Weak knowledge of celiacdisease and gluten among applied medical science students

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Celiac disease (CeD) is an autoimmune disease with several health complications that can lead to patient fatality. Recent studies identified lack of knowledge of CeD in different study groups. Therefore, students' knowledge of CeD is essential, as it will assist them in providing adequate health services to CeD patients in the future. To evaluate students' knowledge, genetic background, and attitude and the prevalence of CeD in the College of Applied Medical Sciences, Jazan University, which has several departments: laboratory, radiology, nutrition, and physiotherapy? A cross-sectional study .This study was conducted on a convenience sample consisting of 211 students from the four departments of the college in December 2020 using a web-based questionnaire. The collected data included the students' demographic characteristics and knowledge of CeD and the prevalence of CeD among the students. Pearson's chi-square test (*P* value of 0.05 or less was considered significant).The response rate was 100%. The participants from the different groups (singles, both sexes, both age groups, all departments) lacked knowledge regarding CeD. Seventy percent selected the wrong choice regarding gluten source, and 65% assumed that medications are a better method of managing CeD. The prevalence rate of CeD in our study group was 9.9%, most of whom were females. Most of them have other health complications, such as T1D, asthma, irritable bowel syndrome, and eczema. Our study reveals lack of knowledge of CeD among the College of Medical Sciences students. Therefore, CeD should be introduced to students in seminars and posters. Moreover, national programs that focus on CeD like they do on other diseases, such as diabetes and cancer, is required, as CeD can lead to several complications, such as T1D.

Keywords: Celiac disease, knowledge, genetic background, prevalence.

INTRODUCTION

Celiac disease (CeD) is a systemic immune-mediated genetically inherited disease. It is a chronic disorder resulting from gluten-sensitive enteropathy (Ludvigsson et al. 2013). CeD patients are required to follow a gluten-free diet, as consumption of gluten can lead to an immediate immune response and inflammation in the intestinal mucosa (Green and Jabri, 2003). CeD has many clinical complications that can affect patients' social life, including gastrointestinal disturbance, poor appetite, constipation, fatigue, steatorrhea, anemia, and weight loss (Hovell et al. 2001; Green and Jabri, 2003). CeD can also lead to intestinal damage that affect the absorption capability of villi, which will lead to nutrient malabsorption (Tye-Din, Galipeau and Agardh, 2018).

A major advancement in CeD management was the confirmation of the autoimmune nature of the disease through the classification of the tissue transglutaminase as an autoimmune antigen (Caio et al. 2019). The development of the disease is strongly linked to the patient's genetic background, including positivity for human leukocyte antigens (HLA-DQ2, HLA-DQ8) and other involved genes. Environmental factors, such as dysbiosis of gut microbiota and viral infections, also play a role (Lionetti et al. 2014). In addition, CeD has a high familial recurrence rate (10%–15%) and high concordance among monozygotic twins (70%–80%) due to its hereditary components, including HLA class II heterodimers (DQ2 and DQ8) (Lundin and Wijmenga, 2015). Compared with the general population, HLA-DQ2 homozygous infants with CeD-positive first-degree family members have a much higher risk (25%–30%) of developing early-onset CeD (Lionetti et al. 2014). Despite the 25%–30%frequency of the HLA-DQ2/HLA-DQ8 allele in the general population, only HLA-compatible individuals (3%) will develop CeD (Mazzilli et al. 1992). More than 100 non-HLA-related genes associated with CeD have been identified by genome-wide association studies, which conferring the limitation of the genetic risk of these genes, but they may lead to the discovery of new pathways of the CeD pathogenesis (Lundin and Wijmenga, 2015). CeD prevalence in Saudi Arabia is unknown because there are no government epidemiological programs evaluating its prevalence similar

to those for diabetes and cancer. To our knowledge, there are a few studies on the knowledge and prevalence of CeD in Saudi Arabia. A study focusing on children from the eastern province of Saudi Arabia found that only 3% of the participants were positive for CeD (Al Hatlani, 2015). A study conducted in Riyadh tested 318 small intestinal biopsies from children and found that 59 were CeD-positive (18.5%) (Al-Hussaini et al. 2012). A cross-sectional study in Saudi Arabia revealed that 11.3% of type-1-diabetic children are also CeD-positive (Al-Hussaini et al. 2012). Furthermore, a study analyzed the serum of 1167 studentsin three different cities for IgA and IgG endomysial antibodies, and the percentages of CeD-positive students were 2.1% in Aseer, 1.8% in Madinah, and 3.2% in Al-Qaseem (Aljebreen et al. 2013).

A study revealed that health/medical professionals in Riyadh, Saudi Arabia, have poor knowledge of CeD (Assiri *et al.* 2015).This has encouraged us to evaluate the knowledge of medical science students in Jazan University regarding CeD; determine the prevalence of CeD among the students; and assess CeD complications on their health, social life, and academic life.

MATERIALS AND METHODS

Survey design:

This cross-sectional web-based study was conducted in December 2020 and aimed to evaluate about 200 students from the College of Medical Sciences, Jazan University. We assessed the students' knowledge about CeD and determined the prevalence of CeD among them. A web-based questionnaire was used instead of a paper-based questionnaire for data collection because web-based questionnaires are more efficient than paper-based ones (Almehmadi, Salih and Al-hazmi, 2019).

Data collection:

Data were collected by sharing the survey link via different social media platforms to the students. The questions included in the survey were designed to determine the students' knowledge of CeD and assess CeD prevalence in the college. The students participating in this study were from the college's four departments: laboratory, nutrition, radiology, and physiotherapy. The number of college students is about 1000, and around 21% participated in this study.

Questionnaire

A structured and well-established questionnaire was used for this study. It was based on previous studies with similar purposes. Questions were chosen to determine respondents' knowledge of coeliac disease (CeD), gluten, CeD managements, CeD complications, the effects of CeD on social and academic life, the prevalence of CeD among students of the College of Medical Sciences and whether CeD was hereditary. Those who had CeD were asked additional questions about the disease. The web-based survey was designed so that it did not collect participant's private information—such as their name, contact information, and home-address—which could compromise the individual's privacy. Most questions required a "Yes" or "No" answer.

Ethical considerations

The study received ethical approval from the Research Ethics Committee at Jazan University, Jazan, and Kingdom of Saudi Arabia.

Data analysis

The questionnaire was sent to 211 potential participants, and the response rate was 100 %. The data were checked for completeness. Data analysis was performed using GNU PSPP 0.10.1-g1082b8. Categorical variables were expressed as frequencies and percentages. Our data predicator variable and outcome variable is categorical therefore we have applied Pearson's Chi-square test.The students' levels of knowledge about CeD were compared and the distributions of responses were analyzed and a p-value of .05 or less was significant.

RESULTS

Characteristics of respondents

The demographics of the participants are presented in Table I. They comprised 98 males (46.4 %) and 113 females (53.6 %); and all of them were Saudi. Approximately 55 % of the participants were ≤ 22 years old, and about 45 % were > 22 years old. The highest response rate was from the laboratory department (32.2 %), and the lowest rate was from the radiology department (18 %).

Knowledge about CeD and gluten

The analysis of the students' knowledge was assessed by different categories: gender, age, marital status, and department. Their answers to the question "Do you have previous knowledge of CeD disease?" are in Table II. Next, their answers to questions about the source of gluten and CeD management were assessed. The number students who did not have previous knowledge of CeD was significantly higher than those who did have such knowledge (.001 and .005, respectively). According to marital status, the number of single students who did not have such knowledge was significantly higher than married students (.001). However, although married students had more knowledge about CeD, the result was insignificant. In each department, there were more students who did not know about CeD, but the result for laboratory students was not significant. To confirm the previous findings, the students were asked two questions. The first was about the source of gluten; a significantly higher number chose the wrong answer: animal meat.

Table I: Demographic characteristics of the participants.

Characteristic		Male (n=98)	Female (n=113)	Total (n=211)	Percentage
Age	≤ 22 years	51	66	117	55.5 %
	> 22 years	47	47	94	44.5 %
Marital status	Single	86	97	183	86.7 %
	Married	12	16	28	13.3 %
Department	Laboratory	43	25	68	32.2 %
	Nutrition	19	32	51	24.2 %
	Radiology	15	23	38	18.0 %
	Physiotherapy	21	33	54	25.6 %

Table 2: Knowledge score of the students regarding CeD

	Category	Answer	N (%)	Chi-square	*P value*
Gender	Male	Yes	22 (22.44 %)	29.7	.001
		No	76 (77.56 %)		
	Female	Yes	41 (36.28 %)	7.8	.005
		No	72 (63.71 %)		
Marital status	Married	Yes	17 (60.7 %)	1.2	.257
		No	11 (39.28 %)		
	Single	Yes	46 (33.5 %)	45.2	.001
		No	137 (66.5 %)		
Age group	≤ 22 years	Yes	31 (27.35 %)	24	.001
		No	86 (72.64 %)		
	> 22 years	Yes	32 (34 %)	9.5	.002
		No	62 (66 %)		
Department	Laboratory	Yes	23 (33.8 %)	7.1	.08
		No	45 (66.17 %)		
	Nutrition	Yes	11 (21.5 %)	16.5	.001
		No	40 (78.5 %)		
	Radiology	Yes	11 (30 %)	6.7	.009
		No	27 (70 %)		
	Physiotherapy	Yes	18 (33.3 %)	6	.014
		No	36 (66.7 %)		
Gluten source	Animal meat		146 (70 %)	31	.001
	Wheat, rye, and barley		65 (30 %)		
CeD management	Medication to regulate gluten intolerance and sensitivity		138 (65 %)	20	.001
	Following a gluten-free diet		73 (35 %)		

Table 3: General knowledge regarding CeD.

#	Question	Male n (%)		Female n (%)		Chi-square	*P value*
		Yes	No	Yes	No		
1	Is coeliac disease an autoimmune disease?	34 (34 %)	64 (66 %)	40 (35 %)	73 (65 %)	18.82	.001
2	Do coeliac patients require a special type of diet?	42 42 %)	56 (58 %)	53 (46 %)	60 (54 %)	2.09	.148
3	Is coeliac disease genetically inherited?	39 (39 %)	59 (61 %)	47 (41 %)	66 (59 %)	6.49	.001
4	The coeliac patients can consume (eat) all type of cereal and bread?	71 (72 %)	27 (28 %)	65 (57 %)	48 (43 %)	17.64	.001
5	Do you recommend that all food products must be labeled if they contain gluten?	58 (59 %)	40 (41 %)	70 (61 %)	43 (39 %)	10.47	.011
6	Can coeliac disease affect academic or social life?	52 (53 %)	46 (47 %)	58 (51 %)	55 (49 %)	0.38	.536
7	Do you think coeliac disease can lead to other health complications like type 1 diabetes?	26 (26 %)	72 (74 %)	34 (30 %)	79 (70 %)	39.25	.001
8	Do you have difficulty in determining which foods contain gluten?	72 (73 %)	26 (27 %)	88 (77 %)	25 (23 %)	54.26	.001
9	Do you think coeliac disease is common in Saudi Arabia?	36 (36 %)	62 (64 %)	38 (33 %)	75 (67 %)	18.81	.001

Table 4: Prevalence and clinical complications of CeD.

Questions	Answer	Male n (%)	Female n (%)	Chi-square	*P* value
Has one or both of your parents been diagnosed with CeD?	Yes	7 (100 %)	10 (71.42 %)	8.05	0.005
	No	0	4 (28.58 %)		
Are your parents relatives?	Yes	6 (85.71 %)	9 (92.85 %)	8.5	0.001
	No	1 (14.3 %)	1 (7.15 %)		
Do you suffer from asthma?		2 (28.57 %)	7 (50 %)	0.43	0.513
Do you suffer from irritable bowel syndrome (IBS)?		5 (71.42 %)	12 (85.71 %)	8.05	0.005
Do you suffer from eczema?		1 (14.28 %)	5 (35.71 %)	3.86	0.050
Do you suffer from Type 1 diabetes?		4 (57.14 %)	6 (42.84 %)	0.05	0.827
Have you had an appendectomy? ?		1 (14.28 %)	2 (14.28 %)	10.71	0.001

The second question was about methods of CeD management; a significantly higher number believed that medication was a better approach than following a gluten-free diet.

Their knowledge was assessed through a range of questions regarding CeD (Table III). For question 1, a significant number of students believed CeD is not an autoimmune disease, that it is genetically inherited and that it does not lead to T1D. Moreover, a significant number of students believed CeD patients could consume all types of cereal and bread, and there was no need to put the gluten content on food labels. At the same time, they were not aware which foods contained gluten.

Prevalence of CeD

Students were asked if they had been diagnosed with CeD, those who answered yes were asked several other questions designed only for them (Table IV). About 21 students confirmed being CeD positive: 7 males (33.3 %) and 14 females (66.7 %). All male students confirmed one or both of their parents had CeD and 10 females (71.42 %) confirmed the same. Those who answered yes were asked if their parents were relatives, 6 of the 7 males

and 9 of the 14 females answered yes. Then, those students were asked if they also had asthma as well; 2 males and 7 females answered yes. Significantly, 5 males and 7 females had irritable bowel syndrome (IBS), significantly 1 male and 5 females had eczema, 4 males and 6 females had T1D and significantly 1 male and 2 female had had an appendectomy.

DISCUSSION

To our knowledge this study is the first in Saudi Arabia to test the knowledge of CeD and the genetic background, attitudes, and prevalence of CeD in medical science college students. At least 200 students each year graduate from applied medical science colleges at Jazan university. They have received intensive courses in the four departments: laboratory, nutrition, radiology, and physiotherapy. Graduates who enroll into the job market in the medical field must be thoroughly prepared to provide great service to patients with minimal medical errors.

The human immune system is a double-edged blade. It protects the human body from pathogens, but during autoimmune diseases it can cause great damage to the human body. The lack of knowledge about CeD and gluten among health professionals can lead to fatal medical errors. CeD prevalence is rising and it is frequently not detected by health professionals(Singh *et al.* 2018). In addition, because of the lack of a national epidemiological program for CeD like those for diabetes and cancer, the prevalence of CeD in Saudi Arabia can be obtained only from previous studies. Seroprevalence of CeD in Saudi Arabia has been estimated between 2 % and 8 %—equal to those of densely populated countries like India and other developed countries like Sweden and Czech Republic (Singh *et al.* 2018).

Lack of knowledge about CeD is not a new issue. Several studies have documented a lack of knowledge of CeD in different subject groups. In the UK, (Karajeh et al. 2005)showed a lack of knowledge of ced among chefs (Karajeh et al. 2005). Studies in New Zealand and Saudi Arabia have found the same findings (Assiri et al. 2015; Schultz, Shin and Coppell, 2017; M. Almehmadi, 2020).

Our study has shown a lack of knowledge among medical sciences students about many aspects of CeD. Significantly, higher levels of students—from all the departments—lacked knowledge about CeD. Moreover, significantly fewer students were aware about the source of gluten. The best method for controlling CeD is to follow a lifelong gluten-free diet (Alhassan *et al.* 2019), but a significant number of participants picked the incorrect answer: using medications to regulate gluten intolerance and sensitivity. To test further knowledge of CeD, participants were asked 9 questions (Table III) and the responses to all the questions showed a lack of knowledge about CeD. The answers to question 8 showed that many of the participants could not determine which foods contained gluten.

The participants in our study who were diagnosed by

a gastroenterologist were 21, a prevalence of about 9.9 %. This was is slightly higher than the findings in other studies (Aljebreen et al. 2013; Singh et al. 2018). Of the students with CeD, 17 (80 %) acknowledged that one or both parents had CeD, and 15 (88 %) acknowledged that their parents were relatives. This suggests that environmental and genetic factors play essential roles in developing CeD (Liu, Rewers and Eisenbarth, 2005). As for complications of CeD, 2 males and 7 females had asthma, 5 males and 12 females had IBS, 1 male and 5 females had eczema, 4 males and 6 females had T1D, and 1 male and 2 females had had appendectomies. Studies have associated CeD with T1D (Cohn, Sofia and Kupfer, 2014; M. M. Almehmadi, 2020); both are autoimmune diseases, which cause enormous damage to the human body. The two ailments have common factors, and a study have detected overlapping between the two diseases (Cohn, Sofia and Kupfer, 2014). Most of our study participants had CeD and IBS, studies have associated those two disorders (Sanders et al. 2001, 2003; Shahbazkhani et al. 2003). CeD has been positively associated with appendectomies (Ludvigsson et al. 2006), but only 3 CeD patients in our study had had an appendectomy. Atopic dermatitis also is an autoimmune disease and studies have associated it with CeD in that both are autoimmune diseases (Caproni *et al.* 2012).

CONCLUSION

To conclude, our study revealed a lack of knowledge among students of medical science colleges regarding CeD. This underscores the need to provide educational seminars to introduce all students to CeD and similar disorders.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

M H as done all work in this article.

REFERENCES

A. Al-Hussaini, N. Sulaiman, M. Al-Zahrani, A. Alenizi, I. El Haj, High prevalence of celiac disease among Saudi children with type 1 diabetes: a prospective cross-sectional study, 2012.

E. Alhassan, A. Yadav, C.P. Kelly, R. Mukherjee, Novel non-dietary therapies for celiac disease, Cell. Mol. Gastroenterol. Hepatol. (2019).

A.M. Aljebreen, M.A. Almadi, A. Alhammad, F.Z. Al, F. Abdulrahman, M. Aljebreen, A. Faleh, G. Division, Seroprevalence of celiac disease among healthy adolescents in Saudi Arabia, (2013).

M. Almehmadi, M. Salih, A. Al-hazmi, Awareness of human papillomavirus infection complications, cervical cancer, and vaccine among the Saudi population. A cross-sectional survey, Saudi Med. J. 40 (2019) 555–559.

A.M. Assiri, A. Saeed, E. Saeed, M.I. El-Mouzan, A.A. Alsarkhy, M. Al-Turaiki, A. Al-Mehaidib, M. Rashid, A. Ullah, Assessment of knowledge of celiac disease among health care professionals, Saudi Med. J. (2015).

G. Caio, U. Volta, A. Sapone, D.A. Leffler, R. De Giorgio, C. Catassi, A. Fasano, Celiac disease: A comprehensive current review, BMC Med. (2019).

M. Caproni, V. Bonciolini, A. D'Errico, E. Antiga, P. Fabbri, Celiac disease and dermatologic manifestations: many skin clue to unfold gluten-sensitive enteropathy., Gastroenterol. Res. Pract. 2012 (2012) 952753.

A. Cohn, A.M. Sofia, S.S. Kupfer, Type 1 diabetes and celiac disease: clinical overlap and new insights into disease pathogenesis., Curr. Diab. Rep. 14 (2014) 517.

Almehmadi M. Seroprevalence of IgM and IgG in Serum of COVID-19 Diabetic Patients After Recovery. Clinical Laboratory. 2022 Mar;68(3). DOI: 10.7754/clin.lab.2021.210632. PMID: 35254016.

P.H.R. Green, B. Jabri, Coeliac disease., Lancet (London, England). 362 (2003) 383–91.

M. Al Hatlani, Prevalence of celiac disease among symptom-free children from the Eastern Province of Saudi Arabia, Saudi J. Gastroenterol. (2015).

C.J. Hovell, J.A. Collett, G. Vautier, A.J. Cheng, E. Sutanto, D.F. Mallon, J.K. Olynyk, D.J. Cullen, High prevalence of coeliac disease in a population-based study from Western Australia: a case for screening?, Med. J. Aust. 175 (2001) 247–50.

M. KARAJEH, D. HURLSTONE, T. PATEL, D. SANDERS, Chefs? knowledge of coeliac disease (compared to the public): a questionnaire survey from the United Kingdom, Clin. Nutr. 24 (2005) 206–210.

. Lionetti, S. Castellaneta, R. Francavilla, A. Pulvirenti, E. Tonutti, S. Amarri, M. Barbato, C. Barbera, G. Barera, A. Bellantoni, E. Castellano, G. Guariso, M.G. Limongelli, S. Pellegrino, C. Polloni, C. Ughi, G. Zuin, A. Fasano, C. Catassi, Introduction of Gluten, HLA Status, and the Risk of Celiac Disease in Children, N. Engl. J. Med. (2014).

E. Liu, M. Rewers, G.S. Eisenbarth, Genetic Testing: Who Should Do the Testing and What Is the Role of Genetic Testing in the Setting of Celiac Disease?, (2005).

J.F. Ludvigsson, J. Askling, A. Ekbom, S.M. Montgomery, Diagnosis underlying appendectomy and coeliac disease risk, Dig. Liver Dis. 38 (2006) 823–828.

J.F. Ludvigsson, D.A. Leffler, J.C. Bai, F. Biagi, A. Fasano, P.H.R. Green, M. Hadjivassiliou, K. Kaukinen, C.P. Kelly, J.N. Leonard, K.E.A. Lundin, J.A. Murray, D.S. Sanders, M.M. Walker, F. Zingone, C. Ciacci, The Oslo definitions for coeliac disease and related terms, Gut. 62 (2013) 43–52.

K.E.A. Lundin, C. Wijmenga, Coeliac disease and autoimmune disease - Genetic overlap and screening, Nat. Rev. Gastroenterol. Hepatol. (2015).

Mazen Almehmadi, Evaluation of liver function show hypoproteinemia in untreated cancer patients: A cross-sectional study, Annals of Cancer Research and Therapy, 2020, Volume 28, Issue 2, https://doi.org/10.4993/acrt.28.63

M.C. Mazzilli, P. Ferrante, P. Mariani, E. Martone, F. Petronzelli, P. Triglione, M. Bonamico, A study of Italian pediatric celiac disease patients confirms that the primary HLA association is to the DQ(α1*0501, β1*0201) heterodimer, Hum. Immunol. (1992).

D.S. Sanders, M.J. Carter, D.P. Hurlstone, A. Pearce, A.M. Ward, M.E. McAlindon, A.J. Lobo, Association of adult coeliac disease with irritable bowel syndrome: a case-control study in patients fulfilling ROME II criteria referred to secondary care, Lancet. 358 (2001) 1504–1508.

Mazen Almehmadi, Khalid Alzahrani, Magdi M. Salih, Abdulaziz Alsharif, Naif Alsiwiehri, Alaa Shafie, Abdulraheem A. Almalki, Ayman Alhazmi, Haytham Dahlawi, Mohammed S. Alharthi, Mustafa Halawi, Abdulrhman M. Almehmadi, Hatem H. Allam, Prevalence of vitamin D deficiency in early-diagnosed cancer patients: A cross-sectional study, Annals of Cancer Research and Therapy, 2020, Volume 28, Issue 2, Pages 54-59, https://doi.org/10.4993/acrt.28.5

D.S. Sanders, D. Patel, T.J. Stephenson, A.M. Ward, E. V McCloskey, M. Hadjivassiliou, A.J. Lobo, A primary care cross-sectional study of undiagnosed adult coeliac disease., Eur. J. Gastroenterol. Hepatol. 15 (2003) 407–13.

M. Schultz, S. Shin, K.J. Coppell, Awareness of coeliac disease among chefs and cooks depends on the level and place of training, Asia Pac. J. Clin. Nutr. 26 (2017) 719–724.

Almehmadi M M (July 02, 2020) Association Between Random Glucose Level and Leukocytes Count in Female Cancer Patients. Cureus 12(7): e8962. doi:10.7759/cureus.8962.

B. Shahbazkhani, M. Forootan, S. Merat, M.R. Akbari, S. Nasserimoghadam, H. Vahedi, R. Malekzadeh, Coeliac disease presenting with symptoms of irritable bowel syndrome., Aliment. Pharmacol. Ther. 18 (2003) 231–5.

P. Singh, A. Arora, T.A. Strand, D.A. Leffler, C. Catassi, P.H. Green, C.P. Kelly, V. Ahuja, G.K. Makharia, Global Prevalence of Celiac Disease: Systematic Review and Meta-analysis., Clin. Gastroenterol. Hepatol. 16 (2018) 823-836.e2.

J.A. Tye-Din, H.J. Galipeau, D. Agardh, Celiac Disease: A Review of Current Concepts in Pathogenesis, Prevention, and Novel Therapies, Front. Pediatr. 6 (2018) 350.