Postprint version : 1.0

Journal website : <https://onlinelibrary.wiley.com/doi/pdf/10.1111/dmcn.14333>

Pubmed link : <https://www.ncbi.nlm.nih.gov/pubmed/31468507>

DOI : 10.1111/dmcn.14333

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Physical activity and sedentary behaviour in children with spina bifida

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Aim To describe active and sedentary time in children with spina bifida and to compare their physical activity on weekdays versus weekends.

Method In this exploratory cross-sectional study, data from 13 Canadian and 22 Dutch children with spina bifida (14 females, 21 males; mean age 10y 11mo, standard deviation [SD] 3y 6mo, range 5y 6mo–18y; Hoffer classification distribution: community [$n=28$], household [$n=3$], non-functional [$n=3$], and non-ambulator [$n=1$]) were analysed. Objective measures of physical activity and sedentary behaviour were obtained by using ActiGraph or Actiheart activity monitors. Data for the participants wearing the ActiGraph were compared with age- and sex-matched controls that were developing typically using independentsamples t-tests. Activity data collected on weekdays was compared to those on weekends.

Results ActiGraph data demonstrated children with spina bifida spent more time sedentary (mean [SD] 49.5min/h [5.78]) and less time in moderate to vigorous physical activity (mean [SD] 2.33min/h [1.61]) compared with the typically developing group (mean [SD] 41.0min/h [5.76] and 5.46min/h [2.13], $p=0.001$ and $p<0.001$ respectively). For both ActiGraph- and Actiheart-derived data, physical activity and sedentary time were not significantly different between weekdays and weekends.

Interpretation Children with spina bifida have reduced levels of physical activity and increased sedentary behaviour, with no statistical differences seen between weekdays

and weekends. Several methodological issues related to activity monitoring warrant consideration when choosing the appropriate method to quantify physical activity and sedentary behaviour.

Abbreviations

CPM	Counts per minute
HRR	Heart rate reserve
LPA	Light physical activity
MPA	Moderate physical activity
MVPA	Moderate to vigorous physical Activity

Physical activity and sedentary behaviour are independently related to the risk of adverse health outcomes.¹⁻⁴ Low physical activity and high sedentary time are increasingly recognized in children with disabilities.^{5,6} As a result of their physical impairments, lifestyle, environmental factors, and the interaction between these factors, these individuals are at increased risk for secondary physical and mental health problems, including obesity and depression.⁶⁻⁸

Spina bifida is a complex congenital disorder that describes a spectrum of neural tube defects.⁹ The severity of the disorder can range from completely asymptomatic to functionally impaired.¹⁰ Though folic acid fortification has reduced the incidence of spina bifida, the prevalence in children and adolescents is still substantial, with 4 to 5 per 10 000 live-born children having spina bifida in Canada and the Netherlands.^{11,12} Moreover, the number of people with spina bifida is growing because of increased life expectancy,¹³ requiring a lifespan approach to ensure optimal health and wellbeing.

Both self-report and objective measures exist for the evaluation of physical activity and sedentary behaviour, each with distinct strengths and limitations.¹⁴ Objective measures of physical activity and sedentary time, namely activity monitors, have been shown to be appropriate in ambulatory and non-ambulatory children and adults with other chronic childhood conditions, such as cerebral palsy.¹⁵⁻¹⁷

To date, only a few studies have implemented the use of objective measures to investigate physical activity and sedentary time, one construct of sedentary behaviour, in adolescents with spina bifida. Of these, adolescents were over the age of 14 years and reported physical activity was limited to either total minutes of activity or static versus dynamic activity time.^{6,18} Furthermore, physical activity was only measured over a 48-hour period,^{6,18} warranting longer periods of investigation in this population, which also allows for comparison between weekdays and weekends.

There remains a knowledge gap pertaining to the physical activity and sedentary time of school-aged children with spina bifida. The present study involved existing data from two projects, in an international collaboration between Dutch and Canadian research groups. The purpose of this study was to describe active and sedentary time in children with spina bifida, as determined by two commonly used activity monitors, the ActiGraph and Actiheart, and to compare physical activity and sedentary time on weekdays and weekends. A secondary objective was to explore differences in physical activity outcomes between Canadian and Dutch adolescents with spina bifida. Last, we aimed to discuss contemporary challenges regarding the objective measurement of movement in individuals with spina bifida.

Method

Participants

This paper is a secondary analysis of two data sets, one from Canada and one from the Netherlands. These data were from larger research initiatives, cross-sectional in design, investigating the status of bone health, physical activity, and/or energy expenditure in children with spina bifida. The two studies were approved by the Hamilton Health Sciences Research Ethics Board in Hamilton, Canada, and the University Medical Ethics Committee in Utrecht, the Netherlands respectively. All children and their parents received written and verbal information about the study, and provided written informed consent before participation.

Participants were recruited through the spina bifida clinic at McMaster Children's Hospital in Hamilton, Canada ($n=13$) from October 2012 to December 2013. Participants with spina bifida were also recruited from the parent organization for families with neurological diseases (the BOSK; <https://www.bosk.nl/>) and the spina bifida outpatient clinic at Wilhelmina's Children Hospital in Utrecht, the Netherlands ($n=22$) from January to April 2009. The inclusion criteria in both groups were as follows: (1) diagnosed with spina bifida; (2) between the ages of 6 and 18 years; and (3) able to follow instructions regarding testing and training. Typically developing adolescents ($n=13$) were recruited from the Hamilton community and were matched to the Canadian spina bifida group by age and sex.

Hoffer classification

Ambulatory status of participants was described using the Hoffer classification, the most commonly used measurement system to determine ambulatory status in individuals with spina bifida.¹⁹ In this study, Hoffer classification was designated by a physician or senior research member at the time of recruitment using the modified Hoffer Functional Ambulation scale.^{20,21} Classification categories include 'community ambulator', 'household ambulator', 'non-functional ambulator', and 'non-ambulator'.

What this paper adds

- Reduced levels of physical activity and sedentary time were quantified in children with spina bifida.
- Objective quantification of physical behaviour in ambulatory and non-ambulatory school-aged children with spina bifida is possible.

Activity monitors

This study involved existing data in collaboration between Dutch and Canadian research groups. While these two projects were similar in study aim and design, each site chose the objective measurement tool that was available to them at the time of recruitment. Among research-grade accelerometers, the ActiGraph monitors have been employed in a number of different patient populations and, in fact, account for more than 50 per cent of published studies.²² The Actiheart is the second most frequently used objective measure of physical activity by researchers (16% of published studies).²² Furthermore, it was considered an appropriate comparator given that it measures physiological responses to exercise (i.e. heart rate). In a validation study by de Groot et al., prediction of physical activity energy expenditure using heart rate was superior to prediction of physical activity energy expenditure using accelerometry data in ambulatory children with spina bifida.²³

ActiGraph

The ActiGraph GT3X activity monitor (ActiGraph LLC, Pensacola, FL, USA) has demonstrated high reliability, with an intraclass correlation coefficient for activity counts of 0.97.²⁴ Each device weighs 28g with dimensions of 3.8cm×3.7cm×1.8cm and is capable of recording acceleration in the vertical, anteroposterior, and mediolateral planes ranging from ± 6 units of gravity in magnitude. Accelerations are sampled by a 12-bit analogue-to-digital filter at 30Hz and stored in raw format (units of gravity), which are subsequently converted into user-defined sampling intervals or epochs. Because of the brief, intermittent nature of physical activity in children and adolescents, activity data were stored using a 3-second epoch.²⁵

Measured accelerations are converted into counts per 3-second epoch and then categorized into activity intensities based on predetermined cut-points. In this study, we calculated average time spent in sedentary, light physical activity (LPA), moderate physical activity (MPA), and moderate to vigorous physical activity (MVPA). These categories were determined using the cut-points developed by Evenson et al.,²⁶ which were validated for use in children and adolescents with cerebral palsy.¹⁵ Total, weekday, and weekend average time by activity intensity and average vertical axis activity counts per minute (CPM) were chosen as the ActiGraph-derived physical behaviour outcomes of interest.

Actiheart

The Actiheart activity monitor (CamNtech Ltd, Papworth Everard, UK) weighs 8g, is 7mm thick, and is 33mm in diameter. The device is able to measure heart rate, heart rate variability, and electrocardiogram magnitude using various epoch settings. The measurable range of heart rate is 31 to 250 beats per minute. Heart rate reserve (HRR) was used to calculate the time spent in different physical activity intensity zones (very light, light, moderate, vigorous, and near-maximal to maximal). Former studies have reported the Actiheart demonstrates high intra- and interinstrument reliability²⁷ and is valid for the measurement of physical activity in children with spina bifida.²³ The monitor was set to record data using a 30-second epoch.

Procedure

Canadian participants were asked to wear an ActiGraph activity monitor on the right side of the waist, securely fastened with an elastic belt, during all waking hours for 7 consecutive days. Participants were instructed to remove the activity monitor during any water activities, such as bathing or swimming. Participants were also asked to complete a diary intended to track the exact time monitors were placed on or taken off. Upon completion of the monitoring period, collected accelerometer data and logbook were retrieved and downloaded using ActiLife software (version 6.11.8, ActiGraph LLC, Pensacola, FL, USA). Data were visually inspected to ensure that information in the diary corresponded with the activity monitor output. Any periods of inactivity recorded as non-wear time (as indicated in the diary) were removed from the analysis. Only participants with at least 8 hours of monitoring on at least 1 day were included in the analysis.

Dutch participants visited the Child Development and Exercise Center of the Wilhelmina Children's Hospital for anthropometric measurements and exercise testing. Participants were outfitted with an Actiheart monitor, which was attached to two standard electrodes (H99SG, Kendall, Covidien, Ireland) directly on the chest. During initial rest and exercise testing, heart rate was measured with both the Actiheart as well as with a Polar Accurex monitor (Polar-Nederland BV, Almere, the Netherlands). Initial resting measurements (i.e. resting heart rate [HRR_{REST}]) were recorded while the participants were sitting reading a comic book for 10 minutes. Maximal exercise testing was then completed with a graded treadmill test (EnMill, Enraf, Delft, the Netherlands) using a protocol previously determined to be highly valid and reliable in children with spina bifida.²⁸ The full protocol details outlining the exercise testing are described elsewhere.^{28,29} Participants were

asked to continue wearing the Actiheart monitor for 3 days (2 weekdays, 1 weekend day), during both waking hours and at night, and to complete an activity diary verifying wear time. HRR zones, or intensity zones, were the Actiheart-derived physical behaviour outcomes assessed and were based on the American College of Sports Medicine guidelines for physical activity intensity: very light (<30%); light (30–40%); moderate (40–60%); vigorous (60–90%); and near-maximal to maximal (≥90%).³⁰ A measured heart rate's given HRR zone was calculated as:

$$(\text{HR} - \text{HR}_{\text{REST}}) / (\text{HR}_{\text{PEAK}} - \text{HR}_{\text{REST}}) \times 100\%$$

Resting heart rate was taken from the resting measurement using the Polar Accurex monitor. Peak heart rate (HR_{PEAK}) was determined as the highest registered heart rate achieved during the maximal exercise testing using the Polar Accurex monitor, or during the daily heart rate registration as measured by the Actiheart monitor if a higher value was achieved. Time spent in the different HRR zones was calculated in total minutes and as a percentage of the daily monitoring time, to control for differences in wear time. Similar to the ActiGraph units, only participants with at least 8 hours of daily monitoring time on at least 1 day were included in the analyses. This liberal monitoring time threshold was set to maximize inclusion of participants in the analyses.

Statistical analyses

As an exploratory study making use of two data sets, sample size calculations were not completed. Descriptive statistics were used to report baseline characteristics of each participant. Data were tested for normality with the Shapiro–Wilk test. When necessary, data were transformed using the natural logarithms, and reassessed for normality. Non-parametric tests were completed when the data still failed to achieve normality upon transformation. Levels and duration of physical activity (vertical axis accelerometer CPM; time spent in LPA, MPA, and MVPA) and total sedentary time were compared between spina bifida and (typically developing) control groups using independent sample t-tests. These physical activity and sedentary time data as measured on weekdays versus weekends, from spina bifida and typically developing groups, were also compared.

The five HRR categories, including very light, light, moderate, vigorous, and near-maximal to maximal, were compared between weekday and weekend measurements using Wilcoxon signed-rank tests.

For descriptive purposes and to juxtapose measured physical activity and sedentary time between activity monitors in community and household ambulators, the following ActiGraph and Actiheart categories were merged: sedentary (<101 CPM) and very LPA (<30% HRR); LPA (101–2295 CPM) and LPA (30–40% HRR); MPA (2296–4011 CPM) and MPA (40–60% HRR); MVPA (>2296 CPM) and MPA (40–60% HRR), vigorous physical activity (60–90% HRR), and near-maximal to maximal physical activity (≥90% HRR). In an explorative analysis, Mann–Whitney U tests were used to contrast physical activity time of Canadian and Dutch adolescents with spina bifida. Only community and household ambulators, as determined by the Hoffer classification, were included in this analysis in attempt to make the two cohorts more comparable at a functional level.

Statistical Package for the Social Sciences (SPSS, IBM Corp., version 20, Armonk, NY, USA) was used for data analysis. Statistical significance was set at $p \leq 0.05$ for all analyses.

[Table 1]

Results

The characteristics of all participants are shown in Table 1. Data from 35 Canadian and Dutch children with spina bifida (14 females, 21 males; mean age 10y 11mo, standard deviation [SD] 3y 6mo, range 5y 6mo–18y; Hoffer classification distribution: community [$n=28$], household [$n=3$],

non-functional [$n=3$], and non-ambulator [$n=1$]) were included in the analyses. Data from 47 days were excluded, from a maximal potential monitoring period of 157 days (Dutch and Canadian spina bifida cohorts), because of participant non-compliance or hardware malfunction.

ActiGraph

The 13 Canadian participants had an average (SD) monitoring period of 5.4 (2.1) days. Thirteen typically developing adolescents were matched to the Canadian spina bifida group by age (mean [SD] 10y 11mo [4y 2mo]) and seks ($n=7$ females). Of the potential 194 monitoring days for both the spina bifida and typically developing groups, 15 and 7 days were excluded respectively, because of insufficient wear time (<8 h). Average daily monitoring time did not differ statistically between spina bifida and age- and sex-matched typically developing groups ($p>0.05$). Children with spina bifida did, however, spend more time being sedentary per hour of monitoring time ($p=0.001$), and less time in LPA ($p=0.003$), MPA ($p=0.001$), and MVPA ($p<0.001$) (Table 2). Vertical axis CPM were significantly lower in children with spina bifida than typically developing adolescents ($p=0.001$). The increased sedentary time and decreased activity time in children with spina bifida compared with typically developing adolescents was consistent on both weekdays and weekends (Fig. 1). There was no statistical difference in physical activity or sedentary time measured on weekdays compared to weekends.

Actiheart

Dutch participants ($n=7$ females; mean age [SD] 10y 11mo [3y 1mo]) wore the Actiheart monitor for an average (SD) of 31.4 (15.4) hours, for a total monitoring time of 21 weekdays and 5 weekend days. Data from 32 days were excluded in the analyses because of missing data or software/hardware issues with the Actiheart. Dutch children with spina bifida spent a median of less than 10% of the total monitoring time in light, moderate, or vigorous physical activity categories. Wilcoxon signed-rank tests showed no significant difference in median activity time within the HRR zones between weekdays and weekends (Table 3).

Exploration of similarities and differences between two Countries

To explore potential differences in activity time between Canadian and Dutch cohorts, ActiGraph and Actiheart data are amalgamated in Table 4. Only participants classified as community ($n=7$ Canadian and $n=21$ Dutch) and household ambulators ($n=2$ Canadian and $n=1$ Dutch) were included. Mann-Whitney U tests revealed a significant difference ($U=51.0$; $p=0.037$) in measured sedentary time between the Canadian and Dutch cohorts. The median sedentary time was 578 minutes per day (interquartile range 138min/d) for Canadian participants compared to 757 minutes per day (interquartile range 563min/d) for Dutch participants. Furthermore, there was a significant difference ($U=23.0$; $p<0.001$) between Canadian (median [interquartile range] 121min/d [80.1]) and Dutch (median [interquartile range] 33.5min/d [50.8]) cohorts for LPA times. Though the Dutch participants achieved greater monitoring time (median 845min/d), MPA (median 38.5min/d), and MVPA (median 51.5min/d) compared to Canadian participants (median of 736min/d, 21.5min/d, and 32.1min/d for monitoring time, MPA, and MVPA respectively), these differences were not statistically significant.

[\[Table 2\]](#) [\[Figure 1\]](#) [\[Table 3\]](#)

Discussion

We were able to report on physical activity and sedentary time of children and adolescents with spina bifida using two objective measurement tools. School-aged Canadian children with spina bifida were significantly less active than their typically developing peers and significantly more sedentary. Physical activity and sedentary behaviour of Canadian and Dutch children with spina bifida is

consistent on both weekdays and weekends. Objectively-measured physical activity from both the ActiGraph and Actiheart showed children with spina bifida, on average, spent more than 80% of waking hours being non-exertive (i.e. very light HRR zone) or sedentary, with only small periods of time spent engaging in MVPA. Despite the liberal inclusion threshold of at least 8 hours of monitoring time on at least 1 day, children with spina bifida participating in this study showed relatively low compliance to the requested monitoring periods for both ActiGraph (15d excluded) and Actiheart (32d excluded).

A study in children with juvenile arthritis found large day-to-day variability in measured activity counts, suggesting that large monitoring periods may be needed to more accurately capture habitual physical behaviour.³¹ However, in our sample of children with spina bifida, physical activity and activity counts were consistently lower than those of typically developing peers, with no significant difference in activity between weekdays and weekends. Furthermore, Actiheart-derived activity time in all intensity categories was similar between weekdays and weekends in the Dutch cohort. Together, these results suggest the low day-to-day variability in physical activity and sedentary time of children with spina bifida may warrant shorter monitoring periods. Future studies should evaluate how many measuring days are needed for a valid assessment in adolescents with spina bifida, which might be lower compared to other groups.

One of the limitations of the ActiGraph as a measure of physical activity relates to how minutes of activity per day are split between intensity categories. Past literature has emphasized the importance of implementing population specific 'cut-points' (i.e. threshold values, developed in calibration trials, used to distinguish physical activity intensities) to properly interpret accelerometer-derived activity data.^{32,33} ActiGraph cut-points have not been developed for children with spina bifida. Therefore, minutes of activity within each intensity categorization may not be comparable between children with spina bifida and typically developing adolescents. The actual intensity of a sit-to-stand transition, for example, may be quite different for a child with spina bifida compared to a typically developing child. However, mean vertical axis counts in CPM, a surrogate measure of physical activity not dependent on a cut-point, were still significantly lower in children with spina bifida compared to typically developing adolescents.

Another pertinent consideration when objectively measuring physical behaviour is the selection and attachment location of the activity monitor.³⁴ For non-ambulatory individuals, the hip-worn ActiGraph monitor underestimates activity levels and therefore researchers must interpret these data with discretion. This further supports previous research that has emphasized concerns regarding the use of hip-worn accelerometry in wheelchair users.³⁵ Indeed, a study using the Actical, an accelerometer also worn at the hip, in adolescents with spina bifida showed poor validity in predicting energy expenditure.²³

The use of heart rate as determined by the Actiheart may be the preferred method to evaluate physical activity and sedentary behaviour. A former study evaluating the use of the Actiheart in adolescents with spina bifida found that use of heart rate was preferred over additional use of accelerometer counts, which did not add to the validity of the models predicting energy expenditure during sedentary and active behaviour.²³ Furthermore, the Actiheart has been validated for use in children with various chronic diseases³⁶ and the Actiheart placement on the chest may allow appropriate measurement of heart rate in ambulatory and non-ambulatory adolescents. It should be noted that while the Actiheart measures a physiological response to activity, it is not measuring actual movement; heart rate measurement may be influenced by emotions and stress. Lastly, a limitation of both activity monitors is that they do not distinguish the type of activity or body posture. For example, a distinction between standing and sitting may be important to identify, yet periods of standing would be classified as sedentary time or very LPA based on low acceleration and heart rate.

The fundamental difference between activity monitors (the ActiGraph measuring acceleration and the Actiheart measuring heart rate) may be the reason we observed adolescents with spina bifida

spending more minutes per day in MVPA time in the Dutch sample when compared to the Canadian sample among community and household ambulators, though these were not statistically different. We do acknowledge, however, that directly comparing sedentary time (ActiGraph) and very LPA (Actiheart) is rather crude, as well as comparing ActiGraph- and Actiheart-derived LPA data. In reality, the Actiheart category of very LPA encompasses both sedentary as well as some LPA time. For these reasons, formal statistical results directly comparing ActiGraph- and Actiheart-derived physical activity and sedentary time data should be interpreted with caution.

Sample and cultural differences, among other personal and environmental factors, may also account for actual differences in time spent in MVPA. In particular, data from Dutch children with spina bifida were collected during the winter months of January until April, whereas data from Canadian children were collected over a full year. Opportunities to engage in physical activity may be different based on season, which may have influenced the differences we observed between groups. However, group differences should be seen as a strength. The data from the two groups were complementary in Hoffer classification and level of lesion covered, allowing for greater generalizability to the heterogeneous spina bifida population.

There is a growing interest in assessing comorbidity, such as cardiovascular disease, and associated risk factors, like inactivity and sedentary time, in the field of childhood disability. Previous research has outlined some of the many challenges regarding the measurement of physical behaviour in individuals with disability.³⁷ A variety of outcome measures for physical activity and sedentary behaviour are being used (e.g. self-report questionnaires, accelerometry-based activity monitors), making it difficult to synthesize knowledge and generalize findings internationally.³⁷ To enable future research, it is essential that we understand the ways to assess physical activity and sedentary time, considering standardization of measurement in addition to feasibility and appropriate representation of all activities of daily living.³⁷ The data presented in this research study highlight many challenges surrounding the measurement of physical behaviour in ambulatory and non-ambulatory children with spina bifida. Informed by the data from the Canadian and Dutch studies, future researchers should carefully consider whether a chosen activity monitor is appropriate for use in their target population, the positioning of the activity monitor on participants, and an appropriate and feasible requested monitoring period.

Conclusion

Objective quantification of physical activity and sedentary time in ambulatory and non-ambulatory children with spina bifida is possible, but should be interpreted with care. The current data suggest that children and adolescents with spina bifida show reduced levels of physical activity and increased sedentary time compared with peers who are developing typically. Additionally, physical activity and sedentary time do not statistically differ between weekdays and weekends. This inactivity and sedentary behaviour may put these children at risk of developing comorbidities in the long-term. As such, it is important to continue to monitor the physical behaviour of individuals with spina bifida throughout the lifespan.

Acknowledgements

A special thank you is due to all participants and their parents or caregivers for their engagement and patience throughout these studies. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors have stated that they had no interests that might be perceived as posing a conflict or bias.

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Tables and figures

Table Participants' demographic and physical characteristics

	Children with spina bifida (n=35)	
	ActiGraph monitor (n=13)	Actiheart monitor (n=22)
Age, y:mo	10:11 (4:1)	10:11 (3:1)
Females, n (%)	7 (53.8)	7 (31.8)
Height, cm	133 (30.0)	141 (20.2)
Weight, kg	39.1 (26.9)	43.4 (20.6)
Hoffer classification, n (%)		
Community ambulator	7 (53.8)	21 (95.5)
Household ambulator	2 (15.4)	1 (4.5)
Non-functional ambulator	3 (23.1)	0
Non-ambulator	1 (7.7)	0
Level of lesion, n (%)		
Thoracic	1 (7.7)	0
Thoracolumbar	2 (15.4)	0
Lumbar	7 (53.9)	17 (77)
Lumbosacral	0	0
Sacral	3 (23.1)	3 (14)
Unknown	0	2 (9.1)
HR _{REST} , bpm ^a	–	90 (14)
HR _{PEAK} , bpm ^a	–	178 (21)
Actiheart-derived HR _{PEAK} , bpm	–	175 (30)
HRR, bpm	–	104 (20)

Data are mean (SD) unless otherwise stated. ^aDerived from Polar Accurex heart rate monitors. HR_{REST}, resting heart rate; HR_{PEAK}, peak heart rate; HRR, heart rate reserve; bpm, beats per minute.

Table 2 ActiGraph monitoring time, physical activity, and sedentary time in children with spina bifida and typically developing adolescents

Table 2: ActiGraph monitoring time, physical activity, and sedentary time in children with spina bifida and typically developing adolescents						
	Spina bifida (n=13)	Typically developing (n=13)	95% CI lower	95% CI upper	t	p
Monitoring time (h/d)	11.9 (1.32)	12.5 (1.37)	–0.53	1.66	1.07	0.296
Vertical axis CPM	272 (169)	619 (275)	162.7	531.6	3.88	0.001
Sedentary time (min/h)	49.5 (5.78)	41.0 (5.76)	–13.1	–3.80	–3.74	0.001
LPA (min/h)	8.17 (4.27)	13.5 (4.07)	1.96	8.72	3.26	0.003
MPA (min/h)	1.47 (1.00)	3.00 (1.06)	0.69	2.36	3.78	0.001
MVPA (min/h)	2.33 (1.61)	5.46 (2.13)	1.60	4.65	4.22	<0.001

Figure 1 ActiGraph data from children with spina bifida (SB) and typically developing (TD) adolescents differentiated between weekdays and weekends. (a) Monitoring time; (b) sedentary time; (c) light physical activity; (d) moderate physical activity; (e) moderate to vigorous physical activity. Data are presented as mean (SD). ^aSignificance set at $p < 0.05$

Table 3 Actiheart percentage of monitoring time spent in heart rate reserve zones per day in children with spina bifida differentiated between weekdays and weekends

	Weekday			Weekend			Week vs weekend p
	n	Median	Q1-Q3	n	Median	Q1-Q3	
Very light (<30%)	21	89.2	81.9-94.7	5	81.4	64.8-97.1	0.465
Light (30-40%)	21	4.5	1.6-7.5	5	4.0	0.69-15	0.273
Moderate (40-60%)	21	4.3	1.9-7.0	5	5.2	0.16-21	1.00
Vigorous (60-90%)	21	0.94	0.30-2.3	5	0.06	0.00-4.6	1.00
Near-maximal to maximal ($\geq 90\%$)	21	0.00	0.00-0.26	5	0.00	0.00-0.81	0.655

Q1, 1st quartile; Q3, 3rd quartile.