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Original Investigation

Active Free Time in Adolescents with and Without Intellectual Disability: An Exploratory Study

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Purpose: The core purpose of this research was: (1) to evaluate physical activity patterns (PA) using objective measures among high-school students and (2) access differences in PA patterns between students with intellectual disability (ID) and their peers without disability.
Methods: In this cross-sectional study 175 students participated (94 boys and 81 girls), 84 students with ID (45 boys and 39 girls), and 91 students without disability (49 boys and 42 girls). Of 84 students with ID, 45 attended institutions for education and rehabilitation, and 39 attended regular schools with special or adapted programs. The minutes that students spent in different physical activity intensities were recorded over seven days and analysed using descriptive and nonparametric statistical methods.
Results: The median value of moderate PA in students with ID in SCER and RSAP was 60.00 (18.80 - 103.80) min and 81.30 (3.70 - 138.00) min, while in students without ID it was 69.00 (49.70 - 108.70) min during the school-day leisure time. No differences were detected. All three groups showed very similar values for time spent in moderate PA, with no statistically significant differences observed ($H(2)= .581$, $P= .747$). Although 43.5% and 43.6% of students with intellectual disabilities did not meet the recommended levels of PA compared with 35% of students without disabilities, no statistically significant differences were observed.
Conclusions: The results of this study indicate that no significant differences were detected in active free time between students with and without intellectual disabilities. However, this finding must be interpreted with caution due to the study's low statistical power.

Keywords: Sensewear armbands, intellectual disabilities, adolescents, energy expenditure.

Introduction

For several decades, physical activity (PA), defined as any movement of the body that results in energy expenditure[1] has been in major focus of public health research and policy. due to its well-documented and wide-ranging benefits.[2–7] Scientific evidence consistently demonstrates that regular PA plays a critical role in the prevention and management of cardiovascular diseases, obesity and type 2 diabetes.[3,5,7,8] It is associated with lower risk of certain cancers and osteoporosis,[3,6] and have a positive effect on psychological and cognitive functioning.[4]
On the other side, physical inactivity is recognized, as a major global health issue.[9,10] Recent global research, indicate that nearly one third of adults (1.8 billion people) worldwide, do not achieve the recommended levels of PA, and in two thirds of countries and regions, trends in insufficient PA have been rising over recent decades.[11] Furthermore, data consistently show that women have higher rates of insufficient PA than men, with disparities often influenced by cultural, social and environmental factors.[11] According to the latest World Health Organisation (WHO) fact sheets and global studies,[12] prevalence of insufficiently active adolescents raises up to 81%, more precisely 84.7% of girls and 77.6% of boys. This data is very concerning because many young people face a higher risk of serious health problems, such as heart disease and diabetes, at an early age.[13] To maintain health and reduce the risk of noncommunicable diseases WHO recommends that children and adolescents engage in at least 60 minutes per day of moderate to vigorous intensity activities.
People with intellectual disabilities (ID) are at a higher risk of developing noncommunicable diseases (NCDs) such as obesity, type 2 diabetes, high blood pressure, and heart disease.[14–17] Some studies have shown that adolescents with ID have twice the risk of developing NCDs compared to their peers without ID.[18,19] Regardless of the risks, adolescents with ID consistently show lower levels of physical activity compared with their typically developing peers[20,21] and often do not meet the recommended guidelines by the World Health Organisation for daily activity.[22–24] Measuring PA is essential for understanding the risk of insufficient activity and its associated health problems. Because PA encompasses any movement of the body that occurs across different areas of daily life, it is important to assess it comprehensively. These areas include occupational activity, leisure-time activity, transportation-related activity, and household activity.[25,26] Each of these domains contributes to overall PA levels and plays a vital role in promoting physical health, mental well-being, and social development. In adolescents, occupational PA refers to movement related to school tasks and program, and leisure-time PA refers to movement or exercise performed during free time for enjoyment, recreation, or sport. Free time can include structured activities like sport participation as well as unstructured activities like dancing, active play with friends. Structured PA is especially important for adolescents with ID, not only for promoting health but also for supporting cognitive development. Previous research has shown that structured PA can enhance cognitive abilities such as problem-solving and creative thinking in youth populations.[27]

School plays a significant part in promoting PA through physical education classes and other programs, free time outside of school hours is important for supporting active life. For many adolescents with ID, school is the only environment where they have opportunities to be part in organized PA[28] and school attendance represents only one of the many factors influencing overall PA levels. Leisure, transport and household activities are important determinants in creating PA patterns. Leisure time is often associated with organized activities, such as school sports teams, community club programs, dance classes, martial arts, or other structured group exercises.[29] These activities typically involve scheduled training sessions, coaching, or supervision and clear rules. In later teenage years, participation in these activities starts to decline.[30,31] This decline can be caused by many factors, such as increased academic pressure, reduced parental involvement or limited access to programs.[32,33]

For adolescents with ID, participation in leisure-time PA, particularly in organized or structured activities, is often more limited compared with their peers without disabilities.[28] This reduced participation is influenced by a combination of individual, environmental, and socioeconomic factors.[34] Individual factors are related to some typical characteristics of adolescents with ID like lower coordination, lower self-confidence and lower ability to understand the rules in sports activities caused by lower cognitive abilities. All of this increases their vulnerability to injuries. For this reason, accurately assessing and profiling their PA levels is crucial for identifying health risks and implementing preventive strategies. Similar approaches to activity profiling have been successfully applied in other populations at risk, providing strong evidence of the importance of understanding PA patterns in planning and programming activities.[35] Environmental factors are related to their living surroundings that can have lack of programs or transport to appropriate facilities. Finally, many after-school activities require some payment fees that are usually out of reach for adolescents with ID. As a result, adolescents with ID often choose unstructured or home activities instead of organized activities. While these unstructured activities still provide some health benefits, they usually offer less opportunities for social interaction, skill development, and long-term fitness improvement.[36] Although an important number of studies have explored physical engagement among school-aged youth, relatively few have targeted specifically on adolescents with ID or have included them within studies that covered a wide age range or disabilities. Therefore, the present study included adolescents with mild ID and compared them to peers without disabilities.

Methods

Participant

Participants were students from eight secondary schools and four centres for education and rehabilitation. They were divided into three groups: (1) students with ID attending specialized centres for education and rehabilitation (SCER), (2) students with ID attending secondary schools following special or adapted program (RSAP) , and (3) students without disabilities. In this study, intellectual disabilities referred to children with mild ID defined as an approximate IQ range of 50 to 69 according to the Wechsler scale, which within the educational context, were manifested through specific learning and attention difficulties. The schools and centres were purposively selected to include students with ID. Individual participants were identified based on existing school records, which included assessments conducted by qualified professionals. Inclusion criteria were age between 14 and 18 years and mild ID. Exclusion criteria were illness or injury, physical disabilities, or any other condition that could affect usual physical activity. The final sample resulted of 175 students, from which 45 attended centres for education and rehabilitation (28 boys and 17 girls), 39 attended regular schools with special or adapted programs (17 boys and 22 girls) and 91 students without disabilities (49 boys and 42 girls). After being informed of the purpose and the procedures of the study, the students' parents or guardians provided the written signed consent to participate in study.

Experimental Protocol

Experimental protocol was divided in two steps, anthropometric measurement and physical activity measurement.

First, we collected anthropometric data, including height, body mass, body fat percentage, and handedness. Measurements were obtained using the Omron BF 511 diagnostic scale (Omron Healthcare Co., Ltd., Kyoto, Japan) and standard anthropometer (Model 100, Gneupel Präzisionsmechanik. (GPM), Bachenbülach, Switzerland). To assess PA, we used multisensory devices SenseWear Armband (BodyMedia Inc., Pittsburgh, PA). These devices through multiple sensors (skin temperature, near-body ambient temperature, a biaxial accelerometer, and galvanic skin response), as well as data on age, sex, height, body weight, dominant hand, and smoking habits, estimates energy expenditure, activity duration, and activity intensity. In addition, the students kept activity diaries to get insight into the types of activities they engaged in across the different groups.

Data Analysis

Collected data from multisensory devices were analysed using SenseWear 8.0 software. Only results that had 10 hours of wearing in active part of day and one day of weekend were included in further analysis. The free time of each student was determined using their activity diary and school timetable.

The intensity of PA was defined by metabolic equivalent of activity (MET). One metabolic equivalent is the amount of oxygen consumed at rest, that is approximately 3.5 mL/kg/min of O_2. Low-intensity PA was defined as activity below 4 METs, moderate-intensity activity referred to activity between 4 and 6.9 METs, and high-intensity PA was defined activity exceeding 7 METs. Sedentary activities were defined as activities requiring less than 1.5 METs. These thresholds were adopted as reference values from a study that included participants of similar age and used the same measurement instruments.[31] For each activity level we extracted duration time The data were entered into tables, and the mean value was calculated. The leisure time diaries showed the frequency of individual activities throughout the day. For each specific activity, the percentage representation was calculated in relation to all leisure-time activities, separately for girls and boys.

Free time was defined as all-time not spent in classes, studying, traveling to school, or performing household duties. Travel to school was classified as free time because it consistently represented a self-directed, non-obligatory period in both diaries and timetables. When students leave home earlier or return later than required, they engage in walking, social interactions, or other voluntary activities, making this period more comparable to leisure than to structured transportation. Free-time activities were analysed using both subjective (diaries and timetables) and objective (SenseWear) measures, ensuring standardized coding across all participants. Results were expressed as percentages reflecting the frequency of each reported activity relative to the total number of activities performed during periods of active

leisure.

Statistical Analysis

For the statistical analysis, we used the software package Statistica, version 7. (TIBCO software, Stat Soft Corp., Tulsa, OK, USA). First, we controlled the normality of the distributions. Kolmogorov-Smirnov showed that the variables were not normally distributed. Therefore, we used non-parametric methods for further analysis. Specifically, to determine differences between groups, we used the Kruskal-Wallis H test with significance fixed at $P < .05$. The calculated η^2_H values indicate negligible effect sizes ($\eta^2\_H \leq .008$; Cohen's $f \leq .091$), and the test had low statistical power ($1\text{-}\beta \leq .17$), limiting the ability to detect small differences between groups.

Results

Table 1 describes basic characteristics of the students with ID in SCER, students with ID that attend RSAP, and students without disabilities. Students attending RSAP are statistically older than the other two groups of students (17.21 ± .83 years), which is major confounding factor as older students are generally less active. Students without disabilities are much higher than their peers with disabilities (170.30 ± 8.60 cm).

Table 1. Basic socio-demographic characteristics of the sample divided into students that attend 1) SCER, 2) RSAP and 3) students without disabilities

Variables	Sample (N = 175)	Students with intellectual disabilities (N = 84)		Students without intellectual disabilities (N = 91)	P- value
		SCER (N = 45)	RSAP (N = 39)		
Sex (%)					
Boys	94 (53.71)	28 (62.22)	17 (43.59)	49 (53.85)	
Girls	81 (46.29)	17 (37.78)	22 (56.41)	42 (46.15)	.232
Age (years)	16.69 ± 1.07	16.49± 1.47	17.21± 0.83	16.56 ± .84	.002
Height (cm)	168.20 ± 9.50	166.10 ± 10.40	165.5 ± 9.45	170.30 ± 8.60	.006
Mass (kg)	65.99 ± 16.90	66.09 ± 20.01	66.38 ± 17.23	65.77 ± 15.21	.981
Body Mass Index (kg/m^2)	23.39 ± 5.77	24.18 ± 7.53	24.39 ± 4.93	22.57 ± 5.00	.148
Percentage of fat (%)*	24.74(14.10 - 32.60)	23.30(12.90 - 31.70)	29.70 (19.90 - 36.50)	22.50 (12.10 – 30.10)	.026

Note: specialized centres for education and rehabilitation (SCER), (2) students with intellectual disabilities attending secondary schools following special or adapted program (RSAP). Value presented through medians and interquartile range (25^{th}- 75^{th} percentile), * - P< .05.

Figure 1 refers to the differences in time spent in low, moderate, vigorous, and very vigorous intensity of PA during school-day leisure time. Although students with ID in SCER had a

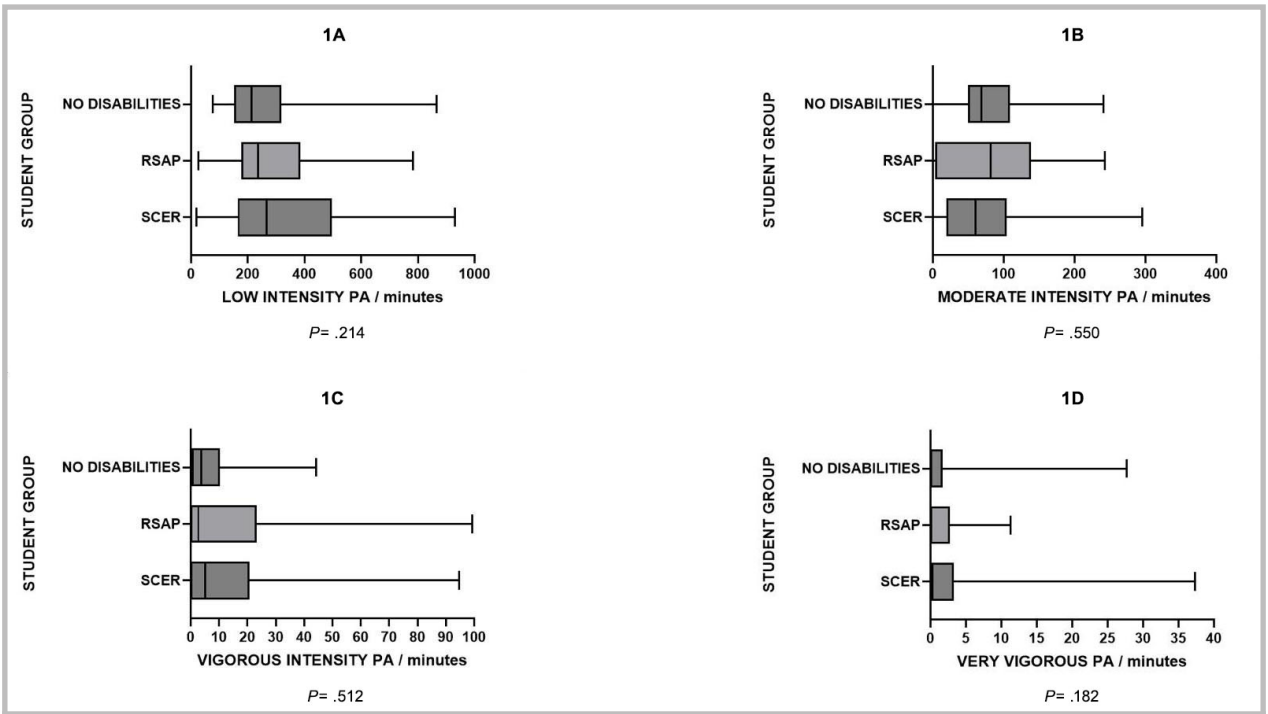

Figure 1. Differences in active PA during school-day leisure time among students in SCER, RSAP, and students without ID: 1A – low PA, 1B – moderate PA, 1C – vigorous PA, 1D – very vigorous PA . Box-and-whisker plots show median (line), interquartile range (box), and min–max values (whiskers).

slightly higher level of low PA during leisure time (Figure 1A), [267.30 (164.70 - 495.90) min], the test failed to detect a statistically significant difference [$H(2)= 3.083$, $P= .214$] due to low powered analysis. The median value for the time spent in moderate activities (Figure 1B) shows similar values across the groups: students with ID in SCER 60.00 (18.80 - 103.80) min, RSAP 81.30 (3.70 - 138.00) and students without ID 69.00 (49.70 - 108.70) min. The test failed to detect a statistically significant difference ($H(2)= 1.195$, $P= .550$). Students with ID in SCER had slightly higher values of vigorous PA duration (Figure 1C), 5.00 (.00 - 20.70) min, compared to students in RSAP [2.70 (.00 - 23.30) min] and children without disabilities [3.70 (.30 - 10.30) min] without significant difference detected ($H(2)= 1.335$, $P= .512$) due to low test power. Also, students with ID in SCER had a higher median value of very vigorous PA duration (Figure 1D), [.30 (.00 - 3.30)] min, but the test failed to detect differences among three groups of students ($H(2)= 3.398$, $P= .182$).

Figure 2 refers to differences in time spent in low (2A), moderate (2B), vigorous (2C), and very vigorous PA (2D) during weekend among students in SCER, RSAP, and students without ID. Although students with ID in SCER had slightly higher levels

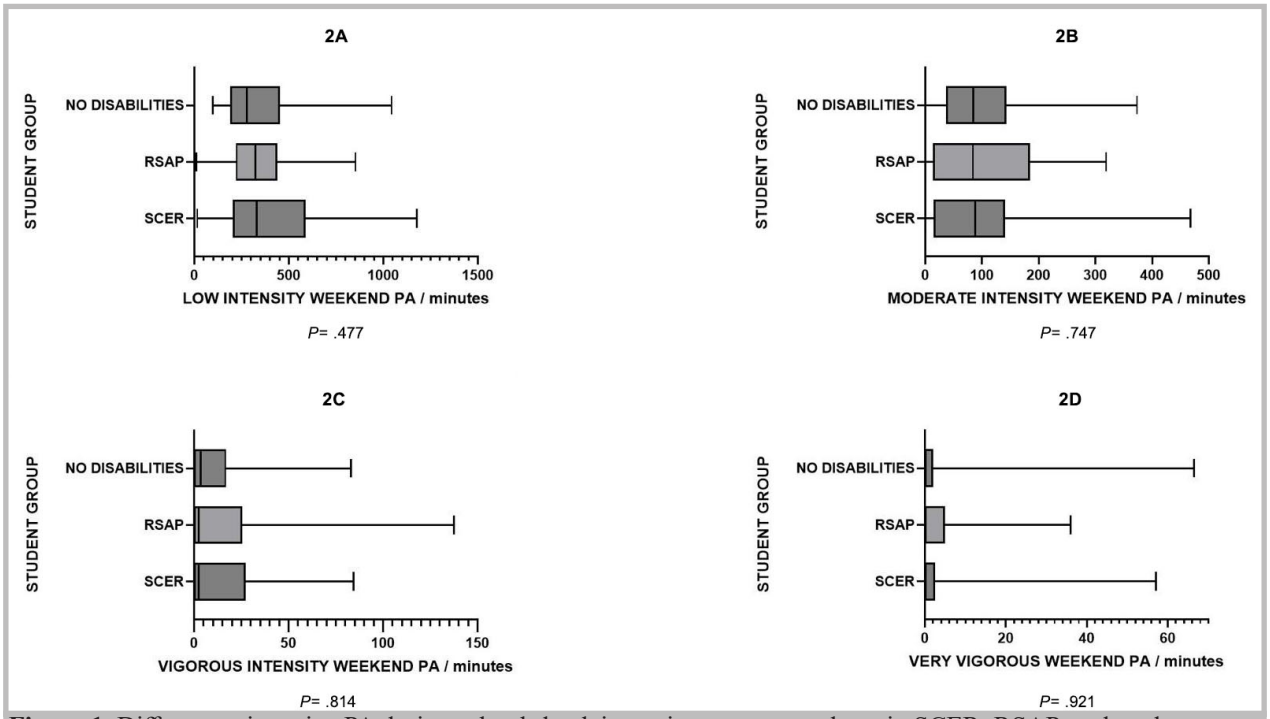

Figure 1. Differences in active PA during school-day leisure time among students in SCER, RSAP, and students without ID: 1A – low PA, 1B – moderate PA, 1C – vigorous PA, 1D – very vigorous PA . Box-and-whisker plots show median (line), interquartile range (box), and min–max values (whiskers).

of time spent in low PA during the weekend [330.50 (203.50 - 588.50) min] than the students without ID [279.00 (191.50 - 452.50) min], the Kruskal-Wallis test failed to detect statistically significant differences between the groups ($H(2)= 1.1478$, $P= .477$). Median moderate PA was similar across groups: SCER 88.80 (14.75–140.80) min, RSAP 84.00 (14.00–185.00) min, and students without ID 85.00 (37.00–143.00) min. The test failed to detect differences ($H(2)= .581$, $P= .747$). Students without ID had slightly higher durations of vigorous PA at 3.50 (.00 - 17.00) min, compared to students with ID in SCER [2.50 (.00 - 27.25) min] and RSAP [2.50 (.00 - 25.50) min]. Despite this, the test failed to detect significant differences in vigorous ($H(2)=.413$, $P=.814$) and very vigorous ($H(2)= .165$, $P=.921$) activities due to low test power.

Descriptive results indicated that 46.7% of students in the SCER group, 43.6% in the RSAP group, and 35.2% of students without disabilities did not meet the recommended PA guidelines during school day free time. The chi-square test did not show a statistically significant difference, $\chi^2(2, N = 175) = 1.93$, $P= .38$. During the weekend, 37.8% of students with ID in SCER, 35.9% students with ID in RSAP and 35.2% without ID didn't meet the guidelines. $\chi^2(2, N = 175) = .186$, $P= .911$.

Discussion

This study investigated patterns of objectively measured PA during free time among students with ID and their peers without disability. This study failed to detect significant differences between students with and without disabilities, which is linked to low statistical power. Furthermore, we failed to detect differences between students with disabilities in SCER and RSAP. A major confounding factor for the lack of differences is statistically significant age difference between students in the RSAP and two groups. Although the study included students aged 14–18, students with ID in the RSAP group were older, which may have influenced the results, as PA tends to decrease with age during adolescence.[31]

Considering the World Health Organization recommendations on PA, our findings indicate that, during leisure time, students with disabilities show a lower tendency to meet these standards compared to their peers without disabilities, even though a clear difference in proportions was not observed. Also, during weekends, in both groups the number of students not meeting the recommendations shows a decreasing trend.

Other studies that tried to identify patterns of PA of students with ID during leisure time don't align with the results of our study.[22,23,36] These studies have indicated that PA tends to decrease during leisure time. Specifically, a study by Foley et al. reported a significant decrease of 28.1% in PA during free time and 20% during the weekend.[23] A common limitation in research involving students with disabilities is the small sample sizes, as well as inclusion of students with heterogeneous disability types and big age difference, as in this study. One study reported that none of the adolescents with ID met the

guidelines, compared with 60% of those without ID.[22] This study involved students from special and inclusive schools of similar age, but with a wider range including moderate to severe ID. It concluded that adolescents with disabilities are less active and have fewer opportunities to meet activity guidelines during leisure time. Study, using objective measures in the same age group across the entire day, found students with disabilities less active than their peers.[36] Some studies revealed important insides of recreational behaviours of adolescents with ID.[37] The data indicate that majority of participants (70.6%) engage in passive recreational activities like listening to music or watching television, which aligns with previous literature highlighting the preference for sedentary leisure activities in this population. It's also concerning that 32.4% of participants did not involve themselves in any PA during non-school hours. Previous research has identified insufficient active commuting to and from school as the most common reason for differences in PA between adolescents with and without ID.[22,38–40] Inactive commuting to school has been shown to be one contributing factor to lower PA levels in adolescents with ID. This is likely related to safety concerns and a lack of environmental awareness and support for this at-risk population, as well as the distance that needs to be covered to reach school. The distance between home and school has been documented as a significant limiting factor in reducing PA, which has also been confirmed in previous study.[40] In addition to relying on passive transportation (e.g., cars, buses), adolescents with intellectual disabilities have generally been found to engage less in organized PA or sports, both during school and in extracurricular settings.[38] According to the activity diaries in this study, a significant portion of the active part of the day was related to walking to school. The most active students were those attending regular schools following a special or adapted program, followed by students without disabilities, then girls with disabilities attending regular schools under a special or adapted program, and finally girls without disabilities. In general, boys walk to school more than girls, and the least active group were girls with disabilities attending SCER. Therefore, we can say that our observations confirm trends noted in the previous studies when it comes to students attending SCER.

Descriptive findings from the activity diaries found that both, students with disabilities and student without disabilities engaged in similar leisure activities. Similar findings were reported by Stanish et al.[36] They found that students with disabilities and those without them tend to choose similar activities, although the frequency and intensity were shaped by the setting in which they were performed. When it comes to the active part of free time, walking is among the most common activities, what is consistent with previous findings for both groups.[37,40] In addition to walking, our study also revealed that during the week, female students participate more in household chores compared to male students in both groups, while engagement in sports activities is more common among girls without disabilities compared to those with disabilities. Numerous studies also emphasize the importance of organized sports as one of the few opportunities for adolescents to meet the recommended levels of PA necessary for maintaining good health.[11,13,18] Participation in structured PA, such as team sports, fitness classes, or school-based programs, has been documented as a significant contributing factor to overall daily PA levels and help adolescents reach health-related guidelines. In our study, boys with disabilities attending SCER and RSAP spent a considerable amount of time engaged in organized sports activities, comparable to their peers without disabilities. Our findings demonstrate that, when provided with appropriate surroundings and opportunities, students with disabilities can participate in structured PA at a similar level to their peers without disabilities. However, a notable difference was observed among girls. Girls with disabilities were significantly less involved in organized sports compared to girls without disabilities. This disparity may be influenced by a variety of factors, most of them individual like lower motivation, fewer available programs tailored to their needs or expectations, or even a lack of encouragement from their family and friends. These results point to the importance of initiatives that encourage sports participation among girls with disabilities so they too can benefit from regular organized PA.

Having a pet, particularly a dog, could encourages adolescents to engage in outdoor activities like walking or playing with animals outside, contributing to higher levels of daily PA and positive effect off fresh air. An informal observation from the diaries suggested that students who have pets tend to spend more time outdoors. However, this information was not systematically collected and should not be interpreted as a formal study finding. This highlights a potential area for further research.

Practical Applications

The collected activity data provide valuable insights into adolescents' PA. While more than half of students with intellectual disabilities achieve recommended PA levels in their free time, greater focus is needed on increasing activity during school-day free time. This study underscores the need to promote inclusive and accessible PA for all students. Organized sports should be adapted to engage students with intellectual disabilities, particularly girls. Encouraging active commuting, such as walking or biking to school, can boost daily activity, while household chores should be recognized as meaningful PA, especially for girls.

Conclusions

This study was unable to detect significant differences in free-time PA between students with ID and their peers without disabilities, due to low statistical power. Nevertheless, a substantial proportion of students in both groups did not meet the recommended activity levels during free time. A significant age difference between the groups was observed, which was not controlled and could have influenced PA, representing a major confounding factor.

Larger and more detailed studies are needed to better understand the factors influencing activity and to develop targeted interventions, especially for girls with disabilities. In addition to objective measures, qualitative research on interests, preferences, and perceived barriers is crucial for planning effective and specific interventions.

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Ethical Committee approval

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Topic

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Conflicts of interest

The authors have no conflicts of interest to declare.

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Author-s contribution

Conceptualization, M.C. and L.P.; methodology, M.C; formal analysis, M.C.; investigation, M.C.; resources, M.C. and L.P.; data curation, M.C.; writing—original draft preparation, M.C.; writing—review and editing, M.C. and L.P.; supervision, L.P.; project administration, M.C. All authors have read and agreed to the published version of the manuscript.

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