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Exercise and Quality of Life Journal (2026) 18(1): 38-46
DOI: 10.31382/20260606

ORIGINAL SCIENTIFIC PAPER

Assessment of Physical Fitness, Physical Activity Level and Sedentary Behavior in Adolescents With and Without Intellectual Disability

Teddy Bofosa[1], Paulo Bunga[2], Augustin Buhendwa[1], Malgorzata Klass[3], Guy Bumoko[4], Eric Kam[1], Véronique Feipel[5], Constant Nkiama[1], Betty Miangindula[1]

[1] Department of Physical Medicine and Rehabilitation, University Clinics of Kinshasa, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo

[2] Department of Pediatrics, University Clinics of Kinshasa, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo

[3] Research Unit in Cardio-Respiratory Physiology, Exercise & Nutrition, Faculty of Human Movement Sciences, Université Libre de Bruxelles (U.L.B.), 1070 Brussels, Belgium

[4] Neurology Department, Neuro-Psychopathological Center, Faculty of Medicine, University of Kinshasa, Kinshasa, Democratic Republic of the Congo

[5] Functional Anatomy Laboratory, Faculty of Human Movement Sciences, Université Libre de Bruxelles (U.L.B.), 1070 Brussels, Belgium

Received: 23 December 2025 | Accepted: 10 April 2026 | Published: 15 June 2026

Abstract

Physical fitness is an important marker of health from a young age, yet it has been little studied in adolescents with intellectual disability (ID) in the Democratic Republic of Congo. This study aimed to compare physical fitness, physical activity levels, and sedentary behaviors between adolescents with and without ID. A cross-sectional analytical design was used with 569 adolescents divided into two groups: 303 with ID (13.54 ± 1.07 years; 180 boys, 123 girls) and 266 without ID (13.54 ± 1.10 years; 142 boys, 124 girls). Data were collected over a three-month period from November 2022 to February 2023. Physical fitness was assessed using the Eurofit test battery, including grip strength, explosive strength, seated trunk flexion, and the 20-meter shuttle run. Anthropometric measurements were also taken, and physical activity and sedentary behavior were assessed using the CAPAS-Q 8–18 questionnaire. Adolescents with ID showed significantly lower physical activity levels and higher sedentary behavior than their peers without ID ($p < .001$). They also performed worse on grip strength, explosive strength, and cardiorespiratory endurance tests ($d = -0.77$ to -1.23 for boys; $d = -0.77$ to -1.73 for girls; $p < .001$). These findings highlight important disparities and underscore the need for further longitudinal and intervention studies.

Keywords: intellectual disability · physical fitness · physical activity · sedentary behavior

✉ Correspondence:
Teddy Bofosa
bofosa.linkoko@unikin.ac.cd

Introduction

Physical fitness is a critical indicator of health throughout life, particularly during childhood and adolescence (Bermejo-Cantarero et al., 2021). Low physical fitness increases the risk of cardiovascular and metabolic disorders, as well as premature mortality in adulthood (Chiang et al., 2024). Regular moderate-to-vigorous physical activity (PA) supports the development and maintenance of physical fitness, whereas sedentary behavior has negative health consequences (Bermejo-Cantarero et al., 2021). The World Health Organization (WHO) recommends at least 60 minutes of daily PA for children and adolescents or intensive sessions three times per week (WHO, 2020; Pan et al., 2015). Adolescents with intellectual disability (ID) typically show lower physical fitness than peers with typical development (Bricout & Pace, 2018). Cognitive, motor, and adaptive limitations further restrict their participation in PA (Ravaud et al., 2003). In the Democratic Republic of Congo (DRC), about 13 million people, or 18% of the population, live with a disability (Langwana & Bitumba, 2016). High prevalence is associated with armed conflicts, domestic accidents, disabling diseases, and limited access to preventive and curative healthcare (Omadjela & Angalawe, 2022). Despite their numbers, adolescents with ID face social, educational, and economic exclusion, with restricted access to schooling, employment, and basic services (Langwana & Bitumba, 2016).

Education, a fundamental right, is often delayed for children with disabilities, particularly those with ID, resulting in late school enrollment during adolescence (Ebwel & Roeyers, 2016). Special schools in Kinshasa typically focus on theoretical lessons and vocational training, with limited adapted sports facilities and few qualified instructors in adapted physical activity. This context may increase sedentary behavior and negatively affect physical fitness in adolescents with ID.

Despite these challenges, no studies in the DRC have simultaneously assessed physical fitness, PA levels, and sedentary behavior in adolescents with ID, even though these factors strongly influence health outcomes. This gap motivated the present study, which addresses the following research question: What are the levels of physical fitness, PA, and sedentary behavior in school-aged adolescents with ID of both sexes compared with peers without ID?

We hypothesized that anthropometric measures would be similar between adolescents with and without ID, but that adolescents with ID would show higher sedentary behavior. This elevated sedentary behavior is expected to be associated with lower physical activity levels and physical fitness compared with peers without ID.

Method

The study population consisted of 870 adolescents of both sexes, including 420 attending special schools and 450 attending mainstream schools.

The following inclusion criteria were applied to recruit participants for this study: being present on the day of the evaluation; having freely agreed to participate in the tests; not having a pathology contraindicating the practice of physical activity and sports; being between 12 and 17 years of age; being in apparent good health for adolescents attending regular schools; having informed consent signed by the adolescents' parents or legal guardians authorizing participation in the study; and having a medical record establishing the diagnosis of mild ID, signed by a doctor or psychologist, for adolescents with ID. The study procedures were approved by the National Health Ethics Committee of the Ministry of Public Health of the Democratic Republic of the Congo (approval number: 404/CNES/BN/PMMF/2022, dated 30 October 2022). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from the parents or legal guardians of all participating adolescents prior to data collection, and assent was obtained from the adolescents themselves. All data were collected, processed, and analyzed confidentially and anonymously. The exclusion criteria were: age under 12 or over 17 years; severe or profound intellectual disability; and neurological or musculoskeletal disorders limiting mobility.

A convenience sample of 569 school-aged adolescents (boys and girls) was recruited, including 303 adolescents with ID (180 boys and 123 girls) enrolled in five special schools: Bondeko Twendeleye Village, Mawete village, Sembola Village, Kikesa Center for People with Disabilities, and Bon Départ School. The sample also included 266 typically developing adolescents (142 boys and 124 girls) from two mainstream schools: Frère Emmanuel Stablum College and Les Chérubins School Complex. These seven schools were selected because physical education or adapted physical activity (APA) was not included in their curricula. The flowchart below illustrates the participant recruitment process.

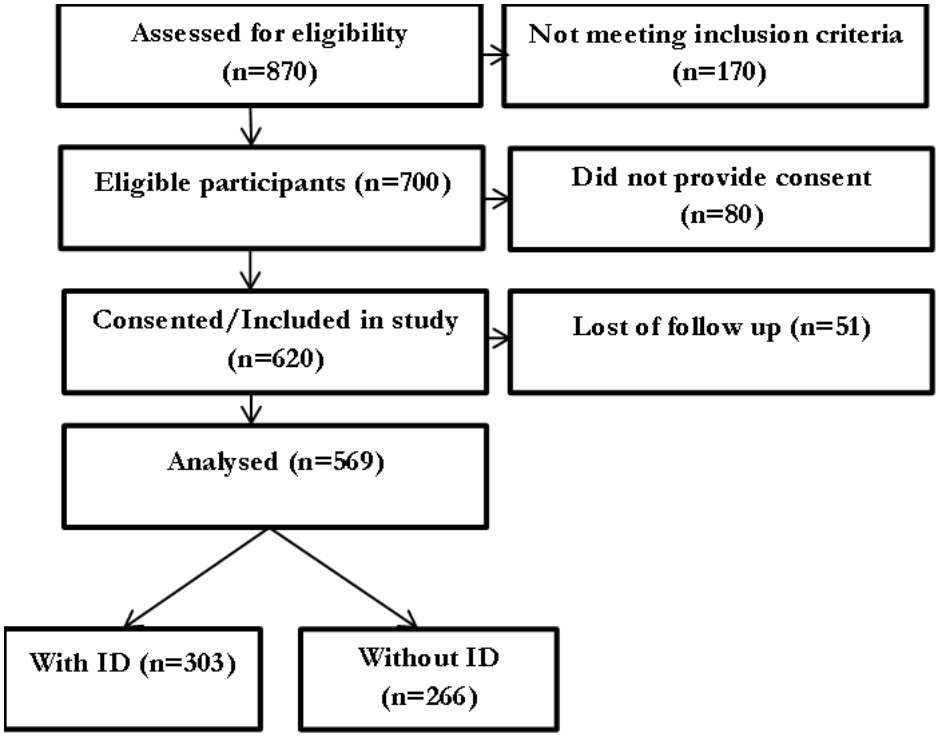

Figure 1. Flowchart

Study Design

This cross-sectional analytical study assessed the physical activity levels, sedentary behaviors, and physical fitness of school-aged adolescent boys and girls with and without intellectual disability (ID) over a three-month period from November 2022 to February 2023.

This study was conducted in Kinshasa, the capital city and province of the Democratic Republic of Congo (DRC). Located in western DRC, Kinshasa covers an area of 9,965 km², and its population is currently estimated at approximately 116,452,162 inhabitants (Worldometer, 2026).

Data Collection Techniques

A data collection form containing the variables of interest (grip strength, explosive strength, muscular endurance, and cardiorespiratory endurance) was developed for this study. Data collection took place from Monday to Friday between 8:30 a.m. and 11:00 a.m. on the premises of the selected establishments. The Children and Adolescents Physical Activity and Sedentary Questionnaire (CAPAS-Q 8–18) is a validated questionnaire used to assess PA levels and sedentary behavior (SB) in several contexts, including school, outside school, and transportation.

For the PA component, the questionnaire includes 14 items: questions 1 to 5 assess PA at school, while questions 6 to 14 assess PA outside school.

Regarding SB, the questionnaire includes 13 items: questions 19 to 21 assess SB at school, questions 22 to 29 assess SB outside school, and questions 30 to 31 assess SB during travel time.

For PA, regardless of the questionnaire section, adolescents with an average score of 1 to 2 were classified as needing improvement, those with a score of 2 to 3 as needing maintenance, and those with a score greater than or equal to 3 as having satisfactory PA or PA to maintain. For SB, adolescents with a score between 1 and 2 were classified as having satisfactory behavior, those with a score from 2 to 4 as having behavior that could be improved or maintained, and those with a score of 4 or above as having behavior that needs improvement (Fillon et al., 2022). It should be noted that the thresholds used to categorize PA and SB in the present study have not been validated in the DRC context. In addition, no reliability testing has been conducted locally.

Anthropometric assessments were performed in accordance with the recommendations of the International Society of Kinanthropometry (Marfell, 2006). All measurements were conducted by trained assessors under standardized conditions. Body mass was measured using a calibrated mechanical scale (Seca 760, Hamburg, Germany) with a precision of 0.1 kg. The scale was placed on

a flat, hard surface prior to measurement. Participants were weighed barefoot and wearing light clothing, standing upright at the center of the scale with feet together. Body mass was recorded to the nearest 0.1 kg.

Stature was measured using a portable stadiometer (Seca, Hamburg, Germany; measurement range 0–200 cm) with a precision of 0.1 cm. Participants stood barefoot in an upright position, with knees fully extended and heels together. The heels, buttocks, and upper back were in contact with the stadiometer, and the head was positioned in the Frankfort horizontal plane. The headboard was gently lowered to the vertex of the head, compressing the hair. Height was recorded to the nearest 0.1 cm. All measurements were taken twice, and the average value was used for analysis. In cases where the two measurements differed beyond acceptable limits, a third measurement was performed, and the median value was retained.

In total, four tests from the Eurofit battery were used: a muscle strength assessment test (grip strength), an explosive strength test (standing long jump), a trunk muscular endurance test (sit-ups), and the Léger et al. (1988) endurance run, which assesses cardiorespiratory endurance. These tests were selected because they assess health-related physical fitness. They were administered according to the guidelines described in the Eurofit battery administration manual (Council of Europe, 1993). Familiarization sessions were organized specifically for adolescents with intellectual disabilities prior to testing. The grip strength test was used to assess the static strength of the upper limbs. Strength was measured using a Takei 5401 dynamometer (Takei, Japan; 5–100 kg). Each adolescent stood upright with the back straight and feet slightly apart and held the dynamometer with the arm extended alongside the body without contact with the leg. The dynamometer was pressed against the palm, with the thumb on one side of the handle and the other fingers gripping the handle. Participants gripped the dynamometer firmly twice for approximately 5 seconds using their stronger hand. The better of the two results, expressed in kilogram-force, was recorded with an accuracy of 0.5 kg.

The long jump test was used to assess explosive strength. Each adolescent stood behind the starting line (0 cm) with feet shoulder-width apart, bent the knees, and used the arms to jump as far as possible. The test was performed twice, and the best result was recorded in centimeters. A tape measure was used to measure jump length. The seated trunk sit-up test was used to assess muscular endurance. Each adolescent sat on a mat with the torso upright, hands behind the neck, knees bent at 90 degrees, and feet flat on the mat. From this position, participants lay on their backs with shoulders in contact with the floor and then sat up, bringing the elbows forward to touch the knees. Their hands remained clasped behind the neck throughout the test. On command, participants repeated this movement as quickly as possible for 30 seconds and continued until the command "stop." The total number of correctly completed sit-ups in 30 seconds was recorded. This test was conducted only once. The Luc Léger shuttle test was used to assess cardiorespiratory endurance. Adolescents were asked to run back and forth over a distance of 20 meters marked by two lines, beyond which they placed their feet before turning around. Audible beeps dictated the running speed, which was initially slow but increased by 0.5 km/h every minute. Each participant continued the test as long as they maintained the required pace. The test ended when the participant stopped or could no longer synchronize crossing the end lines with two consecutive beeps. The last completed stage was used to determine VO_2max. This test was performed only once.

VO_2max (mL/kg/min) was calculated using the equation proposed by Léger et al. (1988), as follows: $VO_2max = 31.025 + (3.238 \times V) - (3.248 \times Age) + (0.1536 \times V \times Age)$, where V = speed of the last stage and speed (km/h) = 8.5 + (0.5 × number of stages).

Because fitness tests require a high degree of motivation (Tremblay et al., 2016), during the administration of all motor or physical tests, adolescents were encouraged by investigators and teachers.

Selection bias may be present in this study, as schools were chosen based on their willingness to host the study. Similarly, information bias should be considered, as no pilot study was conducted to establish the reliability of the questionnaire in the local context or of the anthropometric measurements.

Statistical analysis

The data were pre-coded, decoded, and entered into a Microsoft Excel 2013 workbook before being imported for statistical analysis using Jamovi software version 2.6.44. After verifying normality with the Shapiro-Wilk test, quantitative data were presented as means ± standard deviations in tables, while qualitative data were presented as percentages in figures. Comparisons between groups were performed using an independent samples t-test when homogeneity of variance, tested using Levene's test, was satisfied. When variances were

unequal, Welch's t-test was applied. Effect size was expressed using Cohen's d and was interpreted as negligible when <0.2, small between 0.2 and 0.5, moderate between 0.5 and 0.8, and large when >0.8, with 95% confidence intervals. The significance level was set at $p < .05$.

Results

Figure 2 shows that intellectual disability affected male adolescents more frequently than female adolescents.

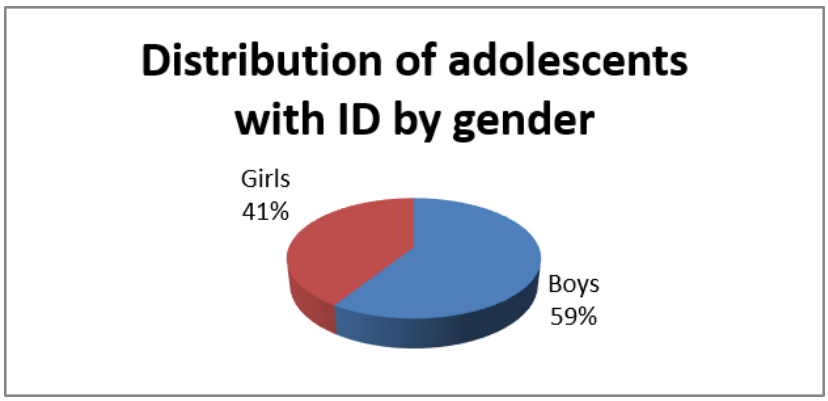

Figure 2. Distribution of adolescents with intellectual disabilities by gender

Table 1 shows that mean height did not differ between male adolescents with intellectual disability (ID) and those without ID ($p = .560$). The same was true for BMI ($p = .131$), whereas the difference in body weight was statistically significant ($p < .001$). Regarding motor tests, significant differences were observed between adolescents without ID and those with ID in grip strength ($p < .001$), explosive strength ($p < .001$), and cardiorespiratory endurance ($p < .001$), with moderate to very large effect sizes and narrow confidence intervals that did not include zero. In contrast, muscular endurance did not differ between the two groups ($p = .844$).

Table 1. Comparison of anthropometric and physical fitness variables between male adolescents with and without intellectual disability

Parameters	Boys with ID (n=180)	Boys without ID (n=142)	Test			
	Mean±SD	Mean±SD	Mean diff.	*P*	Cohen's d	95% CI for d
Age (year)	13.0±0.8	13.2±0.9	-0.2	0.061	0.20	[0.03,0.43]
Weight (kg)	36.31±2.7	34.4±2.6	1.9	<0.001	0.69	[0.46, 0.92]
Height (m)	1.5±0.0	1.51±0.0	0.1	0.560	-0.06	[-0.28,0.15]
BMI (kg/m ^{2})	21.1±2.5	21.6±2.4	-0.5	0.131	0.21	[-0.44,0.02]
Grip strength (kg)	20.7±3.5	23.8±3.5	-3.1	<0.001	-0.87	[-1.10,-0.64]
Explosive Force (cm)	98.1±3.1	102.8±8.4	-4.7	<0.001	-0.76	[-0.99,-0.53]
Muscular endurance (reps/30 s)	12.0±3.1	12.2±2.3	-0.2	0.844	0.02	[-0.19,0.24]
VO_2max (ml/kg/min)	24.2±2.1	29.3±0.5	-5.1	<0.001	-3.17	[-3.45,-2.89]

BMI: body mass index, ID: intellectual disability, SD: standard deviation, CI: confidence interval

Table 2 indicates that mean height differed significantly between female adolescents with and without intellectual disability (ID) ($p < .001$). A similar pattern was observed for body mass index (BMI) ($p = .017$), whereas no significant difference was found for body mass ($p = .878$). With regard to motor performance, significant differences were identified in explosive strength ($p < .001$), handgrip strength ($p < .001$), and cardiorespiratory endurance ($p < .001$). In contrast, no significant difference was observed in muscular endurance ($p = .737$).
Moreover, the large to very large effect sizes, together with relatively narrow confidence intervals, support the robustness and consistency of these findings.

Table 2. Comparison of anthropometric and physical fitness variables between female adolescents with and without intellectual disability

	Girls with ID (n=123)	Girls without ID (n=124)	Test			
Parameters	Mean±SD	Mean±SD	Mean diff.	*P*	Cohen's d	95% CI for d
Age (year)	13.4±1.0	13.5±1.0	-0.1	0.929	0.01	[-0.23,0.26]
Weight (kg)	37.9±3.0	38.1±4.9	-0.2	0.878	0.01	[-0.23,0.26]
Height (m)	1.5±0.05	1.6±0.05	-0.10	<0.001	-2.00	[-2.30,-1.70]
BMI (kg/m^2)	21.6±2.4	20.8±2.5	0.8	0.017	0.33	[0.08,0.58]
Grip strength (kg)	16.5±3.5	20.7±4.2	-4.2	<0.001	-1.09	[-1.36,-0.82]
Explosive Force (cm)	91.2±2.9	96.3±2.9	-5.1	<0.001	-1.72	[-2.02,-1.43]
Muscular endurance (reps/30 s)	13.4±2.1	13.5±1.8	-0.1	0.737	-0.04	[-0.29,0.20]
VO_2max (ml/kg/min)	22.2±0.5	25.1±1.3	-2.9	<0.001	-3.17	[-3.45,-2.89]

BMI: body mass index, ID: intellectual disability, SD: standard deviation, CI: confidence interval

Table 3 shows the comparison of physical activity levels (PAL) and sedentary behavior (SB) between boys with (n = 180) and without intellectual disability (ID) (n = 142). Boys with ID showed lower PAL at school (1.7 ± 0.6 vs. 2.5 ± 0.3) and outside school (1.4 ± 0.8 vs. 2.6 ± 0.3), and higher SB at school (3.8 ± 0.3 vs. 2.2 ± 1.1), outside school (4.7 ± 0.4 vs. 2.3 ± 0.6), and during transportation (4.1 ± 0.2 vs. 2.1 ± 1.5). All differences were significant ($p < .05$), with the largest effect observed during transportation.

Table 3. Comparison of physical activity level and sedentary behavior between male adolescents with and without intellectual disability

	Boys with ID (n=180)	Boys without ID (n=142)	Test			
Parameters	Mean±SD	Mean±SD	Mean diff.	*P*	Cohen's d	95% CI for d
PAL at school	1.7±0.6	2.5±0.3	-0.8	<0.001	-1.63	[-1.88,-1.38]
PAL outside of school	1.4±0.8	2.6±0.3	-1.2	<0.001	-1.95	[-2.21,-1.69]
SB at school	3.8±0.3	2.2±1.1	1.6	<0.001	+2.00	[1.74,2.26]
SB outside of school	4.7±0.4	2.3±0.6	2.4	<0.001	4.74	[-4.25,5.12]
SB during transportation	4.1±0.2	2.1±1.5	2.0	<0.001	1.86	[1.61,2.11]

PAL: physical activity level, SB: sedentary behavior, ID: intellectual disability, SD: standard deviation, CI: confidence interval

Table 4 shows the comparison of physical activity levels (PAL) and sedentary behavior (SB) between girls with (n = 123) and without intellectual disability (ID) (n = 124). Girls with ID presented lower PAL at school (1.1 ± 0.1 vs. 2.2 ± 0.4) and outside school (1.0 ± 0.0 vs. 2.0 ± 0.4), and higher SB at school (4.3 ± 0.3 vs. 2.8 ± 1.0), outside school (5.1 ± 0.2 vs. 2.7 ± 0.9), and during transportation (4.1 ± 0.2 vs. 2.3 ± 1.1). All differences were statistically significant ($p < .001$).

Table 4. Comparison of physical activity level and sedentary behavior between female adolescents with intellectual disability

	Girls with ID (n=123)	Girls without ID (n=124)	Test			
Parameters	Mean±SD	Mean±SD	Mean diff.	*P*	Cohen's d	95% CI for d
PAL at school	1.1±0.1	2.2±0.4	-1.1	<0.001	-3.79	[-4.15,-3.43]
PAL out of school	1.0±0.0	2.0±0.4	-1	<0.001	-3.57	[-4.15,-3.00]
SB at school	4.3±0.3	2.8±1.0	1.5	<0.001	2.10	[1.85,2.35]
SB bout of school	5.1±0.2	2.7±0.9	2.4	<0.001	3.75	[3.40,4.10]
SB during transportation	4.1±0.2	2.3±1.1	1.8	<0.001	2.31	[2.15,2.47]

PAL: physical activity level, SB: sedentary behavior, ID: intellectual disability, SD: standard deviation, CI: confidence interval

Discussion

This analytical cross-sectional study included 569 adolescents, comprising 303 individuals with intellectual disability (ID) enrolled in special schools and 266 without ID attending mainstream schools. Data were collected over a three-month period (November 2022–February 2023). The study aimed to compare physical fitness (PF), physical activity levels (PAL), and sedentary behavior (SB) according to sex and the presence or absence of ID.

No significant difference was observed in mean age between adolescents with and without ID, with a negligible effect size. This finding indicates appropriate comparability between groups and suggests that age-related developmental factors are unlikely to have influenced the observed differences in PF, PAL, and SB. Given that age is a well-established determinant of PF and physical activity (PA) participation during adolescence (Diz et al., 2024), this homogeneity strengthens the internal validity of the study.

In terms of sex distribution, a higher proportion of males was observed among adolescents with ID, with a sex ratio of 1.49. This finding is consistent with previous studies conducted in different contexts, including Benin (Napporn & Agbachi, 2016), France (David et al., 2014), and Finland (Westerinen et al., 2013), all of which reported a predominance of males in populations with ID. This imbalance may be explained, at least in part, by genetic factors, particularly X-linked abnormalities associated with intellectual disability (Westerinen et al., 2013).

Regarding anthropometric parameters, our results indicate a significantly higher body weight among boys with ID, while no significant difference in height was observed between boys with and without ID. In contrast, among girls, age and body weight were similar between those with and without ID, whereas girls with ID exhibited significantly shorter stature. These findings suggest that the observed differences in physical performance cannot be attributed solely to anthropometric characteristics, but rather reflect broader disparities related to motor development and engagement in adapted physical activity (APA). From this perspective, the anthropometric differences observed may further reinforce physical and psychosocial barriers to participation in adapted physical activity.

Regarding neuromuscular abilities, this study demonstrates deficits in lower-limb explosive strength and handgrip strength in both girls and boys with ID, with markedly greater impairments observed in girls, as indicated by very large effect sizes. Muscle strength is a critical determinant of functional independence and participation in PA during adolescence (Mareno et al., 2025). Reduced strength may limit engagement in daily and structured PA, with negative implications for adaptive behavior and psychosocial well-being. These limitations may be particularly pronounced in girls with ID, who often face fewer opportunities to engage in APA. In contrast, the absence of sex differences in muscular endurance suggests that certain components of PF are relatively preserved and may serve as a foundation for long-term PA interventions (Yang et al., 2022).

Cardiorespiratory fitness was also significantly lower in adolescents with ID, with a more pronounced reduction in girls. Given that cardiorespiratory fitness is a key indicator of health and quality of life in youth (Ortega et al., 2008), these findings are clinically relevant. Reduced VO_2max has been associated with early fatigue, limited exercise tolerance, and reduced participation in moderate-to-vigorous PA, contributing to sedentary behavior (Vanhelst et al., 2024; Xueting & Wang, 2022). Consistent with previous research, adolescents with ID exhibited lower cardiorespiratory fitness than their peers without ID (Burhaein & Rozak, 2024).

Finally, adolescents with ID demonstrated lower PA levels and higher SB than those without ID, both at school and outside school. Girls with ID showed the lowest activity levels, reflecting a compounded disadvantage related to gender and disability, while boys with ID exhibited particularly high SB. These patterns align with recent literature and likely reflect multiple barriers, including limited inclusion opportunities, inadequate adapted programs, and dependence on caregivers, which may restrict participation and functional autonomy (Sit et al., 2022; Brian et al., 2023; Shields & Synnot, 2016). This study has several limitations, notably its cross-sectional nature, which does not allow for establishing cause-and-effect relationships between PA, fitness level, and SB. Its convenience sample does not allow for generalization of the findings to the entire population, and the data were obtained using instruments whose reliability has not been demonstrated in the local context. Similarly, the lack of control for potential confounding factors, such as nutritional status and body composition, represents an additional limitation.

Conclusion

Adolescents with ID had reduced levels of PA, high levels of SB, and lower levels of PF compared with their peers without ID. The very large effect sizes found in this study suggest potentially meaningful

differences and justify urgent interventions aimed at promoting APA and reducing SB among adolescents with ID. Further research is needed to better understand the PF of adolescents with ID, and the integration of APA programs is therefore essential.

Declaration of interests: The authors report there are no competing interests to declare.

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