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RESEARCH ARTICLE (ORIGINAL)

# Lifestyle and celiac symptoms in Mexican adolescents and young adults

*Estilo de vida e sintomas celíacos em adolescentes e jovens adultos mexicanos*
*Estilo de vida y síntomas celíacos en adolescentes y adultos jóvenes mexicanos*

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**Abstract**
**Background:** Celiac disease is an autoimmune pathology of the small intestine mucosa that develops in genetically predisposed people. The treatment is the adoption of healthy lifestyles and, in particular, a gluten-free diet.
**Objective:** To correlate lifestyle and celiac symptoms in Mexican adolescents and young adults, comparing gender and age.
**Methodology:** A descriptive, correlational, and cross-sectional study was conducted. Using the virtual snowball technique on the social networking platform Facebook, a non-probabilistic sample of 152 individuals with celiac disease between the ages of 15 and 35 was obtained.
**Results:** The celiac symptom index indicated a significant, negative correlation with lifestyle. The participants showed significant differences in lifestyle based on age and gender.
**Conclusion:** A correlation between lifestyle and celiac disease symptoms in Mexican adolescents and young adults indicates that these individuals may not lead a healthy lifestyle. As a result, they show symptoms of the disease.

**Keywords:** celiac disease; lifestyle; adolescent; young adults; signs and symptoms

**Resumo**
**Enquadramento:** A doença celíaca é uma patologia autoimune da mucosa do intestino delgado que se desenvolve em pessoas geneticamente predispostas, sendo o tratamento a adoção de estilos de vida saudáveis e, em particular, a dieta livre de glúten.
**Objetivo:** Correlacionar o estilo de vida e os sintomas celíacos em adolescentes e jovens adultos mexicanos, estabelecendo uma comparação por sexo e idade.
**Metodologia:** Estudo descritivo, correlacional e transversal. A amostra foi composta por 152 celíacos de 15 a 35 anos. A amostragem foi não probabilística quando utilizada a técnica de bola de neve virtual na rede social Facebook.
**Resultados:** O índice de sintomas celíacos apresentou correlação negativa significativa com estilo de vida. O estilo de vida em relação à idade e o sexo apresentou diferenças significativas entre os participantes.
**Conclusão:** Existe correlação entre o estilo de vida e os sintomas da doença celíaca em uma população mexicana de adolescentes e jovens adultos, evidenciando que estes indivíduos não estão levando um estilo de vida saudável e, consequentemente, estão apresentando sintomas da enfermidade.

**Palavras-chave:** doença celíaca; estilo de vida; adolescentes; jovem adulto; sinais e sintomas

**Resumen**
**Marco contextual:** La celiaquía es una patología autoinmune de la mucosa del intestino delgado que se desarrolla en personas genéticamente predispuestas y cuyo tratamiento es la adopción de hábitos de vida saludables y, en particular, la dieta sin gluten.
**Objetivo:** Correlacionar el estilo de vida y los síntomas celíacos en adolescentes y adultos jóvenes mexicanos, comparando por sexo y edad.
**Metodología:** Estudio descriptivo, correlacional y transversal. La muestra estuvo formada por 152 celíacos de entre 15 y 35 años. El muestreo fue no probabilístico, al utilizar la técnica de bola de nieve virtual en la red social Facebook.
**Resultados:** El índice de síntomas celíacos mostró una correlación negativa significativa con el estilo de vida. El estilo de vida en relación con la edad y el sexo mostró diferencias significativas entre los participantes.
**Conclusión:** Existe una correlación entre el estilo de vida y los síntomas de la celiaquía en una población mexicana de adolescentes y adultos jóvenes, lo que demuestra que estos individuos no llevan un estilo de vida saludable y, en consecuencia, presentan síntomas de esta enfermedad.

**Palabras clave:** enfermedad celíaca; estilo de vida; adolescentes; adultos jovenes; signos y síntomas

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## Introduction

Celiac disease (CD) is a chronic disease that attacks the mucosa of the small intestine and causes symptoms when cereals like wheat, barley, and rye are consumed, with recurrent episodes occurring as the disease progresses (Fueyo-Díaz et al., 2020). In addition, CD typically occurs in childhood or early adolescence. However, due to its similarity to other disorders, it is often underdiagnosed and often not diagnosed until late adolescence or adulthood (Lopes, 2018).

The literature reports an increase in incidence of more than fourfold in recent years, with CD occurring more frequently in adults adulta (Labrada et al., 2020; Zhu et al., 2018). The estimated prevalence of celiac disease is 1% of the world population, mainly women. Symptomatic cases account for 1.7% of people, and another 0.75-1.2% of cases are asymptomatic. In Mexico, the estimated prevalence of celiac disease is 2.6%, but only 0.9% of cases have been formally diagnosed (Cobos-Quevedo et al., 2017; Torres & Collía, 2021).

Although symptoms subside with appropriate treatment, the patient must completely change their lifestyle. This can be challenging for some adolescents and young adults, as the disease is associated with frequent psychosocial changes, conflicts, and maladjustments, making it another hurdle to overcome (Figueiredo et al., 2020). Switching to a gluten-free diet (GFD) can be challenging for individuals' well-being and lifestyle. Embarrassment and economic difficulties can result from visiting places where the disease is unknown and the high cost of gluten-free foods. In addition, adolescents and young adults may lack sufficient knowledge about the disease, leading to conflict, especially in the early stages of the disease (Fueyo-Díaz et al., 2020).

Thus, situations like the one described above often lead to an unhealthy lifestyle in many adolescents and young adults with CD, resulting in a poor prognosis. For this reason, the relationship between lifestyle and CD symptoms should be further explored.

This study is part of a larger research project that aims to fill this gap. Its main objective is to investigate the relationship between lifestyle and CD symptoms in Mexican adolescents and young adults, comparing by gender and age.

## Background

Celiac disease is a systemic autoimmune disease affecting the mucosa of the small intestine caused by the ingestion of gluten by genetically predisposed individuals (Pereira, 2020). In individuals with CD, gluten triggers inflammatory and immunological reactions that damage the intestinal epithelium. As a result, degeneration of these villi occurs, leading to a smooth-looking intestinal epithelium and decreased absorption of water and nutrients through the intestinal surface (Binaghi et al., 2015). CD is not only an autoimmune disease but also multifactorial. Therefore, several factors may influence the pathophysiology, including genetic predisposition, immunological and biochemical conditions, and environmental influences (Lopes, 2018).

However, the underlying cause of etiopathogenesis is an inflammatory process triggered by an inappropriate immune response of intestinal T cells to gluten peptides (Pereira, 2020). Similarly, the onset and progression of CD appear to be significantly related to genetic predisposition, particularly in the context of human leukocyte antigen (HLA), which includes the genes for DQ2 or DQ8 found on chromosome 6 at position 21 (Medeiros, 2013).

Antigen-presenting cells (APCs) have HLA receptors on their membranes, including dendritic cells, macrophages, and B lymphocytes, which bind to antigenic peptides, particularly those in gluten, and present them to T5 cells (Szondy et al., 2017). Once activated, CD4+ T cells generate local inflammation that increases cytokine production. This leads to the release of CD8+ T cells, which cause epithelial injury by receptors interacting with their epithelial ligands, allowing granzymes and perforins to destroy intestinal cells and cause villous atrophy (Pereira, 2020).

Guidelines for managing CD focus on a healthy lifestyle, particularly a lifelong GFD, to reduce symptoms and complications (De la Calle et al., 2020). However, maintaining a healthy lifestyle proves difficult for people with CD. Greater monitoring and dietary control are necessary; some may adopt harmful behaviors that affect their psychological well-being and quality of life. Following a strict diet and worrying about cross-contact can cause stress, anxiety, and depression (Gobbetti et al., 2017).

## Research question

Is there a relationship between lifestyle and celiac symptoms in Mexican adolescents and young adults? Also, is there a difference between genders and ages in lifestyle and CD symptom occurrence?

## Methodology

A descriptive, correlational, and cross-sectional study was conducted between May and July 2022 with a sample of 217 individuals aged 15 to 35 years. A non-probabilistic sample was used through the virtual snowballing technique on the social networking website *Facebook* to ensure a similar proportion of male and female participants. A proportion ($p$) with a confidence level of 95% and an allowable error of 0.05 was estimated using a conservative approach of 50% and a power of 80%. Thus, a sample of 152 participants was obtained.

The survey was conducted virtually through the *Google Forms* platform, and Celíacos de México A.C. *Facebook* group members were invited to participate. This method was used because the COVID-19 pandemic prevented in-person data collection. Participants were asked about their gender, age, education, occupation, and social security status. They also completed the Celiac Symptom

Index questionnaire (CSI), introduced in Mexico by Ramírez-Cervantes et al. (2015), to assess specific CD symptoms and general health status. For this study, patients were dichotomized using a single cut-off point of ≥35, indicating progressive disease. In addition, participants completed the Health Promoting Life Profile II questionnaire (HPLP-II), which measures the frequency of health-promoting behaviors and lifestyles. Serrano-Fernández et al. (2016) translated and adapted the questionnaire into Spanish. The HPLP-II scale includes six subscales: health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management. Scores range from 52 to 208, with a higher score indicating a better lifestyle.

Persons who did not have permission from a legal representative and persons who had not completed the instruments were excluded. In addition, individuals who did not have CD were excluded.

Data were processed using the IBM SPSS Software, version 21.0. First, the reliability of the instruments was assessed with a Cronbach's alpha coefficient greater than 0.70. Then, the distribution of the variables was assessed using the Kolmogorov-Smirnov test, which revealed that nonparametric inferential statistics were required.

Descriptive statistics such as mean, median, standard deviation, and percentage were used to characterize the variables. Comparisons were made with the Mann-Whitney *U* test, and correlations were examined with Spearman's correlation coefficient. The study followed the provisions of the Mexican General Health Law on Health Research and the Declaration of Helsinki. It was approved by the Ethics Committee of the Faculty of Nursing and Obstetrics of the Autonomous University of the State of Mexico (Official Letter No. 005/2022), and all participants gave informed consent.

## Results

Participants had a mean age of 29.53 ± 6.1 years. Adolescents aged 15-19 accounted for only 5.3% of the total sample, while young adults aged 20-35 accounted for 94.7%. The sample was predominantly female (63.2%), with the remaining 36.8% being male. Regarding education level, most individuals had a college degree (86.3%), followed by 11.8% with an incomplete degree and 4.6% who had attended high school. Of the sample, 64.5% were employed, while 24.3% were neither working nor studying. More than half of the participants (55.9%) received social security benefits (Table 1).

**Table 1**

*Sociodemographic Characteristics*

| Characteristic | | *n* | % |
|---|---|---|---|
| Gender | Male | 56 | 36.8 |
| | Female | 96 | 63.2 |
| Age | 15-19 | 8 | 5.3 |
| | 20-35 | 144 | 94.7 |
| Education level | Highschool | 7 | 4.6 |
| | Higher education completed | 127 | 83.6 |
| | Higher education incomplete | 18 | 11.8 |
| Occupation | Studies | 6 | 3.9 |
| | Works | 98 | 64.5 |
| | Studies and works | 11 | 7.2 |
| | Does not study and Does not work | 37 | 24.3 |
| Social Security | IMSS | 85 | 55.9 |
| | ISSSTE | 12 | 7.9 |
| | Other | 55 | 36.2 |

*Note. n* = Number of participants; *%* = Frequency; IMSS = Instituto Mexicano del Seguro Social; ISSSTE = Instituto de Seguridad y Servicios Sociales para los Trabajadores del Estado.

### Celiac Symptom Index

Table 2 presents the celiac symptom index by age and gender. While the young adult group (20-35 years) had higher mean scores than adolescents (15-19 years), there were no significant differences between the groups ($U$ = 425.500; $p$ = 0.207). In terms of gender, men had slightly higher mean scores than women, but the difference was not significant ($U$ = 2674.500; $p$ = 0.958).

**Table 2**

*Mann-Whitney U-test for the Celiac Symptom Index by Age and Gender*

| | | *n* | | *Mdn* | *SD* | *U* | *p-value* |
|---|---|---|---|---|---|---|---|
| Age | 15-19 | 8 | 43.35 | 43.750 | 13.119 | 425.500 | 0.207 |
| | 20-35 | 144 | 47.26 | 46.875 | 11.947 | | |
| Gender | Male | 56 | 47.62 | 46.875 | 12.780 | 2674.500 | 0.958 |
| | Female | 96 | 46.72 | 46.875 | 11.571 | | |

*Note. n* = Number of participants; = Mean; *Mdn* = Median; *SD* = Standard deviation; *U* = Statistical evidence; *p* = Statistical significance.

**Lifestyle**

Table 3 compares lifestyle by age and gender. The results indicate significant differences ($U$ = 224.500; $p$ = 0.003) between individuals aged 15-19 and those aged 20-30. Significant differences ($U$ = 1280.000; $p$ = 0.000) between men and women were observed. Young adults and women were found to lead less healthy lifestyles than other groups.

**Table 3**

*Mann-Whitney U-test for Lifestyle by Age and Gender*

| | | *n* | | *Mdn* | *SD* | *U* | *Valor p* |
|---|---|---|---|---|---|---|---|
| Age | 15-19 | 8 | 69.83 | 64.516 | 8.654 | 224.500 | 0.003 |
| | 20-35 | 144 | 54.09 | 43.225 | 15.434 | | |
| Gender | Male | 56 | 63.31 | 63.225 | 14.641 | 1280.000 | 0.000 |
| | Female | 96 | 50.02 | 43.225 | 13.925 | | |

*Note. n* = Number of participants; = Mean; *Mdn* = Median; *SD* = Standard deviation; *U* = Statistical evidence; *p* = Statistical significance.

**Correlations between variables**

The relationship between age, celiac symptom index, and lifestyle was determined using a correlation matrix of the continuous variables (Table 4). Age was significantly and negatively correlated with health responsibility ($r_s$ = -0.208, $p$ = 0.05) and physical activity ($r_s$ = -0.169, $p$ = 0.05), suggesting that lifestyle becomes unhealthier with age ($r_s$ = -0.169, $p$ = 0.05).

Occupation shows a significant positive correlation with the celiac symptom index ($r_s$ = 0.306, $p$ = 0.01) and the specific CD symptoms factor ($r_s$ = 0.524, $p$ = 0.05). In addition, it showed a significant negative correlation with the general health factor ($r_s$ = -0.290, $p$ = 0.01). These results suggest that CD symptoms are more likely to occur in participants who work and that their general health deteriorates the longer they work. Similarly, a significant negative correlation was found with nutrition ($r_s$ = -0.336, $p$ = 0.01) and stress management ($r_s$ = -0.281, $p$ = 0.01), meaning that nutrition and stress management decreased the more they worked.

The celiac symptom index showed significant negative correlations with lifestyle ($r_s$ = -0.246, $p$ = 0.01), nutrition ($r_s$ = -0.301, $p$ = 0.01), spiritual growth ($r_s$ = -0,540, $p$ = 0.01), interpersonal relationships ($r_s$ = -0.215, $p$ = 0.01), and stress management ($r_s$ = -0.294, $p$ = 0.01). This suggests that a higher frequency of CD symptoms is related to an unhealthier lifestyle, as well as poorer nutrition, spiritual growth, interpersonal relationships, and stress management.

**Table 4**

*Spearman's Correlation Coefficient – Correlation matrix*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 1 | | | | | | | | | | | |
| 2. Occupation | -0.123 | 1 | | | | | | | | | | |
| 3. Celiac Symptom Index | -0.069 | 0.306** | 1 | | | | | | | | | |
| 4. Specific Symptoms | -0.102 | 0.524** | 0.910** | 1 | | | | | | | | |
| 5. General Health | 0.054 | -0.290** | 0.663** | 0.372** | 1 | | | | | | | |
| 6. Health Promotion | -0.169* | 0.053 | -0.246** | -0.179* | -0.270** | 1 | | | | | | |
| 7. Health Responsibility | -0.208* | 0.111 | 0.012 | 0.021 | -0.148 | 0.807** | 1 | | | | | |
| 8. Physical Activity | -0.169* | -0.085 | -0.159 | -0.167* | -0.127 | 0.925** | 0.580** | 1 | | | | |
| 9. Nutrition | -0.006 | -0.336** | -0.301** | -0.328** | 0.000 | 0.849** | 0.609** | 0.790** | 1 | | | |
| 10. Spiritual Growth | 0.095 | -0.030 | -0.540** | -0.525** | -0.402** | 0.538** | 0.303** | 0.398** | 0.617** | 1 | | |
| 11. Interpersonal Relations | -0.129 | 0.116 | -0.215** | -0.129 | -0.328** | 0.792** | 0.711** | 0.693** | 0.525** | 0.208* | 1 | |
| 12. Stress Management | 0.33 | -0.281** | -0.294** | -0.373** | 0.014 | 0.798** | 0.586** | 0.717** | 0.926** | 0.647** | 0.506** | 1 |

*Note.* ** $p < 0.01$; *$p < 0.05$.

## Discussion

In this study, we compared and correlated the lifestyle and presence of CD signs and symptoms in adolescents and young adults. The majority of individuals with CD involved in this study were female. This can be attributed to two factors: First, women make up the majority of the population in Mexico, meaning that there are more women than men in the country (Instituto Nacional de Estadística y Geografia [INEGI], 2020); second, women are more susceptible to CD and other autoimmune diseases than men, with the prevalence of CD being 2 to 3 times higher in women than in men (Moscoso & Quera, 2015).

Regarding the age of the participants, 94.7% were between 20 and 35 years old. It is well-established that this disease can be diagnosed at any age and affects children and adults almost equally (Wolf et al., 2019). Most participants have social security benefits. In Mexico, coverage is reserved for those formally employed by a company that meets the criteria of a legitimate business or for those who qualify as beneficiaries of an insured person. Alternatively, the insurance requirements may be met through voluntary incorporation (Bermúdez, 2020). However, if the individual is not covered by the current social insurance programs, they must turn to the private sector. This poses a challenge due to exorbitant fees and results in many individuals with chronic conditions being unable to obtain adequate medical care.

The results suggest that, despite differences in age and gender, all participants had clinical signs of inflammation attributable to gluten consumption, suggesting that adherence to the recommended GFD is the right way to treat CD symptoms. One possible factor contributing to this problem is the age and employment status of the respondents, many of whom are young adults with busy schedules who may eat out and thus come into contact with gluten-containing foods. According to Bryant-Jorge (2018), people with CD are often afraid to eat away from home, either because of the risk of accidental gluten exposure or because they are uncomfortable explaining their condition to others. The problem persists despite recent educational campaigns about CD. Many restaurants and chefs do not offer gluten-free options because they underestimate the prevalence of the disease.

This study shows that an unhealthy lifestyle is more prev-

alent in young adults and female participants. Parents are responsible for monitoring their children's health during childhood and adolescence. However, as children enter adulthood, a period of decreased parental control and increased autonomy, they tend to make their own decisions and often place their financial success and personal goals above their health and well-being. In addition, health services are not typically viewed as a source of support by this population because they feel they do not meet their real needs and only turn to these services when they already feel ill (Escobar-Castellanos & Cid-Henríquez, 2018).

On the other hand, women often juggle their work and caregiving responsibilities, leading them to neglect their health and well-being. According to Ferrer-Lues et al. (2021) and Morales-Ramírez et al. (2020), female caregivers often take on burdensome tasks that affect their health and significantly decline their quality of life. For example, some women work about eight hours in addition to domestic tasks such as caring for the family and managing the household. Other women who do not receive a salary must rely on their partners or other family members for financial support, which can limit their ability to make decisions. This leads to deteriorating health, chronic diseases, and unhealthy lifestyles characterized by little exercise, poor nutrition, and too little rest. Such behaviors contribute to mental health problems such as depression, anxiety, and stress.

The study found an association between CD symptoms and an unhealthy lifestyle, suggesting that participants with CD symptoms were not leading healthy lifestyles. This can be attributed to the fact that most of the participants are employed and lack time and motivation, which leads them to neglect their health and well-being. In addition, dietary restriction often leads to stress, frustration, and social isolation in people with CD, which may lead to interruption of long-term treatment (Medina, 2020).

This study has some limitations: random sampling was not used due to the difficulty of locating participants. Therefore, individuals with CD may not be accurately represented. The SARS-CoV-2 pandemic may have affected the results by forcing many people to stay at home, possibly leading to unhealthy lifestyles, including inadequate nutrition, anxiety, depression, social isolation, and other factors leading to CD symptoms.

Additional research should be conducted to confirm these findings and look more deeply into the reasons for an unhealthy lifestyle and the barriers that prevent CD patients from following prescribed treatment, ideally beyond the scope of the pandemic.

## Conclusion

The study results show an association between lifestyle and CD symptoms in the Mexican population. Women and young adults appeared to be more likely to have unhealthy lifestyles. The prevalence of CD symptoms exists in both genders and all age groups, which is concerning given the association between an unhealthy lifestyle and CD symptoms.

Several lifestyle factors may contribute to the manifestation of symptoms in celiac patients, including an unbalanced diet, inadequate stress management, social isolation, and self-confidence issues. Therefore, it is critical to address these factors to ensure that patients can enjoy a high quality of life.

The multidisciplinary team must provide holistic support and health-promoting education to celiac patients, especially nurses who contact patients the most. By empowering and motivating individuals to take control of their disease, they can overcome obstacles and achieve a healthy lifestyle.

### Author contributions

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