

# Anthropometric Profile of Children with Celiac Disease before and after treatment with Gluten Free Diet

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## Abstract

**Background:** The concept of gluten free diet (GFD) is simple in its principles but attention needs to be given to the nutritional status of the children to avoid continued malnutrition.

**Aim:** To study the anthropometric parameters in children with Celiac disease at diagnosis and after 12 months of GFD

**Methods:** Children between the age group of 2-16 years with the diagnosis of celiac disease were enrolled. Anthropometric measurements including weight, height and BMI were recorded at the time of diagnosis and after 12 months of GFD.

**Results:** At diagnosis, 50.0% had a weight for age below 3<sup>rd</sup> percentile and the rest were of normal weight (between 3<sup>rd</sup> and 97<sup>th</sup> percentile). 61.1% had short stature with a height for age and 38.9% had normal height. 16.7% of the cases were underweight (BMI <3<sup>rd</sup> percentile), 75.0% had normal BMI (between 3<sup>rd</sup> percentile and adult equivalent of 23) and 8.3% overweight (between adult equivalent of 23 and 27). While after 12 months of GFD, only 2.8% had a weight below 3<sup>rd</sup> percentile and 5.6% had short stature. 66.7%, 22.2% and 11.1% children were of normal BMI, overweight and obese respectively.

**Conclusion:** A significant proportion of the celiac children were malnourished at the time of diagnosis, while after 12 months of GFD, not only did we find improvement but 11.1% of the patients went on to develop obesity. Thus in order to prevent or delay the onset of metabolic syndrome, individualised diet should be structured according to the nutritional status at diagnosis.

**Key words:** celiac disease, nutrition, Gluten free diet, obesity

## Introduction:

Celiac disease is a chronic small bowel enteropathy with an underlying autoimmune mechanism precipitated by exposure to dietary gluten in genetically predisposed people. It is the most common cause of chronic diarrhoea in children and accounts for 26% and 56% of chronic diarrhoea among the adults in Western and Northern India respectively.<sup>[1]</sup> Clinical spectrum of celiac disease includes symptoms of frank mal-absorption (chronic diarrhoea, abdominal pain and distension, weight loss) and extra intestinal manifestations (anaemia, fatigue, neurologic disorders, short stature, dental enamel defects, arthralgia, aphthous stomatitis etc.).

Celiac disease is unique because of its early onset, association with specific comorbidities and because specific dietary modification is its only constant treatment. Codex Alimentarium guidelines define gluten free diet to contain less than 20ppm of gluten and patients are thought to tolerate less than 50mg of gluten per day.<sup>[2]</sup> Milk may be avoided during the initial period of lactose intolerance. Oats are safe in celiac disease but as the commercially available oats are usually contaminated with wheat, barley or rye, it is best avoided.

The concept of gluten free diet is simple in its principles but the task of eliminating all the food and ingredients that contain gluten requires a lot of

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effort and commitment, as the changes imposed are restrictive and permanent. Moreover, long term GFD may not be nutritionally well balanced. Gluten free foods tend to be characterised by high glycaemic index with increased intake of simple sugars and saturated fat over complex carbohydrate and fibre. Also gluten free foods being unpalatable cause the patients to prefer hyperlipidaemic food. Thus, in turns leads to high calorie intake and weight gain. Increased weight gain can also result from improved intestinal absorptive state and mucosal healing with treatment. Therefore more attention needs to be given to the nutritional status of the children even with good compliance to treatment. Hence we planned to study the anthropometric measurements in children with celiac disease at the time of diagnosis and compare them to age and sex matched controls.

### Material and Methods:

The study was conducted in the Department of Paediatrics in the institute, during 2015-2018. Children between the age group of 2-16 years with the diagnosis of celiac disease (newly diagnosed) were enrolled for the study group. Informed written consent was obtained from parents or guardians or attendants of all children before enrolling in to the study. After enrolment, the demographic details and anthropometric measurements including weight, height and BMI (weight in kg/height<sup>2</sup> in kg/m<sup>2</sup>) were recorded for all the children using standard methods. The children were followed up after 12 months of strict GFD and were assessed for treatment compliance. Repeat anthropometric assessment was done and the same was recorded to be compared with the previous measurements and analysed using standard IAP growth charts.

Statistical analysis was performed by the SPSS program for Windows, version 17.0. Continuous variables are presented as mean  $\pm$  SD, and categorical variables are presented as absolute numbers and percentage. Data were checked for normality before statistical analysis. For all statistical tests, p value less than 0.05 was taken to indicate a significant difference.

### Results:

Mean age at diagnosis was  $7.72 \pm 3.26$  years while mean age of onset of disease was  $5.86 \pm 3.09$  years. The gender distribution in the study comprised 16 (44.4%) females and 20 (55.6%) males. Out of the 36 cases, 12 had a disease onset between 3-6 years of age, 11 had an onset between 6-9 years of age with a mean duration of illness being  $22.47 \pm 20.47$  months. Overall, the most common symptom was diarrhoea present in almost two thirds of our cases followed by

pain abdomen and failure to thrive with complaints of not gaining height and weight present in more than half of our cases.

At the time of diagnosis, 50.0% of the cases enrolled had a weight for age below 3<sup>rd</sup> percentile and the rest were of normal weight (between 3<sup>rd</sup> and 97<sup>th</sup> percentile). 61.1% of the cases had short stature with a height for age less than 3<sup>rd</sup> percentile and 38.9% had normal height (between 3<sup>rd</sup> and 97<sup>th</sup> percentile). We also observed that 16.7% of the cases were underweight (BMI <3<sup>rd</sup> percentile), 75.0% had normal BMI for age (BMI between 3<sup>rd</sup> percentile and adult equivalent of 23), 8.3% were overweight (BMI between adult equivalent of 23 and adult equivalent of 27) and none of the children were obese (BMI >adult equivalent of 27).

While after 12 months of GFD, 97.2% of the children had a normal weight and only 2.8% had a weight below 3<sup>rd</sup> percentile. Also, 94.4% had normal height while 5.6% had persistent short stature. All of the children who were underweight at the diagnosis improved with treatment to attain normal BI for age. A total of 24 out of 36 patients i.e. 66.7% of the children had normal BMI after the treatment but 8 of our patients i.e. 22.2% developed overweight and 4 patients i.e. 11.1% became obese with treatment even with good adherence to gluten free diet (Table 1).

**Table 1: Anthropometric profile of the children with celiac disease at diagnosis and after 12 months of GFD**

Anthropometric parameters	At diagnosis		After 12 months of GFD		P Value
	Frequency	%	Frequency	%	
<b>Weight (kg)</b>					
<3rd centile	18	50.0%	1	2.8%	<0.001
3-97th centile	18	50.0%	35	97.2%	
<b>Total</b>	<b>36</b>	<b>100%</b>	<b>36</b>	<b>100%</b>	
<b>Height (cm)</b>					
<3rd centile	22	61.1%	2	5.6%	<0.001
3-97th centile	14	38.9%	34	94.4%	
<b>Total</b>	<b>36</b>	<b>100%</b>	<b>36</b>	<b>100%</b>	
<b>BMI (kg/m<sup>2</sup>)</b>					
<b>Underweight</b>	6	16.7%	0	0.0%	0.006
<b>Normal</b>	27	75.0%	24	66.7%	
<b>Overweight</b>	3	8.3%	8	22.2%	
<b>Obese</b>	0	0.0%	4	11.1%	
<b>Total</b>	<b>36</b>	<b>100%</b>	<b>36</b>	<b>100%</b>	

**Discussion:**

Several studies have indicated that obesity or overweight is not unusual among celiac patients and weight changes are common especially after introduction of GFD. Weight gain in underweight patient is expected and desired with treatment, but majority of patients who are normal or overweight at diagnosis are likely to become overweight or obese after GFD, with a high proportion of them having BMI of 25 or over.<sup>[3]</sup> Celiac disease is associated with various comorbidities, of which type-I diabetes mellitus happens to be an important one. Also patients with celiac disease also show four-fold increased risk for development of systemic hypertension.<sup>[4]</sup> Thus they are more prone to develop metabolic syndrome.

Aurangzeb et al<sup>[5]</sup> in their study in 2010 studying the nutritional status found that 8.7% of the patients were wasted 4.2% were stunted and 20.8% were overweight. In 2010, studying Body mass index in celiac disease and the beneficial effect of a gluten-free diet, Cheng et al<sup>[6]</sup> demonstrated that 17.3% of the celiacs were underweight, 60.7% were normal, 15.2% were overweight and 6.8% were obese. While in a similar study by Dickey et al<sup>[3]</sup> 22% of the patients were found be underweight, 44% to be normal and 34% to be overweight.

But in our study, the children in the study group were more undernourished in comparison. This can be attributed to the fact that over all prevalence of under-nutrition among the general population is more in the Indian subcontinent than the western countries. Also, our cases included only children with advanced i.e. Marsh grade 3B and 3C findings, thus are expected

to have severe disease and are not representative of the whole celiac population. But after 12 months of gluten free diet, 97.2% of the children had a normal weight and only 2.8% had a weight below 3<sup>rd</sup> percentile. A total of 24 out of 36 patients i.e. 66.7% of the children had normal BMI after the treatment but 8 of our patients i.e. 22.2% developed overweight and 4 patients i.e. 11.1% became obese with treatment even with good adherence to gluten free diet.

Similarly a study by Dickey et al<sup>[3]</sup> also demonstrated weight gain in over 81% of patients who were compliant to treatment with 39% of the patients being overweight at the end of ten years of GFD. Studies have also demonstrated that even with GFD, height for age remained significantly lower, while BMI, weight for age, skin fold thickness and mid-arm circumference increased.<sup>[7]</sup> This may be related to the delayed diagnosis in most of patients later in childhood, resulting in slower, probably incomplete height gain while weight gain occurs faster with increase in BMI.

**Conclusions:** A significant proportion of the Celiac children were malnourished at the time of diagnosis but a few went on to develop obesity in a year even with strict gluten free diet for. Thus, in-depth nutritional evaluation should be carried out in all patients with celiac disease soon after diagnosis and individualised diet should be structured according to the nutritional status for every child. In order to prevent or delay the onset of metabolic syndrome, frequent and regular nutritional assessment needs to be carried out not just for ensuring compliance with GFD but also to assess the quality of gluten free diet being taken by the children.

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