD, which might eventually improve the diagnosis, treatment, and follow-up of patients with CD and help avoiding complication occurrence and unnecessary health care costs. CD real prevalence, less commonly associated conditions, correct use of the available serological markers, and diagnostic intestinal biopsy or treatment determinants should be particularly better acknowledged.

You can reach the annexure of this article at https://10.5152/tjg.2018.17236

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Annex I. Physicians' awareness questionnaire

Please answer by selecting the appropriate variant for each situation/question. (With the exception of question 10, only one answer is possible for each question.)

1. Specialty
A. Family medicine
B. Internal medicine
C. Gastroenterology
D. Other specialty

2. Professional degree
A. Resident
B. Specialist
C. Senior physician

3. Age
A. <30 years
B. 30-40 years
C. 40-50 years
D. 50-60 years
E. >60 years

4. Gender
A. Male
B. Female

5. Do you consider the adult celiac disease:
A. Frequent
B. Rare
C. Very rare
D. Do not know

6. Did you recommend celiac disease serology to your patients?
A. Never
B. Rare (unde 5% patients)
C. Frequent

7. Which are the most frequent antibodies prescribed for the celiac disease screening:
A. Anti-transglutaminase
B. Anti-endomisium
C. Anti-gliadin
D. Anti-deaminaded gliadin

8. Do you recommend intestinal biopsy to patients with positive celiac disease serology?
A. Never
B. Rare
C. Frequent

9. Do you recommend celiac disease serology determination in the following situations?
A. Chronic diarrhea
B. Abdominal pain of unknown etiology
C. Weight loss
D. Constipation
E. Unresponsive iron-deficiency anemia
F. Infertility
G. Unexplained transaminases raise
H. Type I diabetes melitus
I. Autoimmune thyroiditis
J. Osteoporosis
K. Sjögren syndrome
L. Turner syndrome
M. Herpetiforme dermatitis
N. Autoimmune hepatitis

10. The cancer risk in patients with celiac disease is:
A. Low
B. Moderate
C. High
D. Do not know

11. The lymphoma risk in celiac disease patients is:
A. Low
B. Moderate
C. High
D. Do not know

12. The adult celiac disease is:
A. A mild pathology
B. A moderate severe pathology
C. A severe pathology

13. The adult celiac disease is:
A. A less debilitating disease
B. A moderatly disabling disease
C. A debilitating disease

14. Do you prescribe a gluten-free diet in patients with celiac disease?
A. Always
B. Rare
C. Frequent
D. Never

15. Which is the most frequent criteria for which you recommend a gluten-free diet?
A. Digestive symptoms
B. Positives anti-gliadines antibodies
C. Positives auto-antibodies (anti-tissue transglutaminases/ anti-endomisium)
D. Intestinal biopsy

16. Do you recommend Ig A screening in celiac disease patients?
A. Always
B. Sometimes
C. Never

17. The celiac disease diagnosis should be performed in:
A. Specialized medical centers
B. Any medical center

18. The celiac disease management should be performed in:
A. Specialized medical centers
B. Any medical center