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Abstract

Celiac disease is an autoimmune disease caused by gluten. This retrospective cross-sectional study with descriptive and analytical aims was conducted over three years, from 2018 to 2021. The participants were 280 patients diagnosed with celiac disease registered in the Gluten Intolerant and Allergic Association of the North in the Tangier-Tetouan-Al Hoceima region. The prevalence and incidence of celiac disease in this region were 1/135 and 1/253, respectively. The average age was 21.18±1.13, and the first symptoms appeared between 10 and 25 years. The data showed a female predominance of 68% versus 32% for males, with a male/female sex ratio of 0.45. The clinical signs of celiac disease manifested more in gastrointestinal symptoms. This study obtained data on 22.6% of microcytic hypochromic anemia patients and 40.7% of *Helicobacter pylori* infections. In addition to celiac disease, the patients showed other pathologies with different rates: repeated spontaneous abortions (2.14%), type 1 diabetes mellitus (1.42%), autism (1.42%), dermatitis herpetiformis (0.72%), cancer (0.72%), and epilepsy (0.35%). Serologically, anti-transglutaminase antibodies were positive in 47.2% of patients. Analyses of histological data from intestinal biopsies from 141 patients were positive in 50.8% of patients. There was a weak correlation between the serological profile and the degree of atrophy.

Keywords: celiac disease, histological, incidence, prevalence, serological

Introduction

Celiac disease (CD) is an immune-mediated response to gluten in wheat, barley, and rye.[1] Following SARS-CoV-2 infection, genetically predisposed people may be more likely to acquire CD, making COVID-19 a candidate for blame in the event of a CD epidemic in the near future.[2] The risk of CD varies within countries.[3] The CD has long been considered a pediatric disease, although it is common at all ages.[4] The incidence of CD is increasing internationally, but the causes of this are yet unknown.[5]

There has been a significant increase in new cases of this disease thanks to improved diagnostic tools and the early screening of people at risk.[6] The diagnosis of this disease is based on a combination of clinical evidence, serological tests, duodenal biopsies,[7] and responses to the gluten-free diet (GFD).[8] It is crucial to keep in mind that all symptoms should be considered important in the beginning.[9] Then, anti-transglutaminase, anti-gliadin, or anti-endomysium antibodies are checked in case of suspicion.[10] To confirm the diagnosis, a small bowel biopsy is recommended if the serological tests are positive.[8] Serology is beneficial but does not replace a duodenal biopsy, which is still necessary.[11] The biopsy is histologically characterized by villous atrophy of the duodenal and crypt hyperplasia.[12] The clinical remission obtained in the months following the introduction of a GFD contributes to the positive diagnosis.[13]

The CD can be detected in patients with anemia, growth retardation, and autoimmune disorders.[14] Once the diagnosis has been made, an additional workup is necessary to detect possible deficiencies such as anemia, hyposideremia, and hypogammaglobulinemia. The complications of CD are numerous; they can concern nutrition, hematology, and bone. CD can be associated with other autoimmune diseases, including thyroiditis, type 1 diabetes mellitus (T1DM), and other serious diseases such as cancer.[15] However, CD in adults is often discovered at the stage of complications. It is estimated that there are many more undiagnosed cases than diagnosed cases.[15] A GFD for life largely protects against most complications and corrects excess mortality.[16] This diet is difficult to follow for several reasons, so that many recent strategies have been developed to tackle the problems in gluten-free diets and products.[17]

In Morocco, few studies have been conducted on CD. In the north of the country, specifically in Tangier, very little data were published on this disease. In this context, this study focused on determining the demographic, clinical, serological, and histological characteristics of CD in the Tangier population, including the period of COVID-19. Several scientific publications on CD were published during the 2020–2021 COVID-19 pandemic, but the impact of the virus on CD incidence is unknown.

Method

This retrospective cross-sectional study with descriptive and analytical aims was conducted over three years (2018–2021). The population of the study during that period of time was 3,791,551 inhabitants of the Tangier-Tetouan-Al Hoceima region. The study involved 280 Moroccan patients with CD aged from one month to 63 years, lived in rural and urban areas of the TTA region, experienced similar social and economic conditions, and was registered with the Association of Gluten Intolerant and Allergic of the North (GIAAN).

Data were collected using a questionnaire that included sociodemographic, clinical, immunological, and histological parameters, as well as the results of the analyses prescribed by a doctor of patients from the GIAAN (Figure 1). Clinical manifestations from 220 patients were recorded, including gastrointestinal symptoms (e.g., abdominal bloating, diarrhea) and non-gastrointestinal symptoms (e.g., bone pain, delayed growth). Due to COVID-19 restrictions, a Google Forms questionnaire was distributed through social media to facilitate data collection. Immuno-serological parameters were analyzed in 180 patients, including anti-transglutaminase IgA antibodies (N = 132), anti-endomysium antibodies (N = 25), and anti-deamidated gliadin antibodies (N = 23). Additionally, histological parameters were assessed in 142 patients, focusing on the analysis of villous atrophy.

After entering the data into Excel, the SPSS Statistics 26 free trial software was used to analyze the data. The results were expressed in percentages, and the statistical analyses of the data consisted of an analysis of variance (ANOVA) and the least significant difference (LSD) test. Furthermore, a correlation test was performed between the serological tests and the histological profile.

Results

The prevalence of CD was determined as the proportion of affected individuals in the population at a given time. The prevalence of CD based on the identification of clinical history, serological positivity, and duodenal biopsy. With 3,791,551 inhabitants of the TTA region (2018–2021) as the population and 280 patients as the sample, it suggests that every one person represent 135

individuals in the population.

The incidence represented the number of new cases reported per year. There were 150 new cases diagnosed during this period (2018–2021) suggesting that every one person represent 253 individuals in the population. The results showed that 68% of the patients were female, while males represented only 32%. The females were the most affected by CD, with a male/female sex ratio of 0.45.
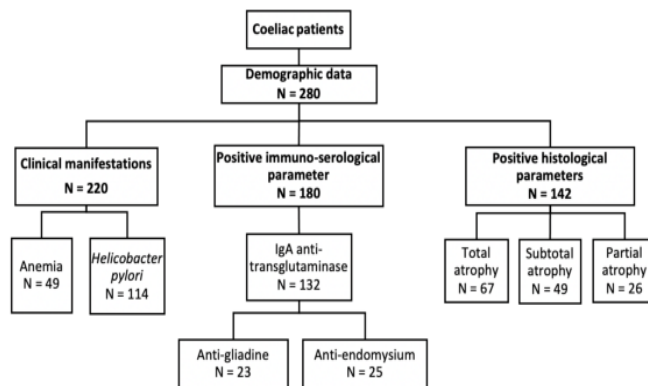
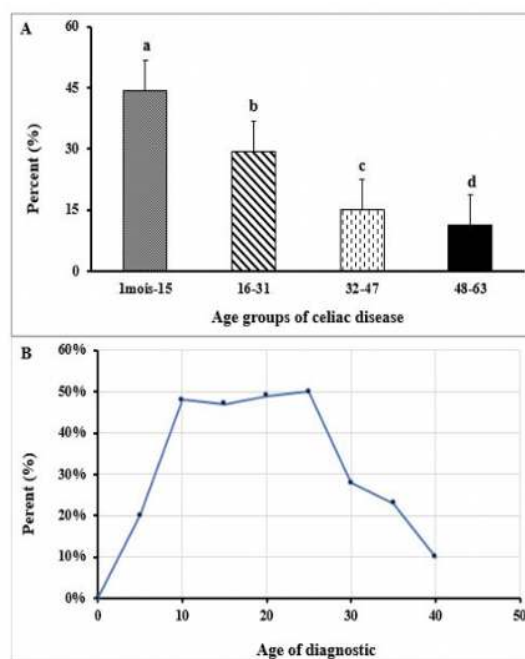The mean age of the CD patients was 21.18±1.13

Figure 1. Data of the Analyzed Parameter

Note: *Bans with different letters represent significantly different values according to Tukey's test (p-value≤0.05).
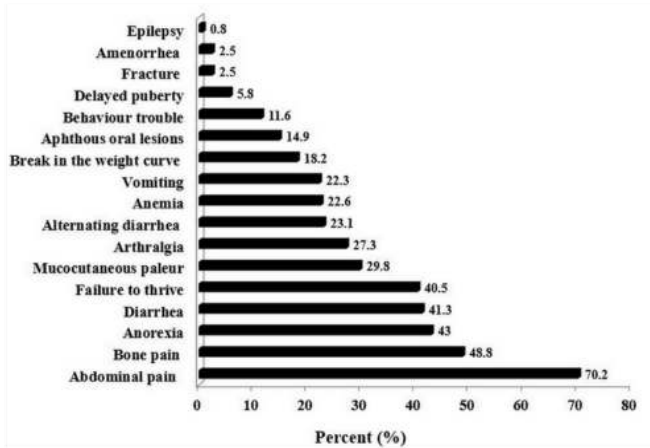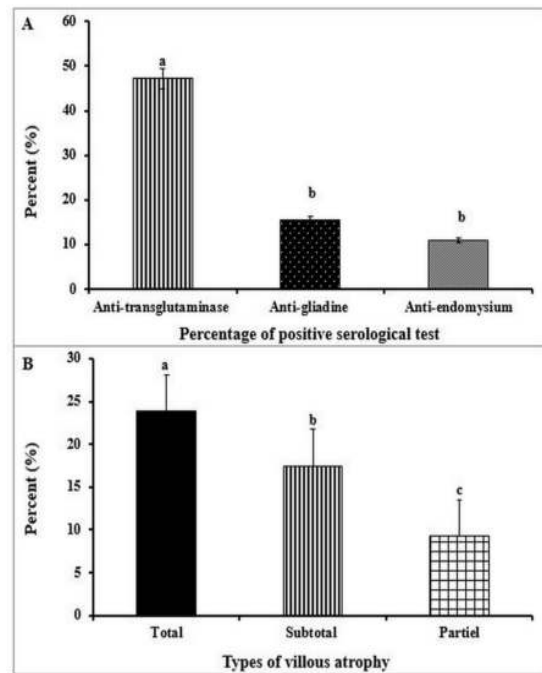
Figure 2. The Age Distribution

Figure 3. Clinical Characteristics of Celiac Disease

Note: *Bans with different letters represent significantly different values according to Tukey's test (p-value≤0.05).

Figure 4. Serological Tests and Types of Villous Atrophy

years, with the minimum and maximum ranging from one month to 63 years. Figure 2A shows that the age group of one month to 15 years is the modal class, which encompasses the biggest percentage of patients at 44.3%, followed by the adult population at 29.3%. The population aged 32–47 years represented 15% of the total number, and, lastly, the population range of 48–63 years had the lowest representation, with a mere 11.4%. It can be concluded that the population sample has different age groups: children, adolescents, adults, and older people. Figure 2B shows that CD could appear at birth and increase until aged 10 years when it reaches its peak. It showed a plateau between 10 and 25 years, when it started declining.

Figure 3 shows that the main signs that revealed CD in patients were mainly digestive—notably, abdominal bloating (70.2%), followed by anorexia (43%), diarrhea (41.3%), alternating diarrhea (23.1%), and vomiting (22.3%). The signs of non-gastrointestinal symptoms were manifested by a failure to thrive (40.5%), a break in the weight curve (18.2%), as well as microcytic hypochromic anemia (22.2%), bone pain (48.8%), arthralgia (27.3%), and fracture (2.5%). The physical signs present in the patients were characterized by mucocutaneous pallor (29.8%) and oral aphthosis (14.9%). Moreover, *Helicobacter pylori* (HP) infection was noted in 40.7% of the patients. Other manifestations were observed: the reproductive disorders of puberty delay (5.8%) and amenorrhea (2.5%) and the neurological disorders of behavioral disorders (11.6%).

The CD is frequently associated with other pathologies. Therefore, screening for these other conditions is necessary to diagnose CD. The main pathologies were associated with CD in this study. The results revealed that 6.77% of the CD patients (n = 19) had associated diseases, including six recurrent spontaneous abortions (2.14%), four cases of T1DM (1.42%), four cases of autism (1.42%), two cases of dermatitis herpetiformis (0.72%), two cases of cancer (0.72%), and one case of epilepsy (0.35%). During the study period, there were two mortality cases due to small bowel cancer.

The results of the serological analyses were collected from the patients' files classified as CD (Figure 4A). It was noted that the anti-transglutaminase antibodies (47.2%) were the most present in the blood of the patients, which gave them the highest concentration compared to the anti-gliadin antibodies (6.42%) and anti-endomysium antibodies (6.78%). After analyzing the graph results, significant differences were observed between the different serological tests: anti-gliadin decreased significantly compared to anti-transglutaminase by 13.6%. Analysis of the histological findings showed that 50.8% of patients had villous atrophy. Figure 4B shows the different types of atrophy: 24% of the patients have total villous atrophy, 17.5% have subtotal villous atrophy, and 9.3% have only partial villous atrophy.

Discussion

The prevalence of CD in this study was 1/135, which was close to the prevalence results of Portugal (1/134)

and Switzerland (1/132).[18] The prevalence of CD is estimated to range from 0.10% to 3.03% in Europe,[19] but it is not widespread in Asia.[20] The prevalence is the highest in Oceania (0.8%),[21] while biopsy-confirmed CD was found to be 1.9% in South Africa.[22] The incidence rate for Americans is 1/133.[23] The increase in prevalence in recent years can be attributed partly to improved diagnostic techniques and increased disease awareness.[24]

The incidence of CD in this study was 1/253. During the three years of study, an increasing disease risk occurred because the association received more than two to three cases weekly. The study by Lebwohl, *et al.*, confirms that the incidence of CD increases with global distribution.[25] This increase in incidence was probably related to the main factors of a better knowledge of asymptomatic forms and a significant change in diet habits, particularly in the consumption of gluten and in the feeding patterns of infants. The members of the GIAAN medical committee were unanimous: there was no increased risk of COVID-19 for CD patients.

The study population included patients of different ages: children, adolescents, adults, and older people, with an average age of 21.18±1.13 years. This study's results were similar to Rekik's, which involved an average age of 28.2 years.[26] In contrast, Dinler, *et al.*, examined a population with a mean age of 8.2 years.[14] While, Tortora, *et al.*, found that 2.5% of older people were 65 years or older at the time of diagnosis.[28] This implies that CD is a disease that can affect any age. Like COVID-19, children are asymptomatic, but older people are the most vulnerable to CD and present serious complications.[27]

Additionally, the peak age for the onset of CD is observed in adolescence and adulthood (10–25 years). This result could be explained by the fact that the diet at this age was based on foods containing gluten, such as bread, biscuits, and pizza, as well as the excessive consumption of industrial products. Women comprised 68% of the patients in this age group, while men comprised only 32%. Another study also found this predominance, showing that CD is two to three times more common in women than men.[28] This predominance could be due to the influence of female hormones or the predisposition to CD being higher in women than men. Likewise, COVID-19 affected more females with CD than males with CD.[27]

The diagnosis of CD is based on a combination of clinical, serological, and histological criteria. However, histology remains the essential reference examination for confirming the diagnosis of CD before starting a GFD.[7] Given the importance of CD in incidence and the consequent delay in diagnosis, it is also useful to carry out the clinical part. In this study, the most dominant clinical manifestations of CD were gastrointestinal signs. Clinically, the table is highly variable.[8] Difficulties in the delay in diagnosis of refractory celiac were consistent with

CD.[29] The CD can appear at any age with a wide range of clinical manifestations, which may be atypical in many cases and may remain more or less "silent" for years while continuing to destroy the intestine and other organs.[29] The spectrum of symptoms of the disease is broad, including both gastrointestinal and non-gastrointestinal symptoms.[30] The chemokine profile found in COVID-19 at the intestinal level closely resembles the immunological response to CD and intestinal bacterial translocation.[2]

HP infection and microcytic hypochromic anemia were common in this study. These results were because the diet of celiac patients contains less fiber and flavonoids, which leads to the appearance of anemia. The HP was an opportunistic bacterium present in the normal flora of an individual. However, it became pathogenic due to the weakening of the body's defenses and was diagnosed in over 40% of patients. This condition was comparable to the study by Nour, *et al.*, that found a 41.6% prevalence of HP.[31] In this context, the search for HP and anemia should be systematic.

This study found several pathological associations with CD. In previous studies, other diseases have been reported in celiac patients, such as selective IgA deficiency, autoimmune thyroiditis, and primary biliary cirrhosis.[9] Malignant complications in CD are rare but serious.[32] T-cell lymphoma and refractory sprue are frequently associated with significant morbidity and mortality.[7] However, Prucher, *et al.*, show that most patients have undergone diagnostic tests for SARS-CoV-2 following complications.[33]

High levels of IgA antibodies were found in patients who had done the test without taking anti-deamidated gliadin peptide (DPG) or anti-endomysial antibody (EMA) tests because testing for these antibodies is more expensive. This condition explained the low rate obtained from these tests. Gozalbo, *et al.*, agree concerning the high prevalence of the Saharawi population, as wheat flour is the staple food of their diet.[34]

DPG antibody tests were only performed in 23 patients. The results were positive in 6.42% of patients. Of the 25 patients tested for EMA, 6.78% were positive. Due to the small number of patients who were tested, this rate was most likely underestimated. More accurate sampling analysis, including DPG and EMA, can improve the immunoserological profile in CD patients. The performance features of the most recent serological assays specific to celiac disease are among the finest.[35] In fact, detecting EMA antibodies is the most specific biological parameter for detecting CD.[36] According to the recommendations of the European Society of Gastroenterology and Paediatrics, IgA transglutaminase antibodies should be used as an initial test, regardless of the children's age.[37] Other studies confirm that IgA is a helpful indicator of CD and ought to be used as the first test for it.[38]

Histological analysis of intestinal biopsies was positive in 50.8% of cases. The biopsy is not systematically performed in all children because of the risks associated with general anesthesia.[9] A biopsy was specially prescribed in atypical forms, such as in cases of high tTGA levels. Therefore, diagnosing villous atrophy is necessary for diagnosing CD and following the GFD evolution. According to the statistical analysis, there was a minor correlation between the serological profile and the degree of atrophy (p-value = 0.361); therefore, it was not statistically significant. In addition, the population did not correlate with the serological tests.

The only treatment currently available is the GFD. However, the difficulties encountered were in part related to a lack of confidence in finding safe gluten-free food.[39] Gluten is present in various products. A GFD should lead to a remission of the symptoms, as there is no current drug treatment. This study underlined the role of the GIAAN in promoting awareness, orientation, and social support for gluten-free products for the benefit of people in poverty. Also, Morocco will soon implement subsidized gluten-free products for people with histological confirmation of villous atrophy.

Conclusion

This study in Morocco explores the demographic, serological, and histological characteristics of CD, revealing similarities to other countries. The CD predominantly affects adult females, and tTGA antibodies are commonly used for screening, although histology remains the definitive diagnostic method. Given the disease's multiple manifestations, diagnosis can be challenging. Expanding the study's sample to other research centers is recommended to validate the results on a broader scale. The study highlights the importance of early detection and multidisciplinary collaboration in patient care, as well as the need for awareness programs and strategies to improve the lives of CD patients, especially considering the economic and social challenges faced in the region. However, limitations such as limited awareness and COVID-19 restrictions were noted, emphasizing the necessity for further efforts in screening and patient support.

Abbreviations

CD: Celiac Disease; GFD: Gluten-Free Diet; T1DM: Type 1 Diabetes mellitus; TTA: Tangier-Tetouan-Al Hoceima; GIAAN: the Association of Gluten Intolerant and Allergic of the North; HP: *Helicobacter pylori*.; DPG: Deamidated Gliadin Peptide; EMA: Endomysial Antibody; TGA: Transglutaminase.

Ethics Approval and Consent to Participate

Not applicable.

References

1. Rubio-Tapia A, Hill ID, Semrad C, et al. American College of Gastroenterology Guidelines Update: Diagnosis and Management of Celiac Disease. Am J Gastroenterol. 2023; 118 (1): 59-76. DOI: 10.14309/ajg.0000000000002075

2. Trovato CM, Montuori M, Pietropaoli N et al. COVID–19 and celiac disease: A pathogenetic hypothesis for a celiac outbreak. Int J Clin Pract. 2021; 75 (9): e14452. DOI: 10.1111/ijcp.14452

3. Lebwohl B, Rubio-Tapia A. Epidemiology, Presentation, and Diagnosis of Celiac Disease. Gastroenterology. 2021; 160 (1): 63-75. DOI: 10.1053/j.gastro.2020.06.098

4. Husby S, Koletzko S, Korponay-Szabó I, et al. European Society Paediatric Gastroenterology, Hepatology and Nutrition Guidelines for Diagnosing Coeliac Disease 2020. J Pediatr Gastroenterol Nutr. 2020; 70 (1): 141-156. DOI: 10.1097/MPG.00000000000024975

5. Gandini A, Gededzha MP, De Maayer T, et al. Diagnosing coeliac disease: A literature review. Hum Immunol. 2021; 82 (12): 930-936. DOI: 10.1016/j.humimm.2021.07.015

6. Choung RS, Ditah IC, Nadeau AM, et al. Trends and racial/ethnic disparities in gluten-sensitive problems in the United States: Findings from the National Health and Nutrition Examination Surveys from 1988 to 2012. Am J Gastroenterol. 2015; 110 (3): 455–461. DOI: 10.1038/ajg.2015.8

7. Torjmen F, Bradai S, Hamida SB, et al. Profil épidémiologique, clinique et thérapeutique de la maladie cœliaque. La Revue de Médecine Interne. 2019; 40 (Suppl 1): A194–A195.DOI:10.1016/j.revmed.2019.03.272

8. Verkarre V, Brousse N. Le diagnostic histologique de la maladie cœliaque. Pathologie Biologie. 2013; 61 (2): e13–9. DOI: 10.1016/j.patbio.2011.03.00

9. Trovato CM, Montuori M, Valitutti F, et al. The Challenge of Treatment in Potential Celiac Disease. Gastroenterol Res Pract. 2019; 2019: 8974751. DOI: 10.1155/2019/8974751

10. Losurdo G, Di Leo M, Santamato E, et al. Serologic diagnosis of celiac disease: May it be suitable for adults? World J Gastroenterol. 2021; 27 (42): 7233-7239. DOI: 10.3748/wjg.v27.i42.7233

11. El Fakiri K, Bourahouate A, Hadi A, et al. La maladie cœliaque du nourrisson et de l'enfant au CHU de Marrakech. J Pédiatr Puéricult. 2016; 29 (6): 289–294. DOI: 10.1016/j.jpp.2016.08.004

12. Sergi C, Shen F, Bouma G. Intraepithelial lymphocytes, scores, mimickers and challenges in diagnosing gluten-sensitive enteropathy (celiac disease). World J Gastroenterol. 2017; 23 (4): 573-589. DOI: 10.3748/wjg.v23.i4.573

13. Nonnotte AC. Intolérance au gluten (maladie coeliaque). Amsterdam: Elsevier; 2020.

14. Sahin Y. Clinical evaluation of children with celiac disease: A single-center experience. Arch Clin Gastroenterol. 2020; 6 (2): 026-030. DOI: 10.17352/2455-2283.000074

15. Cosnes J, Nion-Larmurier I. Les complications de la maladie cœliaque. Pathologie Biologie. 2013; 61 (2): e21–e26. DOI: 10.1016/j.patbio.2011.03.004

16. Hafi M, Labidi A, Amri M, et al. Facteurs associés à la survenue de complications sous régime sans gluten au cours de la maladie cœliaque. La Revue de Médecine Interne. 2016; 37 (Suppl 1): A150. DOI: 10.1016/j.revmed.2016.04.125

17. Demirkesen I, Ozkaya B. Recent strategies for tackling the problems in gluten-free diet and products. Crit Rev Food Sci Nutr. 2022; 62 (3): 571-597. DOI: 10.1080/10408398.2020.1823814

18. Bai JC, Fried M, Corazza GR, et al. World Gastroenterology Organisation global guidelines on celiac disease. J Clin Gastroenterol. 2013; 47 (2): 121–126. DOI: 10.1097/MCG.0b013e31827a6f83

19. Roberts SE, Morrison-Rees S, Thapar N, et al. Systematic review and meta-analysis: the incidence and prevalence of paediatric coeliac disease across Europe. Aliment Pharmacol Ther. 2021; 54 (2): 109-128. DOI: 10.1111/apt.16337

20. Poddighe D, Abdukhakimova D. Celiac Disease in Asia beyond the Middle East and Indian subcontinent: Epidemiological burden and diagnostic barriers. World J Gastroenterol. 2021; 27 (19): 2251-2256. DOI: 10.3748/wjg.v27.i19.2251

21. Glissen Brown JR, Singh P. Coeliac disease. Paediatr Int Child Health. 2019; 39 (1): 23-31. DOI: 10.1080/20469047.2018.1504431

22. Karsas M, Terblanche AJ, Kemp T, van Dyk JC. Prevalence of coeliac disease in children and adolescents with type 1 diabetes mellitus in a tertiary hospital in South Africa. The South African J Child Health. 2021; 15 (2): 212-217. DOI: 10.7196/SAJCH.2021.v15i4.1841

23. Masih J. Value-Chain Analysis of Gluten-Free Foods. Int J Agric Sci Res (IJASR). 2016; 6 (1): 339-346.

24. Catassi C, Gatti S, Fasano A. The new epidemiology of celiac disease. J Pediatr Gastroenterol Nutr. 2014; 59 (Suppl 1): S7–S9. DOI: 10.1097/01.mpg.0000450393.23156.59

25. Lebwohl B, Rubio-Tapia A. Epidemiology, Presentation, and Diagnosis of Celiac Disease. Gastroenterol. 2021; 160 (1): 63–75. DOI: 10.1053/j.gastro.2020.06.098

26. Rekik F, Frikha F, Salah RB, et al. Contribution à l'étude de la maladie cœliaque de l'adulte en milieu de médecine interne: une série mono-centrique de 43 cas. La Revue de Médecine Interne. 2018; 39 (Supppl 2): A142. DOI: 10.1016/j.revmed.2018.10.080

27. Emmi G, Bettiol A, Mattioli I, et al. SARS-CoV-2 infection among patients with systemic autoimmune diseases. Autoimmun Rev. 2020; 19 (7): 102575. DOI: 10.1016/j.autrev.2020.102575

28. Tortora R, Zingone F, Rispo A, et al. Coeliac disease in the elderly in a tertiary centre. Scand J Gastroenterol. 2016; 51 (10): 1179–1183. DOI: 10.1080/00365521.2016.1186222

29. Chibbar R, Nostedt J, Mihalicz D, et al. Refractory Celiac Disease Type II: A Case Report and Literature Review. Front Med (Lausanne). 2020; 7: 564875. DOI: 10.3389/fmed.2020.564875

30. Rajput MS, Chauhan A, Makharia GK. Epidemiology and clinical features of celiac disease in adults. Coeliac Dis Gluten-Related Dis. 2022; 1–23. DOI: 10.1016/B978-0-12-821571-5.00012-X

31. Nour E, Sabbek A, Aya H, et al. Maladie cœliaque: Il y a-t-il un intérêt à réaliser des biopsies gastriques systématiques? La Revue de Médecine Interne. 2017; 38 (Suppl 2): A151–2. DOI: 10.1016/j.revmed.2017.10.092

32. Ivanova M, Bottiglieri L, Sajjadi E, et al. Malignancies in Patients with Celiac Disease: Diagnostic Challenges and Molecular Advances. Genes (Basel). 2023; 14 (2): 376. DOI: 10.3390/genes14020376

33. COVIDSurg Collaborative; GlobalSurg Collaborative. Timing of surgery following SARS-CoV-2 infection: An international prospective cohort study. Anaesthesia. 2021; 76 (6): 748-758. doi: 10.1111/anae.15458

34. Gozalbo M, Guillen M, Taroncher-Ferrer S, et al. Assessment of the Nutritional Status, Diet and Intestinal Parasites in Hosted Saharawi Children. Children (Basel). 2020; 7 (12): 264. DOI: 10.3390/children7120264

35. Penny HA, Raju SA, Sanders DS. Progress in the serology-based diagnosis and management of adult celiac disease. Expert Rev Gastroenterol Hepatol. 2020; 14 (3): 147-154. DOI: 10.1080/17474124.2020.1725472

36. Chtourou L, Amouri A, Maatar R, et al. La maladie cœliaque de l'adulte: présentation clinique et aspects évolutifs. La Revue de Médecine Interne. 2018; 39 (Suppl 1): A146. DOI: 10.1016/j.revmed.2018.03.077

37. Olives JP, Lamireau T, Ruemmele F. Nouvelles recommandations européennes pour le diagnostic de la maladie cœliaque chez l'enfant: une réelle simplification? Archives de Pédiatrie. 2014; 21 (3): 241–244. DOI: 10.1016/j.arcped.2013.12.022

38. Khan MR, Silvester JA, Sparks B, et al. The Utility of IgA-Based Serologic Markers in Diagnosing Celiac Disease in Children 24 Months of Age or Younger. J Pediatr. 2020; 224: 158-161.e2. DOI: 10.1016/j.jpeds.2020.04.009

39. Bathrellou E, Georgopoulou A, Kontogianni M. Perceived barriers to gluten-free diet adherence by people with celiac disease in Greece. Ann Gastroenterol. 2023; 36 (3): 287-292. DOI: 10.20524/aog.2023.0798