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Assessment of Iron Status and Iron Deficiency Anemia in Patients with Celiac Disease in Tripoli University Hospital

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ABSTRACT

***Background**: The iron absorption process occurs mainly in the proximal duodenum portion. this portion is typically destroyed in celiac disease (CD), resulting in a reduction in absorption of iron and subsequent iron deficiency anemia (IDA). IDA is the most common extraintestinal manifestation in CD. The primary treatment of CD is the gluten-free diet (GFD), which is associated with management of IDA, if present. Iron replacement treatment is mainly based on oral iron supplement. The absorption of iron is decreased in patients with untreated CD and unpredictable in patients on a GFD. Anemia Normalization is typically achieved after at least 6 months of GFD, but the process can take up to 2 years for iron stores to replenish.*

***Aim**: This study aimed to assess the status of iron stores and the frequency of iron deficiency anemia in Celiac disease (CD) patients referred to the Department of Gastroenterology, Tripoli University Hospital.*

***Methods**: In this study, 100 CD patients were assessed. The presence and severity of anaemia were determined using the serum hemoglobin concentration according to WHO criteria. The status of body iron stores was also evaluated based on serum ferritin levels.*

***Results**: Mean and SD of age, serum iron, ferritin, TIBC, and serum hemoglobin were 27.98±9.42 years, 32.63± 24.76 µg/dL, 14.86±11.91mg/dL, 259.40±95.42 µg/dL and 10.26±2.54 g/dl, respectively. 38.0% had no anemia, 20.0% had mild anemia, 33.0% had moderate anemia, and 9.0% had severe anemia. 65.0% of patients had depleted iron stores, 35.0% had normal iron stores, and no exposure to iron overload.*

***Conclusion:** In this study, 62.0% of CD patients on a gluten-free diet had some degree of anemia. In addition, 65.0% of patients had depleted iron stores. These results suggest that CD patients should be evaluated for iron status, even with a gluten-free diet.*

Keywords: Celiac Disease (CD), Anemia, Serum Iron, Ferritin, Total Iron-binding Capacity (TIBC), and Serum Hemoglobin.

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Background

1Celiac disease (CD) is a type of enteropathy with a systemic disorder that is mediated by the immune system and occurs during contact with gluten with intestinal mucosa in genetically predisposed individuals. It is characterized by a wide range of gastrointestinal and systemic clinical signs and varying degrees of damage to the small intestinal mucosa [1-3]. Untreated CD can lead to the development of many complications and extra intestinal manifestation associated with the impaired nutritional status of patients [4-6].

Anemia, which occurs in 5 to 40 percent of patients in the West and more than 80 percent of patients in developing countries, is one of the most common extra intestinal manifestations of CD. Although studies have shown that anemia in CD is multifactorial (nutritional or non- nutritional), in a study in which 93% of patients with CD had anemia, the most common cause was iron deficiency (81.5%) [2]. The IDA is the most common extra intestinal manifestations in CD [2, 7-9].

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The iron absorption process occurs mainly in the proximal duodenum portion. this portion typically destroyed in celiac disease (CD), resulting in a reduction in absorption of iron and subsequent iron deficiency anemia (IDA) [2]. There is direct relationship between the degree of villus atrophy and severity of anemia. The recovery of iron stores may take a relatively long time than villi healing time. Thus, iron deficiency may be an important nutritional problem in CD patients [2, 5, 6].

The gluten-free diet (GFD) is the main treatment of CD, which lead to improvement of IDA, if present. Iron replacement treatment mainly based on oral iron supplement. The absorption of iron is decreased in patients with untreated CD and unpredictable in patients on a GFD. Anemia Normalization typically achieved after at least 6 months of GFD, but the process can take up to 2 years for iron stores to replenish. The manifestations of CD can be preventable and treatable with a gluten-free diet, so the early diagnosis of CD is important for the prevention of serious and potentially lethal complications [1, 4, 12].

Aim

This study aimed to assess the status of iron stores and the frequency of iron deficiency anemia in Celiac disease (CD) patients referred to the Gastroenterology OPD, Tripoli university hospital.

Methods

In this analytical cross-sectional study, 100 patients with a definite diagnosis of celiac disease (based on biopsy and serological tests) follow Gastroenterology and hepatology OPD at Tripoli university hospital Center (TUH) in 2024 were entered into the study. The demographic data was collecting from patient recording document. labratory investigation done at local laboratory center of TUH. The presence and severity of anemia were determined using the concentration of serum hemoglobin according to the criteria of the World Health Organization [10]. And the status of body iron stores was assessed based on serum ferritin levels and according to the criteria of the World Health Organization [11]. Data analysis was performed descriptively using SPSS version 26.0.

This study was performed after approval by the medical administration of Tripoli university hospital.

Results

Mean and standard deviation (SD) of age, serum iron, ferritin, TIBC, and serum hemoglobin were 27.98 ±9.42 years, 32.63±24.76 µg/dL, 14.86± 11.91mg/dl, 259.40±95.42 µg/dL, and 10.26±2.54 g/dL, respectively. The difference between serum hemoglobin in men and women was statistically significant (P=0.018), but there was no statistically significant difference between men and women in terms of ferritin and TIBC levels, serum iron and age (Table 1). According to the WHO criteria, 100 patients for whom hemoglobin level information was available, 38.0% (38 patients) had no anemia, 20.0% (20 patients) had mild anemia, 33.0% (33 patients) had moderate anemia, and 9.0% (9 patients) had severe anemia [10]. There was no statistically significant difference between men and women in terms of the severity of anemia (Table 2).

There was no statistically significant difference between the rate and degree of anemia in the mentioned age categories (P=0.460). According to the WHO criteria, 65.0% of patients had depleted iron stores, 35.0% had normal iron stores, and no exposure to iron overload [11]. There was no statistically significant difference between men and women in terms of iron stores (p=0.495).

Table 1: Comparison of Age, Serum Iron, Ferritin, TIBC, and Hemoglobin between Males and Females with Celiac Disease (n=100)

		Mean	DS	Min.	Max.	p-value
Age (years)						
	Male	25.57	7.10	16	41	
	Female	29.03	10.19	16	52	
	Total	27.98	9.42	16	52	
Serum Iron (µg/dL)						0.296
	Male	45.31	31.25	10	140	
	Female	25.80	17.15	3	99	
	Total	32.63	24.76	3	140	
Ferritin (mg/dL)						0.890
	Male	18.26	10.71	3	46	
	Female	13.03	12.20	2	68	
TIBC[1] (µg/dL)	Total	14.86	11.91	2	68	0.363
	Male	284.74	93.57	108	460	
	Female	245.75	94.30	50	451	
	Total	259.40	95.42	50	460	
Haemoglobin (g/dl)						0.018*
	Male	11.30	2.90	5	15	

	Female	9.71	2.15	5	14	
	Total	10.26	2.54	5	15	

[1] TIBC= total iron-binding capacity.
* ($P < 0.05$).

Table 2: Comparison of Anemia Regarding Gender According to WHO Classification (n=100)

Anemia classification	Male		Female		Total of
	Level (g/dl)	No.	Level (g/dl)	No.	No.
Non-anemia	≥ 13	16	≥12	22	38.0
Mild anemia	11-12.9	5	11-11.9	15	20.0
Moderate anemia	8-10.9	10	8-10.9	23	33.0
Severe anemia	<8	3	<8	5	09.0
p-value					0.495

Discussion

The results showed that 62.0 % of CD patients on a gluten-free diet had some degree of anemia. In addition, 65.0% of patients had depleted iron stores. Although accurate interpretation of ferritin levels to assess iron stores necessitates the simultaneous examination of inflammatory markers, the current study was conducted in gluten-free patients, with no consideration given to diet adherence or clinical, serological, or histological symptoms. In a study of assessment of iron status and iron deficiency anemia in patients with CD in Iran, 59 out of 100 CD patients with a mean age of 39.9 years were studied. 68.42% had no anemia, 19.3% had mild anemia, 8.77% had moderate anemia, and 3.51% had severe anemia. In addition, Serum hemoglobin, ferritin, TIBC, and serum iron were 12.6±1.99 g/dl, 54.3±55.3 mg/dL, 365.9±49.1 µg/dL, and 84.1±37.1 µg/dL, respectively. In another study of newly diagnosed CD patients in the Netherlands, 80 individuals with a mean age of 42.8 years were included. The serum levels of folic acid, vitamin B12, hemoglobin, and ferritin were determined. Twenty percent of the patients were vitamin B9 deficient, 19% were vitamin B12 deficient, 46.2% had low iron reserves, and 32.4% had iron deficiency anemia. In another research, 39 newly diagnosed CD patients (32 females and 7 men) with an average age of 48 years were tested for certain nutrients. 41% of patients had B12 insufficiency, 31% had folate deficiency, and 41% were anemic. Additionally, serum vitamin B12 levels recovered to normal without supplementation.

Anemia is connected with iron deficiency, which is generally caused by excessive blood loss or reduced iron absorption. Iron deficiency anemia is more prevalent in newly diagnosed CD

patients and can continue even after commencing a gluten-free diet [13-15]. Iron deficiency anemia in children as well as adults can sometimes be a clinical characteristic of CD, or possibly the only finding [15, 16]. Although good epidemiological data on iron insufficiency in CD are limited, some recent investigations show that iron deficiency is prevalent in both children and adults with celiac disease [17, 18]. As demonstrated in the current study, almost one-quarter of patients had reduced iron reserves, indicating that these patients require a frequent test of iron status not only at the time of diagnosis but also when on a gluten-free diet. However, research suggests that iron insufficiency can still persist despite iron supplementation [19].

According to research, persons with CD have higher levels of mRNA for the DMT1 receptor, ferroportin, hephaestin, and transferrin than healthy controls, yet their iron reserves are lower. These iron-regulating proteins are also boosted by iron shortage (which is unrelated to celiac disease), implying that the re-regulation of iron absorption capacity observed in CD is largely caused by iron insufficiency [20]. In contrast, a recent study discovered that DMT1 and ferroportin mRNA expression increased in celiac disease, regardless of iron shortage. Furthermore, ferritin mRNA expression in celiac disease rises exclusively in patients with iron insufficiency [21].

Despite its high rate of iron deficiency anemia, iron deficiency in CD should only be diagnosed after thorough assessment of other prevalent causes, such as colon cancer [19]. In addition to malabsorption issues induced by the condition, other investigations have identified gastrointestinal occult bleeding as a source of iron deficiency anemia in celiac disease [22].

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