

# Assessing the Prevalence of Food Insecurity among Children with Celiac Disease: A Cross-sectional Study

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**Abstract** Celiac disease (CD) is a chronic immune-mediated enteropathy caused by dietary gluten. The present study aimed to investigate FI in children and adolescents suffering from CD. In this cross-sectional study, a total of 62 known cases of CD (both males and females) were interviewed for assessing FI through a food insecurity questionnaire. Anthropometric indices were also measured. The data are reported as Mean  $\pm$  standard deviation [SD]. Sixty-two patients, 36 females (58.1%) and 26 (41.9%) males, were surveyed. The age of the participants was 11.04  $\pm$  3.8 years. The mean of weight (kg) and height (cm) was 34.69  $\pm$  17.96 and 139.06  $\pm$  0.22, respectively. The mean FI score was 3.4  $\pm$  2.25 which means insecurity without starvation (mild FI). The results showed that 30.6% of patients were food secure, 35.5% were insecure without starvation, 24.2% insecure with mild starvation, and 9.7% insecure with intense starvation (severe insecurity). The overall prevalence of FI was 69.4% among children. Proposed strategies are needed to improve compliance with gluten-free diet. Also producing especial cheaper products with food labeling and better education about the diet would decrease the risk of FI in this population.

**Keywords:** celiac disease, food security, Malabsorption Syndromes, Gluten-Free Diet

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## 1. Introduction

Celiac disease (CD) is an autoimmune genetic-related disease causing abdominal pathology in individuals exposed to gluten. Gluten is a protein existing in rye, barley and wheat. The only known treatment for CD is eliminating gluten from the diet. Gluten-free diet (GFD) causes improvement in clinical manifestations of CD [1]. The CD manifestations can be seen as losing weight, diarrhea and distention in the abdomen [2]. Progressive inflammation of the small intestine is a predominant feature which causes malabsorption if GFD is not complied. [1].

European studies have shown that the rate of GFD compliance is from 32% to 95% [3].

Roma et al. reported that the incorrect labeling of commercially available foods, the limited participation of dieticians and the inadequacy of restaurants to prepare GF meals were the most important causes of low compliance [4]. Due to clinical silence of CD, it remains undiagnosed and the patients are at risk of infertility and osteoporosis [2]. The incidence rate of CD is 1%-2%. Prevalence of CD in Iran is one in 104 to one in 166 [5]. Food insecurity is

defined as lack of access to adequate, nutritious and safe food for fulfilling nutritional needs [6]. Food and Agriculture Organization states that "food security exists when all people, at all times, have physical, social, and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [7]. Height for age, weight for age and body mass index (BMI) for age are essential tools for evaluating nutritional status and growth rate [8]. As there are plenty of economic barriers for GFD compliance, food insecurity becomes an essential factor for evaluation of availability to sufficient food. As mentioned before, malabsorption could happen in CD patients, which in turn leads to malnutrition and food insecurity.

The aim of this study was to evaluate the rate of food insecurity in children with CD and also to assess its relationship with growth parameters in both genders.

## 2. Materials and Methods

We conducted a cross-sectional study in Imam Reza Celiac clinic. Celiac-diagnosed individuals of either gender, aged 5-18 years who started GFD at least 1 month

ago participated in the study. Written informed consent was signed by parents. Patients not adhering to GFD and those starting GFD less than one month were excluded from the study. Adherence to GFD was checked by measuring anthropometric indices and asking about symptoms from parents. Sixty-two individuals were interviewed by means of a questionnaire.

We used the USDA 18-item food security questionnaire [9], which had been validated in other studies in Iran [10]. The USDA food security questionnaire which determines food security status of the household in the last 12 months was completed by the mother or person preparing food for the family. Then, a registered dietitian (RD) read the items for each patient again to confirm it. Based on the number of affirmative responses, we classified each individual to one of four categories: food-secure (0–2 affirmative responses), food-insecure without hunger (3–7 affirmative responses), food-insecure with moderate hunger (8–12 affirmative responses), and food-insecure with severe hunger (13–18 affirmative responses). The sum of scores was classified into four groups: food-secure (0–1.8), food-insecure without hunger (2.4–4.3), food-insecure with moderate hunger (4.7–6.3) and food-insecure with severe hunger (6.6–9.3).

Patient's weight and height were also measured by clinical examination. Weight was divided to (height)<sup>2</sup> calculate body mass index (BMI). To evaluate the growth status, we used Centers for Disease Control and Prevention (CDC) growth standards including: BMI for age, stature for age and weight for age. The data were expressed by relative Z- scores.

Statistical analysis was performed by SPSS software version 22. The data were expressed as mean  $\pm$  standard deviation. Data were statistically analyzed by using Independent sample t-test and Pearson correlation test. A P value of  $<0.05$  was considered significant.

### 3. Results

Sixty-two patients, 36 females (58.1%) and 26 (41.9%) males, participated in the study. Patients' characteristics are shown in Table 1. The appetite in 49 (79%) patients was good, in 8 (12.9%) patient's average, and in 5 (8.1%) patients poor. 17 (27.4%) patients had diabetes, 6 (9.7%) had anemia, 5 (8.1%) had lactose intolerance and 4 (6.5%) had thyroid disease.

**Table 1. Clinical and Nutritional Parameters in CD Patients**

parameter	mean
Weight, kg	34.69 $\pm$ 17.96
Height, m	1.39 $\pm$ 0.22
Body mass index, kg/m <sup>2</sup>	16.76 $\pm$ 4.19
Age, y	11.04 $\pm$ 3.8
BMI for age z score, SD	-0.84 $\pm$ 1.30
weight for age z scores, SD	-0.94 $\pm$ 1.45
height for age z scores, SD	-0.61 $\pm$ 1.25

The mean food insecurity score was  $3.4 \pm 2.25$  which means insecurity without hunger (mild food insecurity). The results showed that 30.6% of patients were food secure, 35.5% were insecure without hunger, 24.2%

insecure with mild hunger, and 9.7% insecure with intense hunger (severe insecurity).

No significant correlation was found between food security score and all the factors including: weight, height, BMI, age, BMI for age z scores, weight for age z scores, height for age z scores.

The correlation between food insecurity and weight and height is shown in Table 2. Independent t-test was used and no significant relationship was seen (Table 2).

In Table 3, patients are divided into malnourished (weight for age z score  $<-2$ ) and well-nourished (weight for age z score  $\geq -2$ ). There was no significant difference between the two groups regarding food insecurity score

Independent sample t-test was used and no significant relationship was seen between food insecurity and none of the z scores (Table 3).

**Table 2. Comparison of anthropometric data in celiac patients with and without food insecurity**

Parameter (Mean $\pm$ S.E)	Food insecure (food insecure score between 2.4-9.3)	Food secure (food insecure score between 0-1.8)	P value
weight	32.95 $\pm$ 2.23	38.63 $\pm$ 5.47	0.34
BMI	16.24 $\pm$ 0.44	17.94 $\pm$ 1.4	0.26

**Table 3. Food insecurity score in celiac patients by nutritional status based on Z-score weight for age**

Parameter (Mean $\pm$ S.E)	Well nourished (weight for age z score $\geq -2$ ) n=43	Malnourished (weight for age z score $<-2$ )n= 19	P value
food insecurity	3.28 $\pm$ 0.34	3.92 $\pm$ 0.5	0.3

### 4. Discussion

Gluten free diet -the only celiac disease medical treatment- has many limitations 9. Studies show that gluten-free diets replacing corn and rice instead of wheat and barley are poor in fiber, protein, iron, zinc, folate and potassium, while having higher fat, carbohydrates and sugar, thus higher glycemic index leads to an increase in the risk of metabolic syndrome and cardiovascular disease [11]. The removal of gluten and all of its products from the diet will limit food choices with poor nutritional value, poor quality, unpleasant mouth feel, less viscous and less pale bread 18 and in addition to reducing food diversification, it will result in limited food access [12]. The World Bank, in its report on the Challenge of Hunger in Africa, states that food security in each community has two main prerequisites: ensuring food availability in the community, and ensuring the family's ability to obtain food [13]. In celiac disease, both prerequisites are scarred. In fact, gluten contamination and inadequate quantities of gluten-free foods make it difficult for the celiac community to feed. On the other hand, low or poor availability of GF products and the high cost of these foods will reduce the access of families. Gluten found in 70% of manufactured food products and the labeling of commercially available foods are incorrect [14].

This condition breaks the principle of the human right to adequate food (HRAF). Therefore, the level of food and nutritional insecurity is expected to be high in patients with celiac disease [15]. Results indicate the high

prevalence of insecurity in the studied population. 69.4% of children have different levels of food insecurity, most of them not hungry. The prevalence of food insecurity was reported 49% among Iranian household and 67% in Iranian children in 2016 [16]. In Shiraz, the prevalence of food insecurity was reported to be around 44% in 2008. That study showed that factors such as low social and economic status, and more children and children under the age of 18 are likely to be at higher incidence of food insecurity [17].

The percentage of food insecurity was 69.17% in the upper GI (gastric, esophagus, both) cancer patients, in Tehran in 2012 and it was significantly higher than general people [18,19]. Thus, the prevalence of food insecurity in children with celiac disease was the same as GI cancer patients and higher than Iranian healthy children.

There was no significant correlation between food security score and all the factors including: weight, height, BMI, age, BMI for age z scores, weight for age z scores, height for age z scores. This lack of correlation between food insecurity and anthropometric indices can be due to the fact that food insecurity coincided with moderate to severe hunger in only 33.9% of cases. In fact, 66.1% of children with celiac disease did not suffer from hunger. Therefore, insecurity has not been able to significantly affect the anthropometric indices and the growth of celiac children.

According to household expenditure research studies in Iran, a quarter of population cannot meet their needs for energy and half of them have micro-nutrient deficiency [16]. On the 2013 map, Iran has been at the risk of moderate food insecurity. In the fourth and fifth development plans, food security has been considered as a prerequisite for having a healthy society as a major macroeconomic targets [13].

The imbalance of food intake and food insecurity and hunger can also have adverse effects on physical, social and mental wellbeing [16]. The macroeconomic policies affecting the change in prices and wages and the provision of services to households have an impact on food supplies. A study of Dastgiri et al in 2011 showed that having a monthly income, a house and car has a significant effect on household food insecurity status, where food secure families had a house, a car and monthly fix income compared to food insecure families [20].

Although still economic factors play a decisive role in the food security, the social and cultural factors can also affect the households' access to food supplies and food choices [13]. This means that while access to gluten-free products is difficult and the cost of these products is high, education on nutrition and increasing awareness of the community about the disease can be effective in changing the level of food insecurity in these patients [5].

Celiac disease is known to affect up to 1% of the population and has seen a fourfold increase in incidence over the past two decades [12]. Indeed, over the last few decades significant changes in western dietary habits by increased wheat production and gluten intake, higher gluten content in modern wheat and exposure to pollution, infectious habitat and stress load, and improved diagnosis have led to a rise in celiac diseases [21], but there is still a low number of people who find it difficult to research.

Another limitation of the study was the lack of good cooperation between families in completing the questionnaires, which is due to the cultural barriers in the community and the lack of knowledge about the disease. This study had no control group because the study was performed at Imam Reza Celiac Clinic, where all children presented with celiac disease and we had no access to healthy children. For this reason, the results of previous studies were used to compare the results.

It is suggested that future researchers should study a larger population of Celiac patients to check the food security. Also, the use of healthy children as a control group is suggested. It is also possible to investigate the food security in other family members and survey other effective economic and social factors.

## 5. Conclusion

The adequate access to food is everyone's right, including people with celiac disease. Celiac individuals are at risk of food and nutritional insecurity because of the need for a gluten-free diet and the lack of adequate access to these products and high prices of them. Proper social and economic policies for the adequate and safe production of gluten-free products, proper pricing of these products and increased access to them can help to control this food insecurity. On the other hand, increasing public awareness about the disease and educating proper nutrition to families with Celiac disease will have an effective role in reducing this trend.

## Conflict of Interest

The authors declare no conflict of interest.

## Footnote

CD: celiac disease.

HRAF: human right to adequate food.

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