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Original Research

Impact of the Balanced School Day on Glycemic Control in Children with Type 1 Diabetes

Robert I. Stein MDCM [a], Manpreet Doulla MD [a,b], Jamie A. Seabrook PhD [c,d,e,f,g], Lorraine Yau BSc [c], Natasha Hamilton RD [h], Marina I. Salvadori MD [a], Paula D.N. Dworatzek PhD, RD [c,i,*]

[a] Department of Pediatrics, Western University, London, Ontario, Canada
[b] Department of Pediatrics, University of Calgary, Calgary, Alberta, Canada
[c] School of Food and Nutritional Sciences, Brescia University College, Western University, London, Ontario, Canada
[d] Children's Health Research Institute, London, Ontario, Canada
[e] Lawson Health Research Institute, London, Ontario, Canada
[f] Human Environments Analysis Laboratory, Western University, London, Ontario, Canada
[g] Department of Epidemiology and Biostatistics, Western University, London, Ontario, Canada
[h] London Health Sciences Centre, London, Ontario, Canada
[i] Schulich Interfaculty Program in Public Health, Western University, London, Ontario, Canada

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ABSTRACT

Objective: The balanced school day (BSD) is an alternative elementary school schedule whereby children have 2 20-minute eating periods instead of 1 20-minute lunch, as is found in the traditional schedule (TS). We assessed the glycated hemoglobin (A1C) levels of children with type 1 diabetes in the TS vs. the BSD because 2 eating periods have the potential to impact blood glucose control.
Methods: A1C levels representative of the summer months (SumA1C) and A1C levels occurring at least 3 months after the start of the school year (SchA1C) were obtained retrospectively. A parental survey of perceptions of lunch planning, activity levels and diabetes management at school was also completed.
Results: Our sample included 97 students (TS=42, BSD=55). The mean age ± SD was 10.9±2.6 and 10.1±2.8 years in the TS and BSD, respectively (p=0.12). Sex distribution was not statistically different; 54% were female in TS vs. 36% in BSD; p=0.08. SumA1C was similar in the 2 groups (TS: 8.3±1.1% vs. BSD: 8.0±0.8%; p=0.08). There was a significant within-group increase from SumA1C to SchA1C in the BSD group only (p=0.001), with mean A1C values increasing from 8.0%±0.8% to 8.5%±1.0% in the BSD group compared to no significant increase in the TS group. Parental perceptions of lunch planning, physical activity and diabetes management were similar, regardless of school schedule.
Conclusions: Children with type 1 diabetes in the BSD appear to have worse diabetes control during the school year compared to the summer, which is not evident in children in the TS. Additional school supports may assist students in the BSD.

Mots clés :
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RÉSUMÉ

Objectif : La journée scolaire équilibrée (JSÉ) offerte à l'école primaire est un horaire selon lequel les enfants ont 2 périodes de repas de 20 minutes au lieu de 1 période de dîner de 20 minutes telle qu'on l'observe dans l'horaire scolaire traditionnel (HST). Nous avons évalué les concentrations d'hémoglobine glyquée (A1c) des enfants atteints de diabète de type 1 ayant un HST *vs* des enfants atteints de diabète de type 1 ayant une JSÉ puisque 2 périodes de repas ont le potentiel d'influencer la maîtrise de la glycémie.
Méthodes : Les concentrations d'A1c représentatives des mois d'été (A1cÉté) et les concentrations d'A1c apparaissant au moins 3 mois après le début de l'année scolaire (A1cScolaire) ont été obtenues de façon rétrospective. Une enquête auprès des parents au sujet de leurs perceptions de la planification du dîner, des niveaux d'activités et de la prise en charge du diabète à l'école a également été remplie.

* Address for correspondence: Paula Dworatzek, PhD, School of Food and Nutritional Sciences, Brescia University College at Western University, 1285 Western Road, London, Ontario N6G 1H2, Canada.
E-mail address: pdworatz@uwo.ca

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Résultats : Notre échantillon comprenait 97 élèves (HST=42, JSÉ=55). L'âge moyen±ÉT était respectivement de 10,9±2,6 et de 10,1±2,8 ans dans le groupe HST et le groupe JSÉ (p=0,12). La répartition par sexe n'était pas statistiquement différente; 54 % étaient de sexe féminin dans le groupe HST *vs* 36 % dans le groupe JSÉ; p=0,08. L'A1cÉté était similaire dans les 2 groupes (HST : 8,3±1,1 % *vs* JSÉ : 8,0±0,8 %; p=0,08). Il existait des augmentations significatives au sein du groupe de l'A1cÉté à A1cScolaire dans le groupe JSÉ seulement (p=0,001), soit des valeurs moyennes d'A1c allant de 8,0 %±0,8 % à 8,5 %±1,0 % dans le groupe JSÉ comparativement à une augmentation non significative dans le groupe HST. Les perceptions des parents sur la planification du dîner, l'activité physique et la prise en charge du diabète étaient similaires, quel que soit l'horaire scolaire.

Conclusions : Les enfants atteints du diabète de type 1 du groupe JSÉ semblent avoir une plus mauvaise maîtrise du diabète durant l'année scolaire que durant l'été, alors que cette augmentation n'est pas évidente chez les enfants du groupe HST. Un soutien scolaire additionnel peut aider les élèves du groupe JSÉ.

Introduction

The balanced school day schedule (BSD) is an alternative instructional schedule that has been introduced in many Canadian schools with the intention of improving the learning environment (1–3). This schedule includes 3 instructional periods of 100 minutes that are separated by 2 45-minute breaks, with 20 minutes for eating and 25 minutes for activity (2,3). This differs from the traditional schedule (TS), which includes a 15-minute morning recess, a 60-minute lunch break that includes 20 minutes for eating and 40 minutes for activity, and a 15-minute afternoon recess (2,3). Children in the BSD schedule have fewer pedometer step counts (4), but no significant difference in school-day caloric intake has been found (5). Nevertheless, the additional 20-minute eating period in the BSD is a possible concern for children with chronic diseases who require dietary modifications (2). To our knowledge, there are no published studies examining the impact of the BSD schedule on the health of children with type 1 diabetes.

Type 1 diabetes is a chronic medical condition that results from insulin deficiency (6). Children with type 1 diabetes require exogenous insulin, either by subcutaneous injection (3 or 4 times daily) or by insulin pump, to normalize blood glucose levels (6). Diabetes care is optimized when insulin action matches carbohydrate intake (7,8). Other factors important for good diabetes care at school include routine blood-glucose monitoring, carbohydrate counting and proper recognition and management of hyper- or hypoglycemia, usually without adult supervision (9–12). Barriers to any of these diabetes-related tasks can have negative impacts on children. Recommendations have been made by the Canadian Diabetes Association, Canadian Pediatric Endocrine Group, American Diabetes Association and American Association of Diabetes Educators to help ensure that children with diabetes can integrate their diabetes care into the school routine (9–14).

The BSD schedule could provide obstacles for children with type 1 diabetes, regardless of their insulin regimens, because the 2 nutrition breaks occur at 10:35 AM and 1:00 PM daily (2). For children taking 3 daily insulin injections, the timing of carbohydrate ingestion does not coincide with the action of the intermediate-acting insulin injected at breakfast (7). Children taking 4 daily injections must decide at which break to inject their lunchtime insulin or whether to give a fifth injection to manage the 2 nutrition breaks. Children using insulin pumps may manage more easily if they can operate their own pumps. These issues can be more challenging for younger children who rely on parents or nurses coming to school to help manage insulin dosing. This study explores whether the BSD schedule poses a barrier to optimal diabetes care for elementary school children by assessing diabetes control (glycated hemoglobin [A1C] levels) and management in children who are on the TS compared to the BSD schedule.

Methods

Elementary school children in Southwestern Ontario who have had type 1 diabetes for longer than 1 year were recruited from the pediatric diabetes clinic at Children's Hospital, London Health Sciences Centre, in London, Ontario between December 2013 and May 2014. Children with known hemoglobinopathies, celiac disease or attention deficit hyperactivity disorder on stimulants and children on medications other than insulin known to affect blood glucose levels were excluded.

The sample consisted of children who attend school for full days, 5 days per week, from kindergarten to grade 8. Eligible patients and their parental guardians were given surveys to complete in the clinic. Parental consent was implied by completion of the survey, and a signed assent was obtained from all patients.

A1C levels representative of the summer (SumA1C) were obtained through a chart review and were compared to A1C levels at least 3 months after the start of the school year (SchA1C). SumA1C levels were included if measured in August or September because these were deemed most representative of the summer months. A1C levels were quantified using a DCA Vantage Analyzer (Siemens, Munich, Germany), which meets the accepted criteria for precision and accuracy (6,15). Body mass indexes (BMIs)-for-age were calculated using heights and weights obtained in the clinic, and World Health Organization growth charts were used to determine gender-specific BMIs for age z scores and percentiles (World Health Organization AnthroPlus, Geneva, Switzerland).

Parental perceptions of school schedules, packed lunches, children's participation in physical activities and diabetes management at school were explored through a parental survey. One open-ended question: "Please provide your opinion about the Balanced School Day and the impact it has had on your child's diabetes management," was asked of parents with children on the BSD. Qualitative responses were transcribed verbatim, and content was independently analyzed and coded by 2 researchers to identify recurrent themes. Quotes representing themes were selected for inclusion. The study was approved by the Western University Research Ethics Board.

Data were analyzed using SPSS v. 22.0 (IBM, Armonk, New York, United States). Means and standard deviations were used to describe continuous variables. Percentages were used to summarize categorical outcomes. A paired t test assessed mean differences for the within-group variables, SumA1C to SchA1C. Delta A1C (SumA1C-SchA1C) was compared using an independent samples t test between the 2 groups, i.e. TS vs. BSD. Multiple regression was also computed to assess the influence of the BSD on A1C, controlling for the effects of parental education and household income. All other continuous variables were compared between the 2 groups using an independent samples t test. The chi-square test assessed differences in proportions between categorical variables. A p value ≤ 0.05 was considered statistically significant.