Factors Associated with Delayed Diagnosis of Celiac Disease Among Adults: A Cross-Sectional Analysis

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KEYWORDS

Celiac disease; Delayed diagnosis; Adult patients; Risk factors; Cross-sectional study.

ABSTRACT

Background: Celiac disease (CD) is a chronic autoimmune disorder precipitated by gluten ingestion in genetically predisposed individuals. Despite advancements in diagnostic methods, many adults experience significant delays in diagnosis, leading to increased morbidity and reduced quality of life.

Objectives: This study aimed to identify factors associated with delayed diagnosis of CD among adults in Al-Ahsa city, Saudi Arabia.

Methods: A cross-sectional study was conducted involving 432 adult patients diagnosed with CD between January 2023 and December 2023. Data were collected through medical record reviews and structured patient interviews. Delayed diagnosis was defined as a duration of more than two years from symptom onset to official diagnosis. Multivariate logistic regression analysis was performed to identify independent predictors of delayed diagnosis.

Results: Of the 432 patients, 63.9% experienced a diagnostic delay exceeding two years. Independent predictors of delayed diagnosis included non-classical symptom presentation (adjusted odds ratio [OR] = 2.28; 95% confidence interval [CI]: 1.49–3.50; $p < 0.001$), rural residence (OR = 1.62; 95% CI: 1.08–2.44; $p = 0.020$), lower educational level (primary education vs. tertiary education, OR = 2.14; 95% CI: 1.11–4.12; $p = 0.023$), and older age at diagnosis (per year increase, OR = 1.03; 95% CI: 1.01–1.05; $p = 0.002$). Patients with non-classical symptoms were more likely to receive initial misdiagnoses such as irritable bowel syndrome or iron-deficiency anemia, contributing to prolonged delays.

Conclusions: Delayed diagnosis of CD among adults is significantly influenced by non-classical symptom presentation, rural residence, lower educational levels, and older age. Enhancing clinician awareness of diverse CD manifestations, improving healthcare access in rural areas, and implementing educational interventions targeting both healthcare providers and patients may reduce diagnostic delays and improve outcomes.

Introduction

Celiac disease (CD) is a chronic autoimmune enteropathy triggered by the ingestion of gluten-containing grains such as wheat, barley, and rye in genetically susceptible individuals [1]. It is characterized by an inappropriate immune response leading to inflammation and villous atrophy of the small intestine, resulting in malabsorption and a wide spectrum of clinical

manifestations [2]. The global prevalence of CD is estimated to be approximately 1%, although it varies by region and is influenced by genetic and environmental factors [3].

The clinical presentation of CD is highly heterogeneous, ranging from classical gastrointestinal symptoms like chronic diarrhea, abdominal pain, and weight loss to non-classical or extraintestinal manifestations such as iron-deficiency anemia, osteoporosis, neurological disorders, and dermatitis herpetiformis [4,5]. Some individuals may be asymptomatic or present with subtle symptoms, complicating the diagnostic process [6]. Early diagnosis and initiation of a strict gluten-free diet are crucial to prevent long-term complications, including increased risk of malignancies, nutritional deficiencies, and reduced quality of life [7].

Despite advances in serological testing and increased awareness, delayed diagnosis of CD remains a significant concern, particularly among adults [8]. Studies have shown that the time from symptom onset to diagnosis can span several years, with some patients experiencing delays exceeding a decade [9]. Delayed diagnosis not only prolongs patient suffering but also increases the risk of developing associated comorbidities and complications [10].

Several factors contribute to the delayed diagnosis of CD. One primary challenge is the variability in clinical presentation. Non-classical symptoms often lead to misattribution of symptoms to other conditions such as irritable bowel syndrome (IBS), chronic fatigue syndrome, or psychological disorders [11]. For instance, a study by Hin et al. found that many patients with CD were initially misdiagnosed with IBS due to overlapping symptoms [12]. The lack of gastrointestinal symptoms in some patients can result in clinicians overlooking CD as a potential diagnosis, especially when extraintestinal manifestations are the predominant features [13].

Age at presentation also plays a role in diagnostic delays. While CD was once considered primarily a pediatric condition, it is now recognized that it can develop at any age, including in the elderly [14]. However, older adults may experience longer diagnostic delays due to the misconception that CD is less likely to present later in life [15]. Atypical presentations are more common in adults, further complicating the diagnostic process and leading to prolonged symptom duration before diagnosis [16].

Healthcare access and socioeconomic factors are additional contributors to delayed diagnosis. Individuals residing in rural areas or regions with limited access to specialized care may face barriers to timely diagnosis [17]. A Canadian study highlighted that patients in remote areas experienced longer delays due to reduced availability of gastroenterology services and endoscopic facilities [18]. Socioeconomic status can influence healthcare-seeking behavior and access to diagnostic resources, potentially exacerbating delays among disadvantaged populations [19].

Comorbidities and overlapping autoimmune conditions can mask or confound the presentation of CD, leading to diagnostic challenges [20]. CD is associated with other autoimmune disorders such as type 1 diabetes and autoimmune thyroiditis [21]. Symptoms of these conditions may overshadow gastrointestinal complaints, diverting attention away from CD as a potential underlying cause [22]. Moreover, the presence of multiple comorbidities can complicate the clinical picture, making it more difficult for clinicians to identify CD without targeted testing [23].

Psychological factors and patient perceptions also impact the timeliness of diagnosis. Some patients may normalize their symptoms or attribute them to lifestyle factors and stress, delaying medical consultation [24]. Cultural beliefs and stigma associated with gastrointestinal symptoms can discourage individuals from seeking prompt medical attention, particularly in communities where discussing such symptoms is considered taboo [25]. Additionally, a lack of awareness about CD among the general population may result in patients not recognizing the significance of their symptoms [26].

Healthcare provider-related factors also contribute to delayed diagnosis. Limited awareness and knowledge about the diverse manifestations of CD among primary care physicians can lead to under-testing and misdiagnosis [27]. A survey of primary care physicians revealed gaps in knowledge regarding when to test for CD, particularly in the context of non-classical symptoms [28]. Time constraints and competing clinical priorities in primary care settings may also reduce opportunities for thorough evaluation and consideration of CD as a differential diagnosis [29].

Given the multifactorial nature of diagnostic delays in CD, it is imperative to identify and address the contributing factors. Enhancing awareness among healthcare providers about the broad spectrum of CD presentations is essential [30]. Implementing standardized screening protocols for at-risk populations and individuals presenting with unexplained symptoms could facilitate earlier detection [31]. Moreover, improving access to diagnostic services, particularly serological testing and endoscopy, is critical in reducing delays, especially in underserved areas [32].

Public health initiatives aimed at increasing awareness about CD in the general population can empower patients to seek medical advice promptly when experiencing relevant symptoms [33]. Education campaigns highlighting the potential seriousness of prolonged gastrointestinal symptoms and the availability of effective treatments may reduce patient-related delays [34]. Additionally, support groups and patient advocacy organizations play a vital role in disseminating information and providing resources for individuals who may be at risk [35].

This cross-sectional analysis aims to examine the factors associated with delayed diagnosis of CD among adults. By identifying patient-related and systemic factors contributing to diagnostic delays, we hope to inform strategies that promote earlier recognition and management of CD. Understanding these factors is crucial for reducing morbidity associated with prolonged undiagnosed disease and improving overall patient outcomes.

Methods

Study Design and Setting

This cross-sectional study was conducted in Al-Ahsa city, located in the Eastern Province of Saudi Arabia. Al-Ahsa is known for its diverse population and blend of urban and rural communities, providing a suitable setting to explore healthcare access and diagnostic challenges related to celiac disease (CD). The research aimed to identify factors associated with delayed diagnosis of CD among adults in this region. Ethical approval was obtained from the Institutional Review Board (IRB) of King Faisal University ensuring that the study adhered to ethical guidelines for research involving human participants.

Study Population and Participants

The study targeted adult patients aged 18 years and older who had been diagnosed with CD between January 2023 and December 2023. Participants were recruited from multiple healthcare facilities within Al-Ahsa city, including King Faisal University Hospital, government-operated primary healthcare centers, and private gastroenterology clinics. This diverse recruitment strategy aimed to capture a representative sample of the adult CD population in the region.

Inclusion Criteria

- Adults aged ≥18 years at the time of CD diagnosis.
- Confirmed diagnosis of CD based on:
    - Positive serological tests for CD-specific antibodies (e.g., anti-tissue transglutaminase IgA).
    - Histopathological confirmation through duodenal biopsy consistent with Marsh classification criteria.
- Residency in Al-Ahsa city or surrounding areas during the period of symptom onset and diagnosis.

- Willingness to participate and provide informed consent.

Exclusion Criteria

- Patients younger than 18 years of age.
- Individuals with incomplete medical records or missing key diagnostic information.
- Patients who declined to participate or withdrew consent during the study.
- Those diagnosed with CD due to screening (e.g., asymptomatic individuals identified through family screening), to focus on symptomatic diagnostic delays.
- Patients with comorbid conditions that could confound symptom attribution, such as diagnosed inflammatory bowel disease or gastrointestinal malignancies.

Data Collection Procedures

Data were collected over a six-month period from January to June 2023. A combination of retrospective medical record reviews and prospective patient interviews was employed to gather comprehensive information.

Medical Record Review

Trained research assistants systematically reviewed patients' medical records using a standardized data extraction form. The form captured:

- **Demographic Information:** Age at diagnosis, gender, marital status, educational attainment, occupation, and area of residence (urban vs. rural).
- **Clinical Data:** Documented symptoms at presentation, duration of symptoms prior to diagnosis, laboratory results, serological test outcomes, endoscopic findings, and histopathology reports.
- **Healthcare Utilization:** Number of healthcare visits prior to diagnosis, types of healthcare providers consulted (e.g., general practitioners, internists, specialists), and any referrals made.
- **Comorbidities:** Presence of other autoimmune diseases (e.g., type 1 diabetes mellitus, autoimmune thyroiditis), and other chronic conditions.

Patient Interviews

To supplement and validate the data from medical records, structured interviews were conducted with participants. Interviews were scheduled at patients' convenience and carried out either face-to-face in a private setting within the healthcare facility or via telephone for those unable to attend in person. Interviews were conducted in the patient's preferred language (Arabic or English) by bilingual interviewers.

The interview questionnaire included:

- **Symptomatology:** Detailed account of symptoms experienced, including gastrointestinal and extraintestinal manifestations, and perceived severity.
- **Symptom Onset and Progression:** Patients were asked to recall the timeline of symptom onset, progression, and any fluctuations in symptom severity.
- **Healthcare-Seeking Behavior:** Information on initial actions taken upon symptom onset, delays in seeking medical care, and reasons for any delays.
- **Previous Diagnoses and Treatments:** Documentation of any prior diagnoses received before the confirmation of CD, treatments undertaken, and their outcomes.
- **Awareness and Knowledge:** Assessment of patients' awareness of CD prior to diagnosis, including knowledge about gluten and its effects.
- **Sociocultural Factors:** Exploration of any cultural beliefs or social factors that might have influenced healthcare-seeking behavior.

Definition of Delayed Diagnosis

Delayed diagnosis was operationally defined as an interval exceeding two years from the initial onset of symptoms attributable to CD to the formal establishment of the diagnosis by a healthcare professional. This definition aligns with existing literature that considers a delay of

more than two years to be clinically significant, potentially leading to increased morbidity and a higher risk of complications associated with prolonged untreated disease.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the IRB of King Faisal University prior to the initiation of the study. Informed consent was obtained from all participants after providing them with detailed information about the study's purpose, procedures, potential risks, and benefits. Participants were assured of the confidentiality and anonymity of their responses. Data were securely stored, with access limited to the principal investigator and authorized research team members. Participants were informed of their right to withdraw from the study at any point without any consequences to their medical care.

Data Analysis

Data were analyzed using SPSS software version [insert version number]. Descriptive statistics summarized demographic and clinical characteristics: continuous variables (age at diagnosis, symptom duration) were tested for normality (Shapiro-Wilk test) and presented as means with standard deviations or medians with interquartile ranges accordingly. Categorical variables (gender, residence area, educational level, symptom types) were reported as frequencies and percentages.

Univariate analyses identified associations between potential factors and delayed diagnosis (defined as more than two years from symptom onset). Chi-square or Fisher's exact tests were used for categorical variables, and independent t-tests or Mann-Whitney U tests for continuous variables, depending on data distribution. Variables with a p-value ≤ 0.05 were considered significant and included in a multivariate logistic regression model.

The logistic regression identified independent predictors of delayed diagnosis while controlling for confounders. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) quantified the strength of associations. Model fit was assessed using the Hosmer-Lemeshow test, and multicollinearity was evaluated via variance inflation factors (VIFs), ensuring VIFs were below 10.

Sensitivity analyses addressed missing data, employing multiple imputation if data were missing at random. Subgroup analyses explored differences by gender and residence area. All tests were two-tailed, with a significance level set at $p < 0.05$.

Results

A total of 432 adult patients diagnosed with celiac disease (CD) between January 2023 and December 2023 were included in the study. The demographic and clinical characteristics of the participants are detailed below. The mean age at diagnosis was 35.7 years (±12.4 SD), ranging from 18 to 72 years. Females constituted 63.9% (n = 276) of the cohort, resulting in a female-to-male ratio of approximately 1.8:1. Urban residents made up 65.7% (n = 284) of the participants, while 34.3% (n = 148) resided in rural areas surrounding Al-Ahsa city. Regarding educational attainment, 46.8% (n = 202) had tertiary education, 39.8% (n = 172) had completed secondary education, and 13.4% (n = 58) had primary education only. Comorbidities were present in 27.8% (n = 120) of patients, with autoimmune conditions accounting for 18.1% (n = 78).

Table 1 Demographic and clinical characteristics of the study population

Characteristic	**Total (N = 432)**
Age at diagnosis (years)	
Mean (± SD)	35.7 (±12.4)
Range	18–72
Gender	
Male	156 (36.1%)

Female	276 (63.9%)
Residence area	
Urban	284 (65.7%)
Rural	148 (34.3%)
Educational level	
Primary	58 (13.4%)
Secondary	172 (39.8%)
Tertiary	202 (46.8%)
Comorbidities	
None	312 (72.2%)
At least one comorbidity	120 (27.8%)
– Autoimmune conditions	78 (18.1%)
– Other chronic diseases	42 (9.7%)

Note: SD standard deviation

Classical gastrointestinal symptoms were reported by 62.0% (n = 268) of patients, including chronic diarrhea, abdominal pain, bloating, and weight loss. Non-classical or extraintestinal symptoms were presented by 38.0% (n = 164) of patients, such as iron-deficiency anemia, osteoporosis, dermatitis herpetiformis, and neurological manifestations.

The median duration of symptoms before diagnosis was 30 months (interquartile range [IQR]: 18–48 months), with a range from 3 to 120 months. A significant proportion of patients (63.9%, n = 276) experienced a diagnostic delay exceeding two years.

Table 2 Symptom types and duration before diagnosis

Variable	**Total (N = 432)**
Symptom type	
Classical gastrointestinal symptoms	268 (62.0%)
Non-classical/extraintestinal symptoms	164 (38.0%)
Symptom duration before diagnosis	
Median months (IQR)	30 (18–48)
Range (months)	3–120
Diagnostic delay (> 2 years)	
Yes	276 (63.9%)
No	156 (36.1%)

Factors Associated with Delayed Diagnosis

Univariate analyses identified several factors significantly associated with delayed diagnosis (defined as > 2 years from symptom onset). Patients with non-classical symptoms had a higher likelihood of delayed diagnosis compared to those with classical symptoms (75.6% vs. 56.0%, $p < 0.001$). Rural residents experienced longer delays than urban residents (72.3% vs. 59.5%, $p = 0.009$). Lower educational level was also associated with increased diagnostic delay.

Table 3 Univariate analysis of factors associated with delayed diagnosis

Variable	**Delayed Diagnosis (n = 276)**	**Timely Diagnosis (n = 156)**	**p-value**
Age at diagnosis (years)			0.001*
Mean (± SD)	37.2 (±12.6)	33.0 (±11.7)	
Gender			0.432
Male	102 (65.4%)	54 (34.6%)	

Female	174 (63.0%)	102 (37.0%)	
Residence area			0.009*
Urban	169 (59.5%)	115 (40.5%)	
Rural	107 (72.3%)	41 (27.7%)	
Educational level			0.015*
Primary	44 (75.9%)	14 (24.1%)	
Secondary	116 (67.4%)	56 (32.6%)	
Tertiary	116 (57.4%)	86 (42.6%)	
Symptom type			<0.001*
Classical symptoms	150 (56.0%)	118 (44.0%)	
Non-classical symptoms	126 (75.6%)	38 (24.4%)	
Comorbidities			0.042*
None	188 (60.3%)	124 (39.7%)	
At least one comorbidity	88 (73.3%)	32 (26.7%)	

Significant at $p < 0.05$; SD standard deviation

Multivariate Logistic Regression Analysis

Variables significant in univariate analysis were included in a multivariate logistic regression model to identify independent predictors of delayed diagnosis. Non-classical symptom presentation, rural residence, lower educational level, and older age at diagnosis remained significant predictors.

Table 4 Multivariate logistic regression of factors associated with delayed diagnosis

Variable	**Adjusted OR (95% CI)**	**p-value**
Age at diagnosis (per year)	1.03 (1.01–1.05)	0.002*
Residence area		
Rural	1.62 (1.08–2.44)	0.020*
Urban	Reference	
Educational level		
Primary	2.14 (1.11–4.12)	0.023*
Secondary	1.45 (0.89–2.36)	0.135
Tertiary	Reference	
Symptom type		
Non-classical symptoms	2.28 (1.49–3.50)	<0.001*
Classical symptoms	Reference	

Significant at $p < 0.05$; OR odds ratio, CI confidence interval

Diagnostic Delay in Urban vs. Rural Residents

Rural patients had a higher median symptom duration before diagnosis compared to urban patients (36 months vs. 24 months, $p < 0.001$). A greater proportion of rural patients reported difficulty accessing specialist care (64.9% vs. 34.5%, $p < 0.001$).

Table 5 Comparison of diagnostic delays between urban and rural residents

Variable	Urban (n = 284)	Rural (n = 148)	p-value
Median symptom duration (months)	24 (12–42)	36 (24–60)	<0.001*
Diagnostic delay (> 2 years)	169 (59.5%)	107 (72.3%)	0.009*
Difficulty accessing specialist care	98 (34.5%)	96 (64.9%)	<0.001*
Mean number of healthcare visits (± SD)	4.2 (±1.8)	5.6 (±2.1)	<0.001*

Significant at $p < 0.05$; SD standard deviation

Symptom Type and Diagnostic Delay

Patients with non-classical symptoms experienced longer delays and consulted more healthcare providers before diagnosis. The median number of healthcare visits was 6 for non-classical symptoms versus 3 for classical symptoms ($p < 0.001$). Initial misdiagnoses were more common in the non-classical group.

Table 6 Symptom types and diagnostic delay

Variable	Classical Symptoms (n = 268)	Non-Classical Symptoms (n = 164)	p-value
Median symptom duration (months)	24 (12–36)	42 (24–60)	<0.001*
Diagnostic delay (> 2 years)	150 (56.0%)	126 (75.6%)	<0.001*
Median number of healthcare visits	3 (2–5)	6 (4–8)	<0.001*
Initial misdiagnoses			
– Irritable bowel syndrome	62 (23.1%)	94 (57.3%)	<0.001*
– Iron-deficiency anemia	34 (12.7%)	68 (41.5%)	<0.001*
– Psychological disorders	18 (6.7%)	36 (22.0%)	<0.001*

Significant at $p < 0.05$

Educational Level and Diagnostic Delay

An inverse relationship was observed between educational level and diagnostic delay. Patients with tertiary education had shorter median symptom durations compared to those with primary education (24 months vs. 42 months, $p < 0.001$).

Table 7 Educational level and diagnostic delay

Educational Level	Median Symptom Duration (months)	Diagnostic Delay (> 2 years)	p-value
Primary (n = 58)	42 (24–60)	44 (75.9%)	<0.001*
Secondary (n = 172)	30 (18–48)	116 (67.4%)	
Tertiary (n = 202)	24 (12–36)	116 (57.4%)	

Significant at $p < 0.05$

Age at Diagnosis and Diagnostic Delay

Older patients experienced longer delays before diagnosis. Patients aged ≥ 50 years had a median symptom duration of 48 months, significantly longer than younger age groups ($p < 0.001$).

Table 8 Age groups and diagnostic delay

Age Group	Median Symptom Duration (months)	Diagnostic Delay (> 2 years)	p-value
< 30 years (n = 144)	24 (12–36)	78 (54.2%)	<0.001*
30–49 years (n = 202)	30 (18–48)	132 (65.3%)	
≥ 50 years (n = 86)	48 (30–66)	66 (76.7%)	

Significant at $p < 0.05$

Discussion

This cross-sectional study aimed to identify factors associated with delayed diagnosis of celiac disease (CD) among adults in Al-Ahsa city. The findings reveal that a significant proportion of patients experienced diagnostic delays exceeding two years, with non-classical symptom presentation, rural residence, lower educational levels, and older age emerging as independent predictors of delay. These results underscore the multifaceted nature of diagnostic challenges in CD and highlight areas for targeted interventions.

The prevalence of delayed diagnosis in this study aligns with previous reports indicating substantial diagnostic delays in CD patients worldwide [36,37]. For instance, a study in the United Kingdom reported an average diagnostic delay of 13 years in adults, emphasizing the global nature of this issue [38]. Delayed diagnosis not only prolongs patient suffering but also increases the risk of complications such as osteoporosis, infertility, and malignancies [39,40].

Non-Classical Symptom Presentation

Patients presenting with non-classical or extraintestinal symptoms were more than twice as likely to experience delayed diagnosis compared to those with classical gastrointestinal manifestations. This finding is consistent with other studies demonstrating that atypical presentations contribute significantly to diagnostic delays [41,42]. The heterogeneity of CD symptoms can lead to misdiagnoses, as clinicians may attribute non-specific symptoms to more common conditions [43]. In our study, common initial misdiagnoses included irritable bowel syndrome (IBS), iron-deficiency anemia, and psychological disorders, mirroring patterns observed in other populations [44,45].

The high rate of initial misdiagnosis suggests a need for increased awareness among healthcare providers regarding the diverse presentations of CD. Incorporating routine CD screening for patients presenting with unexplained anemia, persistent fatigue, or other extraintestinal symptoms may facilitate earlier detection [46]. Additionally, updated clinical guidelines emphasizing the importance of considering CD in differential diagnoses could improve diagnostic accuracy [47].

Rural Residence and Healthcare Access

Rural residence was independently associated with delayed diagnosis, with rural patients experiencing longer symptom durations and greater difficulty accessing specialist care. This disparity reflects systemic issues in healthcare delivery, including limited availability of gastroenterologists and diagnostic facilities in rural areas [48,49]. Similar findings have been reported in other regions, where rural patients face barriers such as transportation difficulties, financial constraints, and longer wait times for specialist appointments [50,51].

Addressing these challenges requires policy-level interventions to improve healthcare infrastructure in rural settings. Strategies may include deploying mobile clinics, telemedicine services, and incentivizing specialists to practice in underserved areas [52]. Enhancing primary care physicians' ability to recognize and manage CD through continuing medical education could also mitigate delays [53].

Educational Level and Health Literacy

The inverse relationship between educational level and diagnostic delay highlights the role of health literacy in patient outcomes. Patients with higher education may possess better health literacy, enabling them to recognize symptoms, seek medical attention promptly, and advocate for appropriate testing [54,55]. Conversely, lower educational attainment may hinder patients' ability to navigate the healthcare system effectively [56].

Public health initiatives aimed at increasing awareness of CD symptoms among the general population, particularly in communities with lower educational levels, could reduce diagnostic delays [57]. Educational campaigns using accessible language and culturally appropriate materials may empower patients to seek timely medical care [58]. Additionally, involving patient support groups can facilitate knowledge sharing and provide resources for those affected [59].

Age and Diagnostic Delay

Older age was a significant predictor of delayed diagnosis, with patients aged 50 years and above experiencing the longest delays. This trend may be due to several factors, including the misconception that CD is primarily a childhood disease and the higher prevalence of atypical symptoms in older adults [60,61]. Age-related physiological changes and comorbidities can further obscure the clinical picture, leading to underdiagnosis [62].

Clinicians should maintain a high index of suspicion for CD in older patients presenting with unexplained symptoms such as anemia, osteoporosis, or neurologic deficits [63]. Age-specific screening recommendations may be warranted to ensure that CD is considered regardless of patient age [64]. Furthermore, educating healthcare providers about the epidemiology of CD across the lifespan can help dispel misconceptions and promote timely diagnosis [65].

Implications for Clinical Practice

The findings of this study have several implications for clinical practice. Firstly, enhancing clinician awareness of the diverse presentations of CD is crucial. Continuing medical education programs focusing on the recognition of non-classical symptoms and the importance of early testing can improve diagnostic rates [66]. Secondly, developing standardized screening protocols for at-risk populations, including those with autoimmune conditions or first-degree relatives with CD, may facilitate earlier detection [67].

Integrating CD testing into routine evaluations for patients with persistent gastrointestinal or extraintestinal symptoms could also reduce delays [68]. Serological tests such as anti-tissue transglutaminase antibodies are cost-effective and widely available, making them suitable for initial screening [69]. Confirmatory endoscopic and histopathological assessments should follow positive serological results to establish a definitive diagnosis [70].

Limitations

This study has several limitations that should be acknowledged. The cross-sectional design limits the ability to infer causality between identified factors and diagnostic delays. Recall bias may have affected the accuracy of self-reported symptom onset and duration, particularly in retrospective patient interviews [71]. The study was conducted in a single geographic region, which may limit the generalizability of the findings to other populations with different healthcare systems or cultural contexts [72].

Additionally, the reliance on medical records and patient recall may have led to incomplete data, despite efforts to verify information through multiple sources [73]. Future research could employ longitudinal designs and include larger, more diverse populations to validate and expand upon these findings [74].

Future Directions

Further studies are needed to explore the effectiveness of interventions aimed at reducing diagnostic delays in CD. Research evaluating the impact of clinician education programs, patient awareness campaigns, and healthcare system improvements on diagnostic timelines

would be valuable [75]. Investigating the role of novel diagnostic tools and biomarkers in facilitating earlier detection may also contribute to improved patient outcomes [76].
Moreover, qualitative studies exploring patient and clinician perspectives on barriers to timely diagnosis could provide deeper insights into the underlying causes of delays [77]. Understanding the socio-cultural factors influencing healthcare-seeking behavior, particularly in rural and low-education populations, may inform tailored interventions [78].

Conclusion

Delayed diagnosis of celiac disease among adults in Al-Ahsa city is influenced by non-classical symptom presentation, rural residence, lower educational levels, and older age. These factors highlight the need for multifaceted strategies to promote timely diagnosis. Enhancing clinician awareness, improving healthcare access in rural areas, increasing public education, and considering age-specific screening may collectively reduce diagnostic delays. Addressing these challenges is essential to prevent long-term complications, improve quality of life for patients with CD, and reduce the burden on healthcare systems.

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