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Nutrition

Gluten-free oats and diet quality in children and youth with celiac disease

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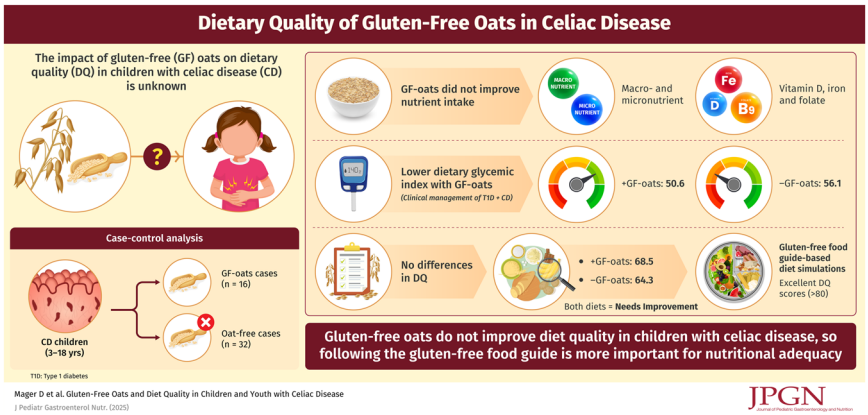
Abstract

Objectives: Celiac disease (CD) requires lifelong adherence to a strict gluten-free diet (GFD). The GFD is associated with higher intakes of fat, added sugars, and glycemic index (GI) and lower diet quality (DQ) in youth with CD. Gluten-free oats (GF-oats) are safe for CD youth, but few studies have studied the nutritional contribution of GF-oats consumption on DQ in children with CD. We hypothesized that youth with CD who consume GF-oats as part of their GFD will have higher DQ, micronutrient and fiber content, and lower GI than a GFD without GF-oats.

Methods: A case-control analysis using age-sex matched controls was performed in youth (ages 3–18 years) with CD in a 1:2 ($N = 16$ GF-oats cases: $N = 32$ Oat-free cases) ratio to compare differences in macro- and micronutrient (Canadian nutrient file), GI (mixed-method approach), DQ (healthy-eating index) between case-controls using validated methodologies. Dietary adequacy was determined by comparisons to dietary reference intakes (DRI) and to gluten free food guide (GFFG) recommendations.

Results: GF-oats did not significantly improve DQ (68.5 ± 16 [cases] vs. 64.3 ± 13 [controls], macro- and micronutrient, fiber intake, or the percentage of children meeting DRIs ($p > 0.05$). Children consuming GF-oats had lower dietary GI than children not consuming GF-oats (50.6 ± 2.4 [+GF-oats] vs. 56.1 ± 7.4 [–GF-oats]; $p = 0.05$). No differences in DQ occurred (±GF-oats) when following GFFG recommendations.

Conclusions: GF-oats are not a major determining factor of overall DQ in CD youth. Regardless of the oats in the GFD, following the pediatric GFFG was more important to DQ.



KEYWORDS

avenin, gluten-free diet, nutritional quality

1 | INTRODUCTION

A lifelong gluten-free diet (GFD) is the main treatment for youth with celiac disease (CD).[1] Current adherence to the GFD is quite variable in children (20%–100%)as following the GFD requires the child and family to make major lifestyle changes.[2,3] The GFD is associated with high intakes of fat/saturated fat, added sugars, and increased glycemic index (GI) in CD youth.[2,4,5] Diet quality (DQ) in children consuming GFD is uniformly low, characterized by low intakes of micronutrients (e.g., folate, vitamin D, iron) and fiber.[2,4,5] Increased reliance on processed and packaged gluten-free (GF) foods, higher GF food costs, and high rates of GF-food insecurity (>47%) are contributors to poor DQ in CD youth consuming the GFD.[2,4,6] A novel gluten free food guide (GFFG) for youth with CD was designed to combat poor DQ.[7] The GFFG provides dietary recommendations that focus on plant-based protein, fruit and vegetable consumption in children/youth with CD, providing tips and educational materials that focus on promoting excellent DQ.[7–9]

Health Canada recommends that children and adults with newly diagnosed CD wait 6 months to ensure remission before introducing GF-oats into the GFD.[1] This recommendation was based upon concerns regarding the risk for cross-contamination of GF-oats, and the potential that avenin, a protein found in oats, might evoke an immunological response in children with CD.[1,10,11] Several studies have confirmed that pure GF-oats (<20 ppm of gluten and labeled GF) are safe and tolerated in CD.[1,10,11] Adding GF-oats offers increased palatability and texture of the GFD and is cost-effective.[12,13] Consuming GF-oats as part of the GFD may also help increase the DQ of children/youth with CD by contributing to increased micronutrient and antioxidant intake and soluble fiber.[1,14] Oats have heart health properties, including slowing intestinal transit time, delaying gastric emptying, and lowering glycemic response by delaying glucose absorption.[14]

Currently, no studies have assessed whether the DQ and macro-and-micronutrient intake of children with CD on the GFD is improved with GF-oat consumption. This study will address this gap by evaluating if DQ will be improved by the addition of GF-oats into the GFD in CD children. This will include a secondary evaluation of whether GF-oats consumption within the GFD, aligned to the GFFG recommendations, confers greater nutritional benefits. We hypothesize that the inclusion of GF-oats in a GFD will be associated with higher DQ, micronutrient content and fiber, along with lower saturated fat and GI than a GFD without GF-oats in CD youth.

What is Known

- The gluten-free diet (GFD) is associated with nutritional limitations and poor dietary quality (DQ).
- Gluten-free (GF) oats are rich in micronutrients and fiber and are safe for most individuals with celiac disease (CD).
- A gluten-free food guide (GFFG) was developed to improve DQ in children with CD.

What is New

- GF-oats are not a major determining factor in improving overall DQ in children with CD.
- GF-oats are associated with lowering dietary glycemic index.
- A high DQ GFD requires adherence to GFFG recommendations and an adequate intake across all food groups rather than relying solely on adding GF-oats.

2 | METHODS

2.1 | Study design and participants

A case-control analysis was conducted between June 2024 and February 2025 using 3-day food records (3-day FR) of children and youth (3–18 years) with CD from two prospective studies.[3,6] CD youth were recruited from the pediatric CD clinics at the Stollery Children's Hospital (Edmonton, Alberta), Alberta Children's Hospital (Calgary, Alberta), and McMaster Children's Hospital (Hamilton, Ontario).[15] CD youth consuming GF-oats (cases; $N = 16$) were age-sex matched in a 1:2 ratio to CD youth who did not consume GF-oats (controls; $N = 32$). A 1:2 ratio was selected to ensure a sufficient sample size to detect a one standard deviation difference in DQ with sufficient power ($\beta = 0.8$) at alpha = 0.05.

Demographic (sex, age, age at CD diagnosis, duration of CD, ethnicity, biopsy-proven CD, child and maternal/paternal age, education, household income, geographical residency [urban vs. rural] and serum anti-tissue transglutaminase [ATTG; Phadia 250 Elia Celikey assay[16]]) and anthropometric (weight, weight *Z*-score, height, height *Z*-score) data were obtained for the case-control. Serum ATTG was obtained from the medical record from the most recent clinic visit (<30 days). Weight and height *Z*-scores were calculated using World Health Organization (WHO) standards.[17]

2.2 | Ethics statement

All studies were approved by the Human Research Ethics Board at the University of Alberta (Pro00103128, Pro00033867, Pro00126345), the Hamilton Integrated Research Ethics Board (#1107), and the Sick Kids Research Ethics Board (#1000048112).

2.3 | Diet intake and analysis

Macro- and micronutrient intake from 3-day FR was analyzed using dietary software (Food Processor®) and the Canadian Nutrient File database.[18] A 3-day FR, capturing both weekdays/weekend days, has been shown to provide valid and reliable estimates of dietary intake in children with CD, with good agreement compared to 5–7 days FR and food frequency questionnaires, and to reduce respondent burden.[19–22] When needed, the nutrient content of brand-name foods was taken from manufacturer websites. The GI of the foods were calculated according to the validated mixed meal methodology and categorized as high, medium, and low (<55 is low GI, 55–60 is medium GI, and >60 is high GI foods).[4,23] Gluten intake was calculated using the Osborne method.[4,24] Nutrient intake was compared to the appropriate age-and-sex dietary reference intakes (DRIs).[25] The WHO recommendation of ≤10% of energy from saturated fat was used as a dietary reference standard.[26]

DQ was calculated using the validated Canadian healthy eating index (HEIC). HEIC is a scoring system with a max score of 100 points.[4,7,27] Scores >80 indicate excellent DQ, scores between 51 and 80 indicate a "need for improvement," and scores ≤50 indicate a poor DQ.[7,8,27]

The amount of oats consumed (g/day) and the form of oats (prepared/cooked or raw/dry) were calculated. The gram intake of oats was then converted to serving size (1 serving [175 mL] of cooked oats = 173.1 g, one serving of dry oats to make one serving [175 mL] of cooked oats = 28 g) and from there converted to the raw intake of oats (serving size × 28 g).[18] This was done to account for differences in weight based on the cooking method.[18]

GFD diet simulations aligned with the pediatric GFFG, with ($N = 6$) and without GF-oats ($N = 6$), were selected and age-sex matched to case-controls to enable comparison of whether the inclusion of GF-oats in GFDs with DQ in the excellent range (DQ scores > 80) confers increased nutritional quality (higher micronutrient, fiber, lower GI, saturated fat, and added sugar).[7,8,27] GFD diet simulations were developed using standardized methodologies described previously.[7,8] GFD diet simulations were developed for children ages 4–18 years that would reflect nutritionally complete food intake that met macro-and-micronutrient requirements for children consuming the GFD.[7] Diet simulations included the consideration of different meal patterns that CD children consume, including international cuisines that reflect the ethnic diversity of the Canadian population.[4]

2.4 | Statistical analysis

Data were expressed as mean ± standard deviation (SD) or median and interquartile range (IQR) for data demonstrating normal or nonnormal distributions, respectively. Normally distributed data were analyzed using independent *t*-tests, and nonparametric data were analyzed using Mann–Whitney. Categorical data (e.g., sex, ethnicity, and analysis of children above or below the EAR [estimated average requirements], RDA [recommended dietary allowances], and AI [adequate intakes]) was analyzed using chi-square or Fisher exact tests. Group means (GF-oat cases, oat-free controls vs. GFFG ± oats) were assessed using analysis of variance, with post hoc pairwise comparisons performed to compare differences in DQ and macro-and- micronutrient intake between the four groups. Bonferroni corrections were done on the post

hoc pairwise data with a cut-off for significance of ≤0.025. Univariate regression analysis was conducted to determine any potential associations between oat intake (grams) and DQ and micronutrient intake in the cases. A p-value ≤ 0.05 was considered statistically significant.

3 | RESULTS

3.1 | Anthropometric and demographic data

No significant differences were found between the GF-oats cases and controls for demographic or clinical data (age, sex, age at diagnosis, duration of CD, biopsy-proven CD diagnosis, ethnicity, household income, paternal/maternal age/education, household income, geographical residency, serum ATTG) or anthropometric (weight, weight Z-score, height, height Z-score) variables ($p > 0.05$) (Table 1). The mean age in the case-control was 10 years, and the majority of the children were Caucasian (79%) and female (77%), and children started consuming GF-oats >6 months after initial CD diagnosis. Households were predominantly located in urban areas (89.5%), with parental education levels above college level (~94%) and household income levels >100 K (~50%).

3.2 | Macro-and-micronutrient intake

No significant differences in macronutrient intake were observed between cases and controls (Supporting Information S2: Table S1). Controls (–GF-oats) had higher intakes of vitamin B2, vitamin B12, and vitamin D compared to cases (+GF-oats) ($p < 0.05$) (Supporting Information S2: Table S2), but no other differences in micronutrient intake between case-controls were observed. In addition, with the exception of vitamin B6 (controls > cases; $p = 0.03$), no significant differences in the number of children meeting the DRI (EAR/RDA/AI) for individual micronutrients were observed between cases and controls ($p < 0.05$). In contrast, GFFG diet simulations (±GF-oats) had higher absolute intakes of protein, fiber and polyunsaturated fat (PUFA) and lower intakes of total fat and saturated fat than cases/controls and significantly higher micronutrients than case-controls ($p < 0.05$) (Supporting Information S2: Tables S3 and S4).

3.3 | GI

The GI was significantly lower in cases (+GF-oats: 50.6 ± 2.4 [cases] vs. –GF-oats: 56.1 ± 7.4 [controls]; $p = 0.05$) (Supporting Information S2: Table S1).

3.4 | DQ and the number of food group servings

3.4.1 | GFD (±Oats)-case controls

There were no significant differences in total DQ and the subdomain scores (adequacy, moderation, and variety) between the cases and controls (Figure 1A). DQ fell within the "needs improvement" category with mean scores of 68.5 ± 16 (cases: +GF-oats) and 64.3 ± 13 (controls: –GF-oats) ($p > 0.05$). This occurred over a range of GF-oats intake (5–96 g/day). However, younger children (<9.5 years) had higher total DQ scores (74.9 ± 16.6 [<9.5 years] vs. 62.2 ± 16.6 [≥9.5 years]; $p = 0.04$) in +GF-oats cases. With the exception of a higher number of grains servings/day in the controls (–GF-oat) ($p = 0.01$), no significant differences in the number of food servings from fruits and vegetables, meat and alternatives and dairy (milk and alternatives) products were observed between cases and controls (Figure 1B). Both groups had high intakes of foods with added sugars/fats (11 ± 4.6 [cases] vs. 14 ± 6.8 [controls] servings/day; $p > 0.05$).

3.4.2 | GFFG diet simulations (±Oats)

Total DQ scores were >80 (excellent DQ) for all GFFG diet simulations. GFFG diet simulations (±GF-oats) had significantly higher total/subdomain (moderation, adequacy) DQ scores when compared to the case-controls ($p < 0.01$). This translated to a higher mean number of servings/day of fruits and vegetables, dairy, meat and alternatives. Intake from added sugars/fat in the "other group" was also significantly lower in the GFFG diet simulations (±GF-oats) compared to the case-controls ($p < 0.05$).

3.5 | DQ and GF-oat consumption

While no significant associations were found between total DQ score and median oats/grams or the number of servings/days consumed ($p > 0.05$), weak positive associations were found between the subset variety DQ scores and oats/grams or the number of servings/days consumed ($R = 0.10–0.15$; $p = 0.01$).

4 | DISCUSSION

The main study findings indicate that adding GF-oats to a GFD does not significantly improve DQ in CD youth. This occurs in the context of pediatric GFDs characterized over a wide range of DQ ("needs improvement" to excellent) and GF-oats intake. The consumption of

TABLE 1 Anthropometric and demographic data for children and youth with CD.

Variables	GF-oats cases ($N = 16$)[a,c]	Oat-free control ($N = 32$),[b,c]	p-Value[d]
Sex (M:F)	4:12	7:25	0.54
Age (years)	9.7 (6.3–11.9)	9.6 (6.6–11.7)	0.96
Age at CD diagnosis (years)	5.8 (3.5–7.7)	6.4 (5.0–9.5)	0.32
Duration of CD (years)	2.6 (1.3–4.6)	1.1 (0.9–4.5)	0.35
Biopsy-proven CD (yes: no)[e]	10:5	24:8	0.73
Ethnicity caucasian[f]	13	24	0.46
South Asian	0	4	
Other/mixed	2	4	
Maternal age	41.5 (38–35)	38.5 (35–42)	0.27
Maternal education[g]	0:16	0:32	0.54
Paternal age	43.5 (39–47)	42 (37–45)	0.32
Paternal education[g]	0: 16	2: 29	0.69
Household income[g]	$105,736 ± 43,736	$95,049 ± 35,927	0.53
Household residency (rural: urban)[g]	2: 13	2: 30	0.41
Serum ATTG	3.2 (1.4–4.3)	2.6 (1.2–13.0)	0.34
Weight (kg)	31.2 (23.1–36.9)	31.4 (22.8–37.2)	0.47
Weight Z-score[h]	0.30 (−0.11 to 0.98)	−0.06 (−0.64 to 1.21)	0.39
Height (cm)	134.1 (119.9–150.8)	130.0 (116.6–147.5)	0.71
Height Z-score[h]	0.24 (−0.02 to 0.55)	−0.17 (−0.81 to 0.74)	0.31

Note: Data are presented as median (interquartile range 25th–75th) or mean ± standard deviation. Abbreviations: ATTG, anti-transglutaminase IgA; CD, celiac disease; F, female; GF, gluten-free; GFD, gluten-free diet; IgA, immunoglobulin A; M, male.

[a]Youth with CD on a GFD with GF-oats (GF-oats cases).

[b]Youth with CD on GFD without GF-oats (oat-free controls).

[c]$N = 47$ for age for child diagnosis, CD duration, ethnicity, weight, weight-Z, height, height-Z; $N = 26$ for serum antitransglutaminase IgA.

[d]p-Values ≤ 0.05 were considered statistically significant. Differences between variables that were normally distributed were analyzed by an independent t-test. Nonparametric data were analyzed by Mann–Whitney. Fisher exact tests were used for categorical variables.

[e]Clinical CD diagnosis confirmed by either biopsy and/or serological testing follow the European society pediatric gastroenterology, hepatology and nutrition guidelines for diagnosing coeliac disease 2020.[15]

[f]Ethnicity was defined from Stats Canada (http://www12.statcan.gc.ca/census-recensement/2006/. ref/rp-guides/ethnic-ethnique-eng.cfm). "Other" ethnic group includes non-Caucasian (e.g., Chinese, Indian) and Indigenous origin.

[g]Self-reported maternal/paternal educational number above and below college preparation. Household income by Canadian dollar ($n = 27$ households). Household Residency as define by urban (town or larger metropolitan area with population >50,000) versus rural (small town or rural population <50,000).

[h]Weight-Z and height-Z were determined based on World Health Organization standards (https://www.who.int/tools/child-growth-standards/standards).

oats in this case-control analysis also showed that there were no significant improvements in macro- and micronutrient intake or the percentage of children/youth meeting DRI (EAR/AI/RDA) recommendations between a GFD (±GF-oats). In fact, most children consumed GFD diets (±GF-oats) higher in added sugar, saturated fat, and sodium and lower in fiber and several micronutrients such as folate, calcium, and vitamins A and D. Although controls (−GF-oats) had higher intakes of riboflavin, vitamin D and B12, this did not translate to a greater number of children meeting the EAR/RDA for these nutrients. One major difference was that consuming GF-oats resulted in a significantly lower dietary GI. Typically, the GI in the GFD is high due to the simple sugars added to GF foods to improve palatability.[2,4] These findings may have important clinical implications, particularly with children with CD and Type 1 diabetes (T1D), whereby GF-oats may confer increased health benefits associated with improved glycemic control.[5,14]

Very few studies have examined the nutritional impact of GF-oats on the GFD. Most studies, in adults

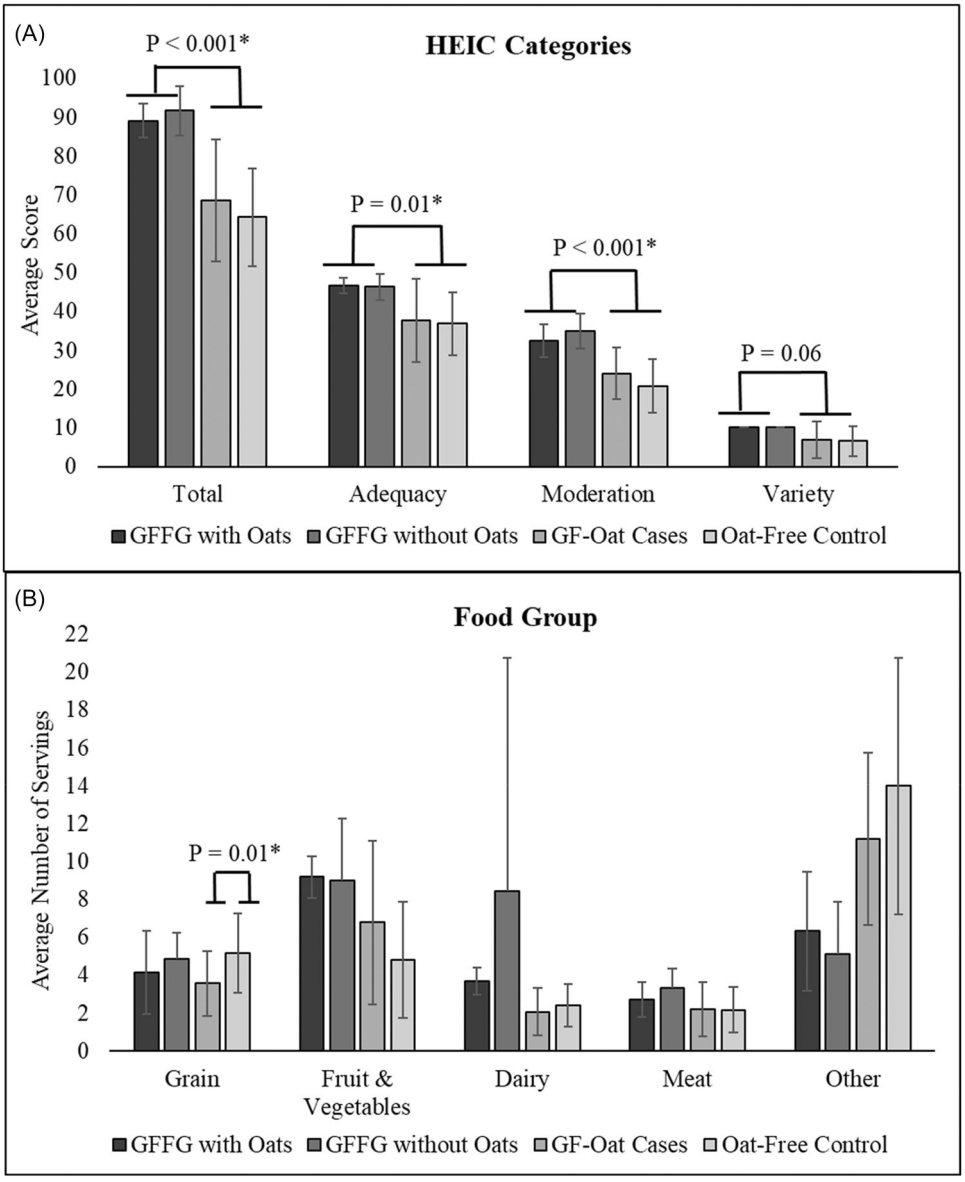


FIGURE 1 Comparison of (A) DQ determined by HEIC and (B) average daily food groups serving among age-sex matched GF-oat cases and oat-free controls in children and youth with celiac disease, and GFFG simulations with (+) and without (–) GF-oats. The range of GF-oats intake is between 5 and 96 g/day. Values are expressed as mean ± standard deviation. Asterisks indicate statistically significant differences ($p \leq 0.025$). HEIC evaluates dietary adequacy, moderation, and variety based on food group servings, and classifies DQ as good (>80), needs improvement (51–80), or poor (<50).[27] DQ, diet quality; GF, gluten-free; GFFG, gluten free food guide; HEIC, Healthy Eating Index Canada.

and children, have focused primarily on establishing the safety of GF-oats.[10,11] GF-oats are generally well tolerated in adults and children; however, depending on the individual, there may be an adjustment period of mild GI symptoms related to the increased fiber.[10,11] This may have implications for adherence to the GFD. Despite this, the safety of GF-oats is still controversial, and this may stem from the differences in the oat cultivars used, as cross-contamination with gluten-containing grains can diminish the purity of the oats.[11] It is very important for clinicians to educate families and children with CD on identifying GF-oats using certified GF labels.

One study showed that a median intake of 100 g/per day of oats over 12 months, in adults ($N = 31$, mean age 47 years), only improved vitamin B1, magnesium, and zinc levels.[28] In this study, half the daily oats were given as oat flour, and the other half was baked into bread.[28] Another adult study ($N = 70$, mean age 59 years) showed that the consumption of oats (20–100 g/day) from store-bought oat products significantly increased fiber intake.[29] In a 2-year intervention trial, 18 adults (mean age 41 years) who consumed an average of 93 (27–137) g/day of GF-rolled oats (oatmeal, muesli, bread, and cakes) had significantly higher iron, fiber, thiamin, and zinc intakes.[30] The variances in these results may

have been attributed to the different forms of oats consumed by the adults with CD (e.g., oatmeal flour, cereals), and the frequency and duration of GF-oats consumed. None of these studies reported on the overall DQ of the diets consumed and the duration of a CD diagnosis varied from newly diagnosed to 41 years on the GFD.[28,29] Adults with CD reported preferring to include oats in their daily GFDs for diversification, cost-effectiveness, taste, satiety and adherence.[29,30]

Within the pediatric CD literature, the maximum intake of GF-oats per day tended to be lower than in adult studies.[31,32] A 1-year study of youth ($N = 42$, 8 months–17.5 years) with newly diagnosed CD, the median intake of oats was 17.5 (5–40) g/day at 6 months and 20 (8–43) g/day at 12 months in the forms of oatmeal, formula, bread, and cookies.[31] Youth who have been on the GFD for 2–16 years ($N = 13$, 9–17 years) in a 2-year controlled intervention trial consumed 45 (13–81) g/day of GF-oats as oatmeal or home-baked bread.[32] Newly diagnosed CD children may consume a lower maximum amount of GF-oats, and this may be due to learning and implementing GFD compared to youth already on an established GFD routine. DQ and the nutritional benefits of including GF-oats were not reported in any of these pediatric studies.[31,32] In the current analysis, about 50% of the children were <9.5 years in the GFD ± GF-oats with no differences between groups, which may have impacted the ability to detect differences in DQ with the addition of GF-oats to the GFD. Younger children (<10 years) have been shown to have a higher DQ than older children with CD, consistent with the current findings.[4] This may be due to parental guidance and the provision of food necessary for physical growth and cognitive development. While the sample size of GF-oats cases was relatively small in this cohort, this was within the ranges of previous studies ($N = 13$–70), has the benefit of using a case-matched design in a 2:1 ratio with no major differences between cases/controls in socio-demographic determinants of the primary outcome of concern.[33] For example, although younger age is a potential mediator of increased DQ, there were no differences in the number of children <10 years or the mean ages (±GF-oats).

One study strength was using GFFG diet simulations based on the GFFG plate recommendations.[7,8] The GFFG was developed to address the nutritional limitations of the GFD in CD youth.[7] The GFFG diet simulations offered the opportunity to examine the incremental difference of adding oats to a GFD in the context of excellent DQ. This secondary analysis demonstrated that it is possible to consume a GFD of high DQ with oats. However, the addition of oats, beyond lowering GI in the GFD, did not confer increased DQ to the GFD consumed. These findings have important clinical implications for children/youth with T1D and CD, whereby lowering of dietary GI may be consistent with better management of glycemia and reduce the health care burden to the child/youth. The study findings reinforce that overall DQ is impacted by all aspects of the diet (e.g., fruit and vegetables, meat and alternatives, and milk and alternatives) and cannot be attributed to improvements in just one food type or food group.

To see a significant benefit in DQ based solely on the addition of GF-oats, children (mean age 10 years) would potentially need to consume 2–49 bowls of 1/2 cup oatmeal to reach iron, folate, fiber, calcium, and potassium DRIs (EAR/AI), respectively (Figure S1). These levels of intake are not feasible for the child as they could result in the displacement of other important nutrients, such as protein and potentially contribute to the onset and exacerbation of GI symptoms (diarrhea, flatulence) and may adversely impact dietary adherence to the GFD.[3] While we did not find any difference in gluten ingestion, with and without oats, this would be an important factor to consider when making recommendations about GF-oat consumption in children/youth with CD. An increased focus on fruit & vegetable consumption, particularly green leafy vegetables for folate, and a higher intake of unsweetened vitamin D and calcium-fortified milk and alternatives are important features of a high DQ GFD.[7]

There are some potential limitations to this analysis. This included using the HEIC tool to measure DQ.[27] While this tool accounts for Health Canada recommendations from the 2007 version of Canada's Food Guide (CFG) and addresses any differences in recommendations for food servings based on age and sex, it does not conform to the more recent 2019 CFG recommendations.[27] The 2019 CFG simplified dietary recommendations by emphasizing flexible eating patterns based on recommended proportions of F&V, whole grains, and protein foods, rather than specifically prescribing the total amounts of food guide servings from each food group that should be consumed daily.[34] While we considered using the alternative DQ tool (Healthy Eating Food Index-2019 [HEFI-2019]), this tool was not used as it does not have specific cut-off values in healthy children to define DQ (poor, "needs improvement," excellent) and has not been validated in clinical pediatric populations.[35,36] Moreover, CFG and HEFI-2019 tools were not developed to consider the unique nutritional limitations of the GFD.[36] To mitigate this issue, we used the HEIC DQ tool, as several other studies have reported on DQ in youth with CD using this tool.[2,4,5] We also included dietary simulations based on GFFG guide content, as the GFFG does consider the unique nutritional considerations of the GFD.[7,8] All diet simulations in the GFFG have an excellent DQ (>80) over a wide range of dietary intakes (±GF-oats).[7,8]

Another potential limitation is the inability to control the amount or form of GF-oats consumed. Children

who consumed GF-oats predominantly ate oatmeal, with some exceptions being oatmeal cookies or oat pancakes. Within this study cohort, the range of oats consumed was 5–96 g/day. Although this may better reflect "real world" consumption of GF-oats by children/youth with CD, compared to a strictly controlled trial, it does not allow for a full evaluation of the effect of GF-oats on DQ in children/youth with CD on the GFD. However, evaluation of oats intake within the context of the diet simulations GFFG with high DQ, support study findings that oat consumption at these levels does not confer increased nutritional adequacy in an ideal GFD diet pattern.[4] A comprehensive assessment of graded doses of GF-oats in the diets of children/youth with CD on DQ, micro-and macronutrient intake, adherence to the GFD and other health outcomes, such as quality of life, is warranted.

5 | CONCLUSIONS

Although GF-oats can be a part of a nutritious GFD, they are not a determining factor for overall DQ. Study results support that clinical practice should encourage diets aligned with the GFFG recommendations to optimize a higher DQ reflective of lower saturated fat and added sugar consumption, lower GI and higher fiber and micronutrient intake.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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