Can J Diabetes 38 (2014) 250–255

Contents lists available at ScienceDirect

Canadian Journal of Diabetes

journal homepage: www.canadianjournalofdiabetes.com

Original Research

Assessment of Habitual Physical Activity in Adolescents with Type 1 Diabetes

Javed Mohammed MD [a], Livia Deda MSc [b], Cheril L. Clarson BM BS [c], Robert I. Stein MD [c], Meaghan S. Cuerden MSc [d], Farid H. Mahmud MD [b,*]

[a] Department of Pediatrics, University of Western Ontario and Lawson Health Research Institute, London, Ontario, Canada
[b] Section of Endocrinology, Department of Pediatrics, Hospital for Sick Children, Toronto, Canada
[c] Department of Pediatric Endocrinology, University of Western Ontario and Lawson Health Research Institute, London, Ontario, Canada
[d] Division of Nephrology, University of Western Ontario and Lawson Health Research Institute, London, Ontario, Canada

ARTICLE INFO

Article history:
Received 16 January 2014
Received in revised form
18 May 2014
Accepted 23 May 2014

Keywords:
adolescence
habitual activity
type 1 diabetes

ABSTRACT

Objective: To evaluate habitual physical activity in a cohort of adolescents with type 1 diabetes in relation to similarly aged control subjects.
Methods: A cross-sectional case control study of 54 healthy adolescents and 66 patients with type 1 diabetes, 14 to 18 years of age, was conducted. Subjects were surveyed using the Habitual Activity Estimation Scale, a validated self-report instrument to assess activity levels in teens. Subjects' time was classified into categories ranging from inactive (lying down, resting) to very active (increased heart rate and diaphoresis). Active time, described in relative (%) and absolute hours per day was determined for each individual. Age, sex, weight, height and body mass index were recorded for all participants, and the charts of subjects with type 1 diabetes were reviewed for most recent levels of glycated hemoglobin, low-density lipoproteins, high-density lipoproteins, total cholesterol, triglycerides and blood pressure. A regression analysis was performed to determine factors associated with hours spent being active.
Results: Subjects with type 1 diabetes spent similar hours being very active (3.4 hours vs. 3.5 hours, p=0.49) but reported more time being inactive than controls (2.0 hours vs. 1.3 hours, p=0.002). In both groups, female gender was associated with more hours spent being active. Metabolic control as assessed by glycated hemoglobin worsened with activity. In the group with type 1 diabetes, more hours spent being active were associated with lower systolic blood pressure, lower serum triglyceride levels, lower total cholesterol and higher high-density lipoproteins, whereas inactivity correlated with higher low-density lipoproteins and total cholesterol.
Conclusions: Adolescents with type 1 diabetes reported significantly more time being inactive than did healthy controls. In patients with type 1 diabetes, activity was associated with improved cardiovascular risk profile.

Mots clés :
adolescence
activité habituelle
diabète de type 1

RÉSUMÉ

Objectif : Évaluer l'activité physique habituelle d'une cohorte d'adolescents souffrant de diabète de type 1 par rapport à des sujets témoins de la même tranche d'âge.
Méthodes : Une étude cas témoins transversale de 54 adolescents en santé et de 66 patients souffrant du diabète de type 1, âgés de 14 à 18 ans, a été réalisée. Les sujets ont répondu au questionnaire HAES (Habitual Activity Estimation Scale), un instrument d'autoévaluation validé pour évaluer les niveaux d'activité des adolescents. Le temps des sujets a été classifié en catégories allant de l'inactivité (s'allonger, se reposer) à un niveau élevé d'activité (augmenter le rythme cardiaque et provoquer la diaphorèse). Le temps consacré à l'activité qui est décrit en heures relatives (%) et absolues par jour a été déterminé pour chaque individu. L'âge, le sexe, le poids, la taille et l'indice de masse corporelle des participants ont été enregistrés, et les dossiers des sujets souffrant du diabète de type 1 ont été passés en revue pour relever les plus récents taux d'hémoglobine glyquée, de lipoprotéines de faible densité, de lipoprotéines de haute densité, de cholestérol total, de triglycérides et les plus récentes mesures de la pression artérielle. Une

* Address for correspondence: Farid H. Mahmud, MD, Division of Endocrinology, Hospital for Sick Children, 555 University Avenue, Toronto, Ontario M5G 1X8, Canada.
E-mail address: farid.mahmud@sickkids.ca

1499-2671/$ – see front matter © 2014 Canadian Diabetes Association
http://dx.doi.org/10.1016/j.jcjd.2014.05.010

analyse de la régression a été réalisée pour déterminer les facteurs associés aux heures consacrées à l'activité.

Résultats : Les sujets souffrant du diabète de type 1 ont consacré un nombre similaire d'heures à un niveau très élevé d'activité (3,4 heures *vs* 3,5 heures, p=0,49), mais ont rapporté plus de temps d'inactivité que les témoins (2,0 heures *vs* 1,3 heure, p=0,002). Dans les deux groupes, les filles ont été associées à un plus grand nombre d'heures consacrées à l'activité. L'équilibre métabolique évalué par l'hémoglobine glyquée s'est détérioré avec l'activité. Dans le groupe souffrant du diabète de type 1 un plus grand nombre d'heures consacrées à l'activité étaient associées à une plus faible pression artérielle systolique, des taux plus faibles de triglycérides sériques, plus faibles de cholestérol total et plus élevés de lipoprotéines de haute densité, tandis que l'inactivité a corrélé avec des taux plus élevés de lipoprotéines de faible densité et de cholestérol total.

Conclusions : Les adolescents souffrant du diabète de type 1 ont rapporté passer beaucoup plus de temps à être inactifs que les témoins en santé. Chez les patients souffrant du diabète de type 1, l'activité était associée à l'amélioration du profil de risque cardiovasculaire.

Introduction

After diet and adequate insulin therapy, exercise is the third essential component of management of type 1 diabetes (1). Current guidelines advise that children with type 1 diabetes should participate in 60 minutes of moderate to vigorous physical activity daily (2). There is also increasing evidence that exercise in children with type 1 diabetes has the potential to prevent cardiovascular disease through decreasing blood pressure and improving lipid profile (2–4). This is of particular importance in patients with type 1 diabetes who have an extremely high risk for premature coronary artery disease during adulthood (5).

Habitual physical activity encompasses the full spectrum of children's activities, from walking to school to random play to competitive sports participation, all of which make a significant contribution to total daily exercise. Currently, limited information exists to describe habitual physical activity in adolescents with type 1 diabetes in relation to their peers. Most studies have focused on measuring the intensity of physical activity and fitness levels between those with type 1 diabetes and healthy adolescents, and less attention has been paid to assessing inactive periods (6,7). Sustained sedentary periods can increase risk for cardiovascular disease even if the person is engaging regularly in physical activity (8), and it is associated with increased adiposity and elevated body mass index (BMI) in youth (9,10). In addition, the health benefits of exercise-intervention programs are often lost when the program is discontinued, highlighting the importance of measuring habitual activity (11).

The Habitual Activity Estimation Scale (HAES) is a self-report questionnaire used to estimate the duration and intensity of daily activity in adolescence. It has proven validity and reliability in pediatric chronic disease states and correlates with physiologic measures of activity (12). Furthermore, it can be completed in 15 minutes in the clinical setting with minimal assistance for children younger than 11 years of age, resulting in high levels of completion and compliance.

The purpose of this cross-sectional study was to assess levels of habitual activity by using the HAES questionnaire in a cohort of adolescents with type 1 diabetes and age-matched healthy controls. We hypothesized that there would be differences in both duration and intensity of physical activity between the 2 groups. In addition, we hypothesized that more active patients with type 1 diabetes would have better metabolic control and better cardiovascular risk profiles than their less active peers.

Methods

In this cross-sectional case control study, 54 healthy adolescents and 66 patients with type 1 diabetes were surveyed using the HAES (12). All participants were surveyed during the spring season to minimize interseason variations in activity levels. Questionnaires were completed by each subject individually after brief instructions were provided.

Recruitment of controls

We approached 55 adolescents 14 to 18 years of age at a local high school; 1 subject refused. The high school was in close proximity to our hospital in the city of London, Ontario, over the course of a 2-week period by our research assistant and 2 trained volunteers from the high school. Consent was obtained from all participants and their parents, and screening questionnaires were completed to exclude those with chronic disease, current significant medical illness or medication use. Ethnicity was not assessed, but age, sex, weight, height and BMI were recorded for all participants.

Recruitment of adolescents with type 1 diabetes

We approached 77 subjects at the pediatric diabetes clinic at Children's Hospital, London Health Sciences Centre. They were 14 to 18 years of age and had been diagnosed with type 1 diabetes according to Canadian Diabetes Association criteria (13) at least 2 years prior to inclusion in the study. Subjects were recruited over a 10-week period using convenience sampling. Subject and parental written informed consents were obtained from all participants. Patient charts were reviewed for the most recent weight, height, blood pressure evaluations and A1C (within 3 months) (DCA2000, Bayer, Minnesota, USA). Total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglycerides were extracted from patient medical records and included if they had been completed within the previous 6-month period; laboratory tests for lipid profile were available for 49 of 66 subjects (we did not request additional venipucture testing). The study protocol was approved by the University of Western Ontario Research Ethics Board and by the school administration. Comparison mean A1C and BMI values for adolescents aged 13 to 19 years (n=264) were derived from annual evaluation of clinic data.

HAES questionnaire

All subjects completed the HAES questionnaire for a typical weekday. Using the HAES, subjects divided their day into 4 easily recognized segments of time (wake-up to breakfast, breakfast to lunch, lunch to supper, supper to bedtime). For each time interval, the percent of time spent in each activity level was recorded. The 4 activity levels as established by the HAES questionnaire were 1) inactive (lying down, sleeping, resting); 2) somewhat inactive (sitting, reading, watching television, playing video games, time in