Sleep Medicine 15 (2014) 1490–1499

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Sleep, executive functioning and behaviour in children and adolescents with type 1 diabetes

Nicole C. Caruso [a], Branka Radovanovic [a], J. Declan Kennedy [b,c], Jennifer Couper [b,d], Mark Kohler [a], Phillip S. Kavanagh [a], A. James Martin [b,c], Kurt Lushington [a,*]

[a] School of Psychology, Social Work and Social Policy, University of South Australia, St Bernards Road, Adelaide, 5000, SA, Australia
[b] Robinson Institute, School of Paediatrics and Reproductive Health, University of Adelaide, King William Road, Adelaide, 5000, SA, Australia
[c] Department of Respiratory and Sleep Medicine, Women's & Children's Hospital, King William Road, North Adelaide, 5006, SA, Australia
[d] Department of Endocrinology, Women's & Children's Hospital, King William Road, North Adelaide, 5006, SA, Australia

ARTICLE INFO

Article history:
Received 22 April 2014
Received in revised form 24 August 2014
Accepted 28 August 2014
Available online 28 September 2014

Keywords:
Children
Type 1 diabetes
Sleep
Behaviour problems
Executive functioning
Mediational analysis

ABSTRACT

Objective: The aim of the study was to examine sleep, neurocognitive and behavioural functioning in children and adolescents with type 1 diabetes (T1D) compared to controls and to test whether sleep quality mediates the relationship between diabetes and neurocognitive and behavioural deficits.
Methods: Participants include 49 children and adolescents with T1D (recruited from a hospital clinic) and 36 healthy controls (age range = 6–16 years). Parents completed a survey consisting of the Sleep Disturbances Scale for Children, the Behavior Rating Inventory of Executive Functions, and the Behavior Assessment System for Children-2. Diabetic and demographic parameters were collated from medical records. The survey was posted to participants.
Results: Children with T1D compared to controls reported a higher frequency of sleep problems, and mild deficits in executive and behavioural functioning. Mediational analyses revealed that sleep quality fully mediated metacognitive functioning, externalised problematic behaviour, and internalised problematic behaviour, but not behavioural regulation.
Conclusions: Rather than the direct impact of T1D on daytime functioning, it is the consequent impact of T1D on sleep and the resulting sleep disruption which can explain much of the neurocognitive and behavioural deficits reported in children with T1D. Maintaining good nocturnal glycaemic control may play a much larger role than previously thought in regulating daytime functioning in children with T1D.
© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Type 1 diabetes (T1D) is an autoimmune disorder characterised by the progressive loss of pancreatic islet β-cells resulting in a loss of insulin production [1,2]. T1D is one of the most common chronic diseases of childhood years. In Australian children the incidence rate has increased to 21 per 100,000 person years [3]. Children with T1D are reported to have reduced neurocognitive performance (eg, executive functioning, sustained attention, psychomotor speed, learning and memory – and as a consequence – reduced intellectual and academic performance [4–8]) and a higher frequency of problematic behaviours (eg, depression, somatisation and social withdrawal [9–14]). The neurocognitive and behavioural deficits in children with T1D have been attributed to poor glycaemic control [12,15]. It is unclear, however, as to what degree sleep disruption modulates these effects. In otherwise healthy children without impaired glycaemic control, sleep disruption is associated with reduced cognitive performance and increased problematic behaviour [16–22]. Our group and others have also shown that sleep quality mediates daytime behaviour and neurocognitive functioning in children with a range of medical conditions, for example, upper airway obstruction and eczema [18,23–27]. Taken together, these findings raise the possibility that sleep disruption may also contribute to the daytime deficits reported in children with T1D.

The literature reporting sleep data in children with T1D is limited. In a review of the literature using 'children', 'sleep', 'type 1 diabetes' and other variants as search keywords using Google Scholar, PubMed and PsychLit databases, we identified 12 studies that report objective sleep data. These include four polysomnographic [28–31], seven questionnaire (including interview) [32–36], and one combined questionnaire, polysomnographic, and actigraphic study [37] (see Table 1). To date, sleep questionnaire data have been

Abbreviations: BASC-2, Behaviour Assessment System for Children-2; BMI, body mass index; BRIEF, Behavior Rating Inventory of Executive Function; CI, confidence interval; ns, non-significant; SDSC, Sleep Disturbance Scale for Children; SES, socioeconomic status; T1D, type 1 diabetes.

* Corresponding author. The University of South Australia, School of Psychology, Social Work and Social Policy, St Bernards Road, Magill, SA, Australia 5072. Tel.: +61 8 8302 4160; fax: +61 8 8302 4377.
E-mail address: kurt.lushington@unisa.edu.au (K. Lushington).

http://dx.doi.org/10.1016/j.sleep.2014.08.011
1389-9457/© 2014 Elsevier B.V. All rights reserved.

Table 1
Summary of sleep studies in children with type 1 diabetes (T1D).

Author and Date	Location and Population	Numbers (Mean Age & Gender)	Sleep Measures	T1D versus Controls	Correlational and Other Results
Blanz et al. (1993) [32]	Germany Hospital Clinic	93 T1D (18.1y, 39F) 93 Control (18.6y, 39F)	Semistructured Interview	Children with T1D compared to controls: ↑ Disturbed sleep	Diabetic severity was not predictive of disturbed sleep
Estrada et al. (2012) [38]	USA Diabetes Registry	78 T1D (5-11y = 25/78; 12–19y = 44/78 and >20y = 9/78: 41/78F) 245 Control (Relatives without T1D) (5–11y = 39/245; 12–19y = 48/245 & > 20y = 158/245: 143/245F)	Questionnaire	Both children and adolescents with T1D and relatives without T1D had similar sleep duration, sleep insufficiency, and daytime napping	Diabetes not predictive of sleep duration or daytime napping
Happe et al. (2005) [33]	Germany Hospital Clinic	46 T1D (12.0y, 25F) 50 Control (12.3y, 29F)	Questionnaire	Children with T1D and Controls had similar frequency of Restless Leg Syndrome, sleep initiation, and maintenance problems and daytime tiredness	Poor sleep initiation was associated with elevated HbA1c levels
Matyka et al. (2000) [28]	USA Hospital Clinic	14 T1D (9.4y, 5F) 15 Control (9.2y, 5F)	Polysomnography	Children with T1D compared to controls: ↑ Awakenings	The frequency of hypoglycaemia was higher in S4 compared to REM sleep
Monaghan et al. (2012) [39]	USA Hospital Clinic	24 T1D (4.1y, 12F)	Questionnaire	In children with T1D compared to general population norms: ↑ Stress in the lead up to and at bedtime ↑ Frequency parents called to bedroom after child settled ↑ Difficulty falling asleep ↑ Wake after sleep onset ↑ Slept in parental bed	Parents with 'insomniac' and 'sleep resistant' children reported higher stress and depression scores 'Insomnia' more frequent and parents more stressed leading up to or at child's bedtime in children on intensive/multiple daily insulin compared to conventional regimes
Perfect (2014) [35]	USA Hospital Clinic	50 T1D (13.4y, 21F)	Questionnaire Sleep Diary	Not applicable	Delayed bedtime on school and non-school nights associated with lower grade point average. Delayed bedtime on non-school nights associated with lower reading, mathematic and writing scores. Longer total sleep time on school nights associated with lower writing scores
Perfect et al. (2012) [37][a]	USA Hospital Clinic	40 T1D (13.5y, 16F) 40 Control (13.5y, 16F)	Questionnaire Actigraphy Polysomnography	In children with T1D compared to controls: ↑ N2 and ↓ N3 sleep ↑ Arousal Index ↑ Central Apnoea Index	Diabetes severity predictive of decreased N3 sleep Diabetes severity, higher HbA1c and higher Average Glucose levels were predictive of increased N2 sleep Average glucose levels were higher in children with OAHI > 1.5 compared to OAHI < 1.5 events/h
Pillar et al. (2003) [29]	Israel Hospital Clinic	15 T1D (12.6y, 8F) 15 Control (13.3y, 6F)	Polysomnography	In children with T1D (±hypoglycaemic) compared to controls: $Nonhypo\text{-}T1D_{AI} > Control_{AI} > Hypo\text{-}T1D_{AI}$ $Hypo\text{-}T1D_{\Delta power} > NonHypo\text{-}T1D_{\Delta power}$ $Hypo\text{-}T1D_{SE} > NonHypo\text{-}T1D_{SE}$ $Hypo\text{-}T1D_{S3+4\%} > NonHypo\text{-}T1D_{S3+4\%}$	Nocturnal hypoglycaemia associated with a deepening of sleep A greater number of awakenings in children with rapid compared to those with slow change in nocturnal glucose levels
Porter et al. (1996) [30]	Australia Hospital Clinic	20 T1D (12.8y, 11F)	Polysomnography	Children with compared to those without hypoglycaemia had similar sleep and arousal indices	Pre-sleep glucose levels were not predictive of subsequent hypoglycaemia during sleep
Varni et al. (2009) [36]	USA Hospital Clinic	83 T1D (12.9y, 39F) and 84 parents of children with T1D 157 Control (13.7y, 83F) 106 Children with Cancer in Treatment (8.2y, 76F)	Questionnaire	In children with T1D compared to controls: ↑ Sleep/Rest Fatigue scores (on both child and parental report) In children with T1D compared to children with cancer: Equivalent Sleep/Rest Fatigue scores (on both child and parental report)	On both child and parental report, higher levels of sleep/rest fatigue were associated with worse emotional, social and school functioning, psychosocial health and physical health
Villa et al. (2000) [31]	Italy Hospital Clinic	25 T1D (7.7y, 6F) 20 Control (8.8y, 5F)	Polysomnography	In children with T1D (especially in patients with poor glycaemic control) compared to controls: ↑ Central apnoea events ↑ Total-apnoeic events ↑ Duration of total-apnoeic events	Both higher HbA1c levels and longer duration of diabetes were predictive of increased frequency of Total-apnoea and Central apnoea events Central apnoea events were more frequent in REM compared to NREM sleep
Yeshayahu & Mahmud (2010) [34]	Canada Not reported	75 T1D (16.0y, 33F) 54 Control (16.3y, 31F)	Questionnaire	In children with T1D compared to controls: ↑ Sleep durations (weekday)	Insulin regime was not predictive of sleep duration[b]

[a] Subset of full diabetic cohort who underwent polysomnography. [b] Insulin regime consisted of continuous subcutaneous infusion, multiple injection or three daily injections. Hypo = hypoglycaemic, AI = Arousal Index, SDB = sleep disordered breathing, NonHypo = non-hypoglycaemic, REM = Rapid eye movement, NREM = Non-rapid eye movement, OAHI=Obstructive Apnea-Hypopnea Index, Δ power = Delta power and SE = sleep efficiency.

Download English Version:

https://daneshyari.com/en/article/3176013

Download Persian Version:

https://daneshyari.com/article/3176013

Daneshyari.com