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Swedish children with celiac disease comply well with a gluten-free diet, and most include oats without reporting any adverse effects: a long-term follow-up study[☆]



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ABSTRACT

The only known treatment for celiac disease is a gluten-free diet (GFD), which initially meant abstinence from wheat, rye, barley, and oats. Recently, oats free from contamination with wheat have been accepted in the GFD. Yet, reports indicate that all celiac disease patients may not tolerate oats. We hypothesized that celiac children comply well with a GFD and that most have included oats in their diet. A food questionnaire was used to check our patients; 316 questionnaires were returned. Mean time on the GFD was 6.9 years, and 96.8% of the children reported that they were trying to keep a strict GFD. However, accidental transgressions occurred in 263 children (83.2%). In 2 of 3 cases, mistakes took place when the patients were not at home. Symptoms after incidental gluten intake were experienced by 162 (61.6%) patients, mostly (87.5%) from the gastrointestinal tract. Small amounts of gluten (<4 g) caused symptoms in 38% of the cases, and 68% reported symptoms during the first 3 hours after gluten consumption. Oats were included in the diet of 89.4% of the children for a mean of 3.4 years. Most (81.9%) ate purified oats, and 45.3% consumed oats less than once a week. Among those who did not consume oats, only 5.9% refrained because of symptoms. General compliance with the GFD was good. Only the duration of the GFD appeared to influence adherence to the diet. Most patients did not report adverse effects after long-term consumption of oats.

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Abbreviations: CD, celiac disease; GFD, gluten-free diet.

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1. Introduction

In Sweden, up to 3% of adolescents have celiac disease (CD) [1], a persistent intolerance to gluten causing damage of the small intestinal mucosa. The pathogenesis of the disease involves interactions between environmental, genetic, and immunologic factors [2]. No definite cure has yet been found. The classic histopathologic characteristics of CD enteropathy are villous atrophy, crypt hyperplasia, increased intraepithelial lymphocytes, and chronic lymphocyte and plasma cell infiltration in the lamina propria [3]. A small intestinal biopsy, an invasive method usually requiring effective sedation/anesthesia, is considered the criterion standard for diagnosing CD in many but not all cases of investigation [4–6]. The American College of Gastroenterology recommends that the diagnosis of CD should always be based on a small intestinal biopsy in both adults and children [7]. The only known treatment for CD is a gluten-free diet (GFD) [8], which cures the intestinal damage in most cases [9]. In the past, GFD meant lifelong abstention from wheat, rye, barley, and oats. Lately, oats grown, processed, and packed entirely separated from cereals containing gluten have been accepted in the diet, first for adults [10] and later also for children [11]. Oat supplementation in a GFD was recommended to the Swedish child population in 2004 by the Swedish Pediatric Association [12]. The effects of this diet change on general compliance with a GFD among children, on the serologic markers of CD, and on the histology of the small intestinal mucosa have been addressed [11,13–16]. In adults, reports indicate that some CD patients may not tolerate oats [17–19]. Arentz-Hansen et al [18] found that the presence of avenin-reactive T cells in the mucosa of patients who have been consuming oats can induce mucosal inflammation. Results from a recent study of long-term consumption of oats, up to 8 years among adults and children, confirm that oats did not cause small-bowel mucosal villous atrophy [19]. Although the long-term effects of including oats in the GFD of children are less well researched, a Finnish study, which followed up children over a 2-year period, showed that the consumption of oats did not induce jejunal transglutaminase 2 immunoglobulin A class autoantibody deposits at the intestinal mucosa. This suggests tolerance to oats [14]. The presence of immunogenic or toxic peptides in the genus *Avena* (oats) has also recently been investigated by Londono et al [20]. Such peptides, known to be active in wheat, rye, and barley, were not present, suggesting that oats are safe for CD patients.

It was previously reported that strict lifelong adherence to a GFD has been problematic for adolescents having CD. Physicians and dietitians who are responsible for this patient group are often aware of the compliance problems of these children. A plethora of studies has indicated and discussed this issue, forwarding possible reasons for this problem [21–26]. Oats have been suggested as a valuable addition in the GFD, for reasons of taste, texture, and fiber content [27].

The hypothesis for the present study was that compliance was generally good among Swedish children with CD and that adding oats to the diet was acceptable for most of the children. To test this, we carried out a long-term follow-up, based on food questionnaires, on children with CD at their annual

check-ups. We sought to elucidate general compliance with a GFD and the long-term use of oats for children with CD. We have attempted to deepen our knowledge of the dietary habits of celiac children, to identify possible obstacles to a satisfactory compliance with a GFD, and to learn more about how safe it is to include oats in a GFD. Understanding more about these aspects may advance the science of human nutrition, especially as it relates to CD children.

2. Methods and materials

2.1. Patients

The study included 316 children and adolescents from 4 different pediatric clinics in southeast Sweden with a biopsy-confirmed CD diagnosis. The mean age was 12 ± 0.2 years. The male-to-female distribution was 1:1.7. The criteria for inclusion in the study were less than the age of 18.5 years, a small-bowel biopsy showing enteropathy compatible with CD, and consumption of a GFD.

2.2. Questionnaire

A food questionnaire was elaborated by the dietitians at 3 pediatric clinics in southeast Sweden and was used for the annual check-ups of pediatric CD patients in the region. Several pilot versions of the questionnaire were used and evaluated before it was finalized and used in the present study. Before the visits to our outpatient departments, the children or, in the case of younger children, the parents were asked to fill out the questionnaire. The questions concerned various aspects of the diet, for example, duration of the GFD, strictness of the diet, possible mistakes related to gluten consumption, experience of symptoms after accidental intake, and other problems with the GFD. They also addressed inclusion of oats in the diet, the duration and frequency of consumption, preferred oat products, and reasons for abstention from oats. An experienced pediatric dietitian assessed the amount of accidental gluten intake. A total of 316 questionnaires were returned, and 95% of them were correctly filled out, that is, all questions were answered.

2.3. Ethics

The study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences, Linköping University, Sweden. Informed written consent was obtained from all the parents of the patients.

2.4. Statistical analyses

Descriptive statistics were presented as means \pm SEM. Number and percentage were given for categorical variables to illustrate patient characteristics. As the data were not normally distributed, nonparametric tests were used. The χ^2 test and Fisher exact test were used to analyze differences in frequencies, and the Spearman rank correlation test was used to calculate correlations. A $P < .05$ was considered

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