

Prevalence of celiac disease in Germany: A prospective follow-up study

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Abstract

AIM: To determine the prevalence of celiac disease in a randomly selected population sample.

METHODS: A total of 2157 subjects (1036 males; 1121 females) participating in a population-based cross-sectional study underwent laboratory testing for tissue transglutaminase and antibodies to immunoglobulin A, endomysium and antigliadin. In a second step, all subjects who had been examined serologically were surveyed using a questionnaire that included questions

specific to celiac disease. Subjects with positive antibody titers and those with histories positive for celiac disease then underwent biopsy. At the first follow up, antibody titers were again determined in these subjects and subjects were questioned regarding symptoms specific for celiac disease and disorders associated with celiac disease. The second follow up consisted of a telephone interview with subjects positive for celiac disease.

RESULTS: Antibody tests consistent with celiac disease were reported in eight subjects, corresponding to an overall prevalence of 1:270 (8/2157). The prevalence among women was 1:224 and 1:518 in men. Classical symptoms were observed in 62.5% of subjects. Atypical celiac disease was present in 25.0%, and transient celiac disease in 12.5%. False-negative test results were returned in three subjects. This yields a sensitivity and specificity of 62.5% and 50.0%, respectively, for tissue transglutaminase immunoglobulin-A antibody; of 62.5% and 71.4% respectively, for endomysium antibody; and of 62.5% and 71.4%, respectively, for antigliadin antibody.

CONCLUSION: The prevalence rate in our collective lies within the middle tertile of comparable studies in Europe. The use of a single antibody test for screening purposes must be called into question.

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Key words: Cross-sectional study; Celiac disease; Screening; Prevalence; Serology

Core tip: Only limited data on the prevalence of celiac disease in the adult European population are available. Aim of the study was to determine the prevalence of celiac disease in a randomly selected population sample in Germany and to assess the sensitivity and specificity of antibody tests. Eight of 2157 (1:270) subjects tested

positive for celiac disease. Tissue transglutaminase immunoglobulin-A antibody yielded a sensitivity of 62.5% (specificity 50.0%), endomysium antibody of 62.5% (71.4%) and anti gliadin antibody of 62.5% (71.4%). The prevalence rate lies within comparable European study results. The use of a single antibody test for screening purposes must be questioned.

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INTRODUCTION

The prevalence of celiac disease in population-representative collectives is reported between 1:42 and 1:558^[1-10] (Table 1) depending on the size of the population studied and the nature of the antisera used for screening. Among blood donors, the reported range is from 1:37 to 1:681^[11-19] (Table 1) and, for non-population representative samples, between 1:86 and 1:709^[20-24] (Table 1).

Subjects suffering from celiac disease may present with typical clinical symptoms, such as diarrhea, weight loss and bloating; or, they may be completely asymptomatic or exhibit only unspecific symptoms. For example, anemia or iron deficiency may be the only initial signs of the disease. Age distribution of first onset shows a first peak between nine months and two years, and a second during the fourth decade^[25].

It has only been in recent years that the clinical manifestations of this very heterogeneous disorder have been arranged in subclasses^[26]. The system of subtypes proposed by Holtmeier *et al*^[26] for the first time integrates clinical symptoms, histology and antibody titers, thus facilitating reliable diagnosis and therapeutic management.

Celiac disease is associated with specific, often serious, complications, including the development of gastric ulcers with the risk of hemorrhage, perforation and stricture, as well as T cell lymphoma^[25,27]. In fact, the risk of lymphoma in patients with celiac disease is about three times as high as that of the general population, with a peak age of onset at about 60 years^[25]. The risk of complications and neoplasia is associated with all forms of celiac disease: hence, the recognition of non-classical disease forms is particularly crucial. A strict, gluten-free diet started as early as possible and maintained lifelong significantly reduces the risk of malignancy^[28]. The protective effects of a gluten-free diet on the development of autoimmune disorders associated with celiac disease, such as diabetes mellitus or autoimmune thyroid diseases, however, remains controversial in the literature^[29-33].

Small bowel biopsy has been the conventional gold standard for the diagnosis of celiac disease. Today, however, greater importance is now attached to serological

studies, including antibodies to tissue transglutaminase (tTGA), endomysium (EMA) and gliadin (AGA)^[8].

To date, no prospective data on the prevalence of celiac disease in a representative adult population sample in Germany have been published. Objective of the present study was to determine the prevalence of celiac disease in a randomly selected population sample.

MATERIALS AND METHODS

Study population

The study "Echinococcus Multilocularis and other Internal Diseases in Leutkirch" (EMIL), a cross-sectional survey assessing the prevalence of *Echinococcus multilocularis* infection and other medical disorders, was conducted in Leutkirch, Germany in 2002. Initially, 4000 of the total 12475 residents were randomly selected by the staff of the municipal registry office from the roster of inhabitants. Out of these 4000 persons, 107 were excluded because their address was unknown or they had not given their informed consent. A total of 2445 individuals finally participated in the study, corresponding to a participation rate of 62.8%. Following exclusion of subjects less than 18 years and subjects with incomplete laboratory results, 2157 subjects were finally included in the present analysis (Figure 1).

The study was conducted in accordance with the principles of the Helsinki Declaration and Good Clinical Practice. It was approved by the ethics committee of the Landesärztekammer Baden-Württemberg. All subjects provided their written informed consent.

Initial study

All subjects were interviewed by a trained interviewer using a standardized questionnaire. In order to reduce interviewer bias as much as possible, each interviewer underwent in-depth training by an interviewing specialist of the state health office^[34].

Because the original EMIL questionnaire did not include specific questions regarding celiac disease, in 2003 all subjects of the EMIL study were mailed a separate questionnaire addressing celiac disease. Subjects were questioned regarding celiac disease that had been diagnosed prior to the date of the EMIL study and were asked whether they were currently (*i.e.*, at the time of the study) prescribed a gluten-free diet. The response rate to this survey stood at 50%.

Each subject underwent phlebotomy of the cubital vein to obtain ca. 25 mL of venous blood. Total immunoglobulin A (IgA) concentration was determined by nephelometry (BN II, Dade Behring, Marburg, Germany). IgA to tTGA was measured using an indirect, non-competitive enzyme immunoassay (Pharmacia Diagnostics Freiburg, Germany). Human recombinant tTGA was used as the antigen. Titers of 5-8 U/mL were considered borderline, while titers > 8 U/L were considered positive. AGA was determined using ELISA (Vita Diagnostics Merzhausen, Germany). Titers of 12-16 U/mL were con-

Table 1 Prevalence of celiac disease in different countries

Country	Prevalence	Characteristics of populations studied			Antibody test method		
		<i>n</i>	Age (yr) mean/median (range)	Males	tTGA	AGA	EMA
Population-representative samples							
Germany (present study)	1:270	2157	42.6 (18-65)	48.03%	-	-	-
New Zealand ^[1]	1:82	1064	50.2 (> 18)	39.80%	-	-	-
Iran ^[2]	1:104	2799	33.7 (18-66)	50%	-	-	-
Ireland ^[3]	1:122	1823	NA (15-65)	NA	-	-	-
Sweden ^[4]	1:190	1894	50 (25-74)	50%	-	-	-
Netherlands ^[5]	1:286	1440	40.6 (20-59)	46%	-	-	-
Spain ^[6]	1:390	1170	44.9 (2-89)	44.70%	-	-	-
Italy ^[7]	1:559	2237	44 (20-87)	46.90%	-	-	-
Greece ^[8]	1:558	2230	46 (18-80)	45%	-	-	-
Finland ^[9]	1:47	2815	NA (52-74)	48%	-	-	-
Finland ^[10]	1:42	4846	NA (30-64)	47%	-	-	-
Italy ^[10]	1:145	2759	NA (30-64)	42%	-	-	-
Germany ^[10]	1:344	3098	NA (30-64)	49%	-	-	-
Blood donors							
Mexico ^[11]	1:37	1009	34 (NA)	68%	-	-	-
Italy ^[12]	1:100	1002	33 (13-90)	43.40%	-	-	-
United States ^[13]	1:105	2845	NA	43%	-	-	-
Iceland ^[14]	1:136	813	36 (17-64)	76.30%	-	-	-
Brazil ^[15]	1:214	2045	32.8 (18-61)	87.60%	-	-	-
Netherlands ^[16]	1:333	1000	NA	NA	-	-	-
Norway ^[17]	1:340	2069	3 (18-67)	66.30%	-	-	-
Iran ^[18]	1:400	2000	35.5 (18-65)	79%	-	-	-
Brazil ^[19]	1:681	2045	32.8 (18-61)	87.60%	-	-	-
Non-population representative collectives							
Turkey ^[20]	1:100	906	38.6 (20-59)	50%	-	-	-
Switzerland ^[21]	1:132	1450	NA (12-18)	39.90%	-	-	-
Argentina ^[22]	1:167	2000	29 (16-79)	50%	-	-	-
Tunisia ^[23]	1:709	1418	27.5 (17-57)	73%	-	-	-
England ^[24]	1:83	7550	59 (45-76)	41%	-	-	-

tTGA: Tissue transglutaminase antibody; EMA: Endomysial antibody; AGA: Antigliadin antibody; NA: Not available; -: Positive.

sidered borderline, while titers > 16 U/L were considered positive. EMA was measured by means of an indirect immunofluorescence technique using a monkey esophagus immunofluorescence kit (The Binding Site, Ltd., Birmingham, United Kingdom). Positive samples exhibit an apple green fluorescence. IgG antibodies to tTGA were determined using an indirect, non-competitive enzyme immunoassay (Phadia GmbH, Freiburg, Germany) in which human recombinant tTGA antigen served as the solid phase. Titers of 7-10 U/mL were considered borderline, while titers > 10 U/L were considered positive.

All subjects testing positive for tTGA IgA underwent a confirmation test together with serological testing for antibodies to EMA and AGA. Subjects with low concentrations of total IgA were tested for tTGA IgG. Subjects with suspected celiac disease also underwent human leukocyte antigen (HLA) typing. Additional specific antibody testing was performed in order to assess the presence of other immunological disorders often associated with celiac disease (islet-cell antibody, anti-GAD, thyroid peroxidase antibody, auto-antibodies to adrenal cortex, parietal cell antibody).

Every effort was made to refer subjects with suspected celiac disease for esophagogastroduodenoscopy in order to obtain tissue samples from the duodenum.

The endoscopies and biopsies were performed by gastroenterologists in private practice. Between one and seven biopsy samples were obtained from each subject. The samples were examined histologically and classified according to the modified Marsh criteria^[35].

HLA loci were detected using the reverse sequence specific oligonucleotide (SSO) dot-blot method. The HLA-A, B and C loci were typed using the reverse SSO line-blot assay. Allele assignment was performed using the Helmberg score software with reference to the current nomenclature report and current literature^[36-38]. Ambiguities were resolved following sequencing of amplicons obtained after SSP with appropriate primers.

First follow-up screening

At the first follow-up assessment, conducted in December 2005, all antibody-positive subjects and subjects with histories suspicious for celiac disease underwent comprehensive re-examination. A total of 20 subjects were invited, of whom 14 (70%) participated (Figure 1). Subjects completed a diet and digestive symptoms questionnaire, antibody levels were rechecked and laboratory parameters routinely assessed in the work-up of celiac disease (blood count, coagulation parameters, iron, ferritin, hepatic enzymes, parathyroid hormone, calcium, magnesium, phos-

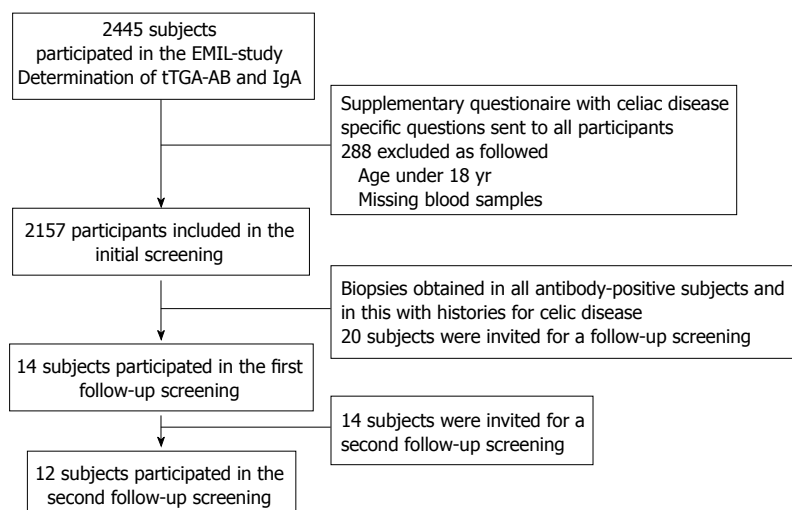


Figure 1 Flow of subjects across the study. tTGA: Tissue transglutaminase antibody; EMIL: Echinococcus Multilocularis and other Internal Diseases in Leutkirch; IgA: Immunoglobulin A.

phate) were obtained.

Second follow-up screening

As a second follow-up screening, a telephone survey was conducted in March 2008. This survey focused on dietary habits, diet compliance and improvement in symptoms as a result of a gluten-free diet. In this follow-up all celiac positives subjects were included. Also included were the questionable celiac positives. Overall, 12 of 14 (86%) subjects participating in the 2005 follow up were contacted by telephone and re interviewed (Figure 1).

Statistical analysis

Statistical calculations were performed with the assistance of the Faculty of Medical Documentation and Informatics of the University of Ulm using the SAS statistical software package (version 9.2; SAS Institute Inc., Cary, NC, United States). Data were analyzed descriptively with regard to absolute and relative frequencies, means and standard deviation. Sensitivity and specificity were calculated for all three antibody test methods. Because of the small number of cases, no statistical tests could be applied.

RESULTS

The study collective available for assessing the prevalence of celiac disease consisted of 2157 subjects (48.0% men, 52.0% women), corresponding to 88% of the total study population. Subjects' age ranged from 18 to 65 years. Their mean age was 42.6 years (standard deviation 12.9 years).

Initial screening

Fifty-five subjects exhibited a reduced total IgA concentration. However, elevated titers for tTGA IgG were not detected in any of these subjects. A total of 14 subjects (0.65%) were positive for tTGA IgA. Histological findings were available for 11 of these subjects. Celiac disease

was confirmed histologically in five cases (Figure 2).

Six subjects were seronegative but reported histories suspicious for celiac disease (Table 2). Histological findings were available for five of these subjects and confirmed the diagnosis of celiac disease in two cases. In two other subjects, the first diagnosis of celiac disease had already been made at a much earlier date and their histological findings were no longer available. Of these, one subject was HLA positive for DQA1 0101, DQB 0501 and was considered positive for celiac disease in our statistical analysis. The second subject was HLA negative for celiac disease and was considered negative for celiac disease in our statistical analysis (Figure 2). Thus, celiac disease was present in eight subjects, confirmed by biopsy in seven cases and by HLA typing in one case.

The sensitivity for tTGA IgA antibodies was 62.5%, with a specificity of 50.0%. EMA was associated with a sensitivity and specificity of 62.5% and 71.4%, respectively; and AGA with sensitivity and specificity of 62.5% and 71.4%, respectively. Confirmed false-negative findings were returned for tTGA IgA antibody in three cases, while false positive findings were documented in four cases. Both EMA and AGA were false negative in two cases and false positive in one case (Table 3).

First follow-up screening

Fourteen of 20 invited subjects participated in the first follow-up screening, corresponding to a participation rate of 70%. tTGA IgA antibodies were detected in three subjects. AGA titers were definitely positive in two subjects. Two subjects were again positive for EMA. Of the six subjects who were initially seronegative but with histories suggestive of celiac disease, three took part in the first follow-up screening: of these, one exhibited positive AGA findings.

Second follow-up screening

The participation rate at the second follow-up screening stood at 86%, 12 of 14 subjects being reached by tele-

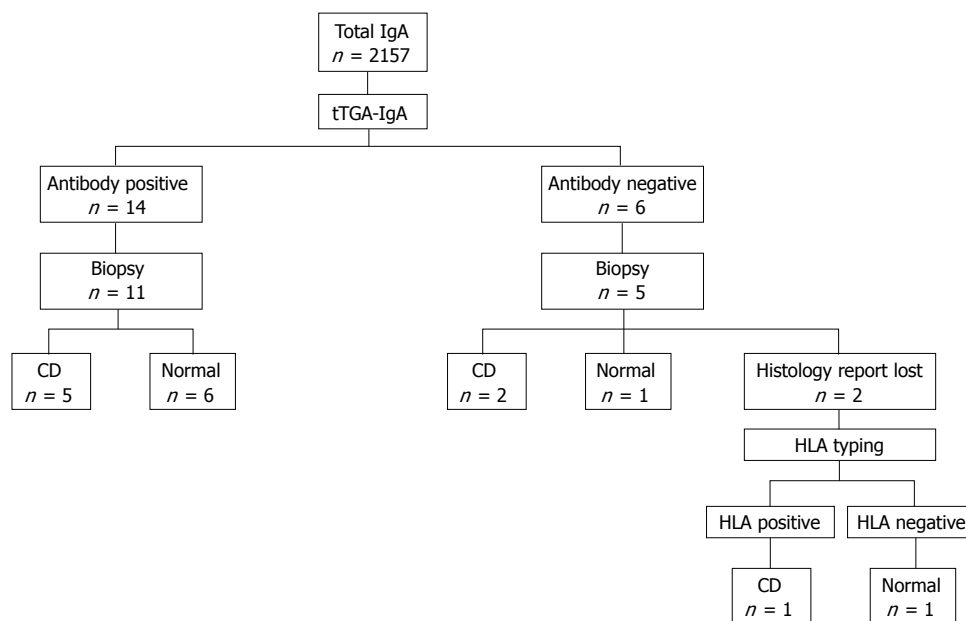


Figure 2 Subjects positive for celiac disease (based on positive antibody tests or by prior history). Total IgA: Total immunoglobulin A; tTGA IgA: Tissue transglutaminase immunoglobulin A; AB positive: Antibody positive; AB negative: Antibody negative; n: Number of subjects; CD: Celiac disease; HLA typing: Human leukocyte antigen typing; HLA: Human leukocyte antigen; HLA positive: Positive for Human leukocyte antigen; HLA negative: Negative for Human leukocyte antigen.

Table 2 Clinical presentation in subjects with seronegative findings but with histories suggestive of celiac disease

Age (yr), sex	Clinical presentation
41 yr, female	Diagnosed in 2000, histology unavailable as report destroyed Diarrhea, weight loss of 43 kg prior to diagnosis, adynamia, flatulence, psychiatric symptoms, paresthesias in the fingers In last six months, new onset of epilepsy with petit-mal seizures
18 yr, female	Diagnosed in 2000, histology unavailable as report destroyed; control biopsies in 1990 and 2005 both without evidence of several signs typical for celiac disease
62 yr, female	Sicca syndrome, lactose intolerance, diarrhea and weight loss Diarrhea, weight loss, fatigue, bone pain, alopecia, osteoporosis, cheilosis. Bronchiectasis known for years
60 yr, female	Diagnosed in 1989, no other data available
40 yr, female	Diagnosed in 1989
56 yr, male	Sporadic constipation, meteorism, no diarrhea Weight loss, abdominal pain, depressive phases, muscle cramps, eczema on the legs and perianal, meteorism, diarrhea after drinking wheat beer

phone and amenable to participation in the standardized interview. Five of eight subjects in our collective had developed classic celiac disease. All subjects maintained a gluten-free diet and reported significant improvement in their intestinal symptoms (Tables 3 and 4). Two further subjects developed atypical celiac disease, which is characterized by mild, atypical symptoms. One subject was monosymptomatic, exhibiting only psoriasis. Subjects were antibody positive and histology revealed changes consistent with Marsh 0-IIIc disease. Despite a strict gluten-free diet, the subject did not report any improvement in his psoriasis (Tables 3 and 4).

The second, female subject was completely asymptomatic. Lactose intolerance was suspected from the subject's history and she avoided all corresponding foods. The subject was antibody positive and histology was consistent with Marsh IIIc disease. Because she continued to be asymptomatic, the subject refused to maintain a gluten-free diet (Tables 3 and 4).

Transient celiac disease was diagnosed in one of the eight subjects. In this disease form, a gluten-free diet leads to complete remission. In this subject, celiac disease had been first diagnosed when she was nine months of age. The subject maintained a strict gluten-free diet until her sixth year; subsequent gastroscopic monitoring failed to return evidence of celiac disease. Since that time, the subject has returned to a diet containing gluten. The subject was negative for DQ2 and DQ8 at HLA typing, but returned positive findings for DQA1*0101 and DQB1*0501. This HLA pattern is observed in rare cases in patients with celiac disease. Lactose intolerance was diagnosed in 2004. Gastroscopy performed under the impetus of the present study revealed no evidence of celiac disease. Negative antibody titers during gluten exposure and biopsy findings consistently negative for celiac disease both initially and during the patient's subsequent course correspond to the subtype of transient celiac disease. Based on these HLA findings and improvement in

Table 3 Change in celiac-specific antibody titers over time

No.	Age (yr), sex	Initial examination			First follow up		
		tTG-IgA (U/mL)	AGA (U/mL)	EMA	tTG-IgA (U/mL)	AGA (U/mL)	EMA
Classic celiac disease							
2	58, F	5.5	19.4	Weak Pos	Neg	Neg	Neg
4	20, F	> 100	27.6	Pos	Neg	Neg	Neg
5	52, F	44.9	24.7	Pos	Neg	Neg	Neg
17	56, M	Neg	78.1	Pos	Neg	Neg	Neg
18	62, F	Neg	Neg	Neg	7	> 100	Neg
Atypical celiac disease							
1	40, M	> 100	69.6	Pos	29.9	38.1	Pos
3	42, F	41.9	56.2	Pos	27	20.1	Pos
Transient celiac disease							
16	18, F	Neg	Neg	Neg	Neg	Neg	Neg

No.: Subject number; F: Female; M: Male; tTG-IgA: Tissue transglutaminase immunoglobulin A; AGA: Antigliadin antibody immunoglobulin A; EMA: Endomysial antibody; Pos: Positive; Neg: Negative.

symptoms subsequent to starting a gluten-free diet, this patient was considered positive for celiac disease despite lack of initial histological findings.

No other autoimmune disorders were found in our collective of patients with celiac disease. Abnormal laboratory findings suggestive of celiac disease were only moderately pronounced. None of the subjects exhibited iron deficiency anemia. Parathyroid hormone levels were elevated in two subjects with celiac disease.

DISCUSSION

To date, very few studies have prospectively investigated the prevalence of celiac disease in representative, population-based samples (Table 1). In fact, no corresponding data from a population-based study of adults are available for Germany.

The EMIL study was designed as a cross-sectional investigation in order to obtain a collective that most closely represented the general population. By contrast, a large number of recent studies^[11-19] have drawn their collectives from blood donors, who are not necessarily representative of a population. A few other studies have investigated non-population representative collectives^[20-24].

Our findings correspond to a prevalence of 1:270 (0.37%) for adults in an urban population in Germany. Other population-based studies have reported prevalences between 0.18% and 2.4%^[1-10], while, for blood donor collectives, prevalences of 0.15%-2.7%^[11-19] have been reported. Henker *et al.*^[39] report a prevalence of 0.19% for asymptomatic celiac disease in children and blood donors. In another study, the same authors report a prevalence of 0.044% in children^[40]. In a study of the incidence of celiac disease in Berlin, Sandforth *et al.*^[41] report an incidence rate of 0.05%. Because of the nature of the collectives, however, these data cannot be compared with our findings. In fact, only one study (Monika Project) retrospectively investigated a representative population-based sample in Germany^[10]. The prevalence of 0.3% reported

in that study is comparable to our findings.

Mustalahti *et al.*^[10] identified large variability in the prevalence of celiac disease between European nations (Finland, 2.4%; Germany, 0.3%; Italy, 0.7%). Although the precise cause of this difference remains unclear, genetic and environmental factors have been discussed. The study by Mustalahti *et al.*^[10] must be assessed critically due to its retrospective nature and the quality of the blood samples.

The antibody test methods utilized in the present study to assess for celiac disease have been shown in a comparison of 34 studies to possess both high sensitivity and quite good specificity (tTG-IgA: 93% *vs* 98%, EMA 93% *vs* 99%)^[42]. The test method for AGA was associated with a lower sensitivity and specificity (80% *vs* 80%-90%)^[43]. In contrast to these results, Dickey *et al.*^[44] and Rostami *et al.*^[45] report a lower sensitivity for AGA and EMA. The results of these tests depend on the severity of mucosal damage. If the damage is slight, the test results may be negative^[45]. As a consequence, the prevalence of celiac disease is not only underestimated but treatment of affected individuals is delayed, which may be associated with an increased risk of malignancy^[46]. Compared with data published by Lewis *et al.*^[42], the present study found a lower sensitivity (62.50%) and specificity (50%) for tTGA IgA antibody. In the present study, EMA and AGA showed comparably a high sensitivity (62.5%) and specificity (71.4%).

The findings of the present study suggest that the use of tTGA IgA antibody as a suitable method for screening a population for celiac disease should be reconsidered^[42,47]. It was only by means of our follow-up examinations that we were able to identify subjects with celiac disease with false-negative antibody titers. Otherwise, the prevalence of celiac disease in our collective would have been too low. With the 50% response rate to our celiac disease questionnaire, it cannot be excluded that there may be other undetected false-negative antibody results. A definite conclusion regarding the reliability of this antibody test method is difficult: on the one hand, the number of patients in the different collectives is very small; also, there have been only very few studies to date in which all antibody-positive patients have been biopsied^[2,8,23].

Quantitative video capsule endoscopy has been described in the literature as a new method in diagnosing celiac disease^[48,49]. The findings of these studies show that quantitative image analysis corresponds to the degree of villous atrophy. These studies, however, show some limitations; hence, the value of this new method must be investigated in further studies.

A limiting factor in the present study certainly relates to the study design itself. The EMIL study was not originally conceived to determine the prevalence of celiac disease. As a result, all study participants had to be sent a questionnaire following completion of the initial EMIL study, the response rate to which stood at only 50%. A further disadvantage is the inclusion in our collective of patients who had already been diagnosed with celiac

Table 4 Clinical presentation, histology and human leukocyte antigen findings in subjects with celiac disease

No.	Age (yr), sex	Histology	HLA DQ2	Clinical presentation
Classical celiac disease				
2	58, F	IIIc	Pos	Diarrhea, abdominal cramps, angular cheilitis, osteoporosis, depression, brittle nails, hypothyroidism
4	20, F	IIIa-IIIc	Pos	Diarrhea, weight variability, circulatory collapse, cheilosis, depression, anxiety, insomnia, brittle nails, restless-leg syndrome
5	52, F	IIIb	Pos	Fatigue, 1 intestinal cramping, nausea, vomiting, weight loss, paresthesias in the hands, joint, bone and abdominal pains, anxiety, depression, Sicca syndrome, muscle cramps
17	56, M	IIIc	Pos	Weight loss, abdominal cramping, depressive phases, muscle cramps, anal eczema, meteorism, diarrhea following consumption of wheat beer
18	62, F	IIIc	Pos	Diarrhea, weight loss, fatigue, bone pain, alopecia, osteoporosis, cheilosis, bronchiectasia
Atypical celiac disease				
1	40, M	0, IIIc	Pos	Psoriatic lesion on the head
3	42, F	IIIc	Pos	No symptoms, suspected lactose intolerance
Transient celiac disease				
16	18, F	NoHisto, ED 1985	Neg	Diarrhea, weight loss, Sicca syndrome, lactose intolerance since 2004

HLA: Human leukocyte antigen; No.: Subject number; Age: In years; NoHisto: Histological findings unavailable; F: Female; M: Male; Histology: Histological findings classified according to Marsh stage; NA: Not available; Pos: Positive; Neg: Negative.

disease. Also problematic is the impact on the standardization of examination conditions of the retroactive refocusing of the study on determining the prevalence of celiac disease. Patients were referred for endoscopy to several gastroenterologists in private practice in Leutkirch. Biopsies returned between one and seven tissue samples. The histological assessment of the biopsy material was performed by pathologists in different centers.

In conclusion, the findings of the present study show a prevalence of 0.37% for celiac disease, which is comparable to that reported in other European studies. The use of a combination of several antibody test methods for screening examinations appears useful.

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COMMENTS

Background

Celiac disease may present with typical clinical signs or patients may be oligo-symptomatic or completely asymptomatic. It is associated with specific, often serious complications. As all forms of celiac disease yield the same risk for complications and especially T cell lymphoma, it is paramount to detect not only the classical form but also patients with atypical disease manifestation.

Research frontiers

Prevalence rates for celiac disease vary for different populations. This may also be due to the scarcity of data from representative samples. Serological antibody

tests constitute the most important screening tools. In the literature the sensitivity and specificity of transglutaminase immunoglobulin-A, endomysium antibody and anti-gliadin antibody tests differ.

Innovations and breakthroughs

This is the first study to prospectively assess the prevalence of celiac disease in a representative population sample of adults in Germany. In comparison to results of the small bowel biopsy the sensitivity and specificity of serological antibody tests for celiac disease were lower than previously described in the literature.

Applications

Their results add to an accurate estimate of the prevalence of celiac disease in the general population. The use of a single antibody test for screening purposes must be called into question.

Peer review

Data over recent years have generally noted increased recognition and diagnosis of celiac disease (CD), with rates approaching 2% in some settings. Rates however, appear to vary between geographical regions. This study based in one German city examined several serological tests and gastroenterology symptoms in a large population of adults. The determined prevalence of less than 0.5% is consistent with some previous data, but substantially less than rates in other countries. Interestingly, only 2 of these 2157 adults had previously been thought to have CD, emphasising that CD is often not recognised in routine clinical practice.

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