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RESEARCH ARTICLE

Effectiveness of a Structured Recreational Physical Activity Program on Static and Dynamic Body Balance in Children with Mild Intellectual Disability (Aged 8–10 Years): An Experimental Intervention Study

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Abstract

Children with mild intellectual disability often exhibit marked deficits in motor coordination and postural control, which significantly limit their functional independence and participation in daily activities. Among these deficits, impaired body balance—both static and dynamic—represents a critical barrier to motor efficiency and social integration. Recreational physical activity has increasingly been recognized as an effective, inclusive, and developmentally appropriate intervention to enhance motor performance and psychological well-being in children with special needs. The present study aimed to examine the effectiveness of a proposed structured recreational physical activity program in improving static and dynamic body balance among children with mild intellectual disability aged 8 to 10 years. An experimental one-group pretest–posttest design was adopted. The study sample consisted of eight children purposively selected from the Psycho-Pedagogical Center for Persons with Disabilities in Biskra, Algeria. Standardized tests assessing static and dynamic balance were administered before and after the implementation of the intervention program. The recreational physical program was specifically designed to accommodate the cognitive, perceptual, and motor characteristics of children with mild intellectual disability, emphasizing playful movement, balance challenges, and progressive motor tasks. Statistical analysis of the collected data revealed statistically significant improvements between pre- and post-test measurements in dynamic balance, static balance, and overall body balance, with all results favoring the post-test assessment. These findings demonstrate that a carefully structured recreational physical activity program can serve as an effective rehabilitative and educational tool for enhancing postural control in children with mild intellectual disability. The study highlights the importance of integrating recreational-based motor interventions within specialized educational and therapeutic settings to promote functional independence, motor competence, and quality of life for this population.

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Introduction and Problem Statement. Advanced nations have long prioritized the development of educational curricula and specialized programs, particularly in the domain of recreational physical activity. Recreational physical activity is widely recognized as a vital component of leisure, promoting physical fitness and overall well-being across all age groups, and is increasingly embraced as a sustainable lifestyle choice. Research consistently underscores its positive influence on psychological and cognitive health, highlighting the strong association between regular physical engagement and mental resilience (HanānMakhyūn, 2003).

Makhyūn (2003) further emphasizes that scholars across disciplines concur on the critical importance of recreational activities—not only for the general population but especially for individuals with disabilities. Providing such opportunities is both a social and humanitarian imperative, aimed at enhancing residual capacities, fostering adaptive functioning, and enabling meaningful participation in society.

Children with intellectual disability represent a particularly vulnerable yet valuable segment of society. They possess emotions, aspirations, and the potential to contribute meaningfully to their communities. Their right to enjoy life, well-being, and equitable opportunities is not a matter of charity but of ethical and societal responsibility (Samīr, 2006, p. 9). Ensuring their access to holistic care—spanning health, psychological support, education, and guidance—is essential for identity formation and human dignity within the limits of their cognitive capabilities.

Despite exhibiting relatively advanced motor development compared to other developmental domains, children with intellectual disability often demonstrate reduced motor proficiency relative to their typically developing peers—particularly in reaction time, fine motor skills, and postural balance (ʿUbayd, 1999, p. 67). This observation is corroborated by Ibrāhīm (1996), who notes that such children frequently lack fundamental motor skills, which may contribute to emotional and behavioral challenges. Similarly, Al-Rousan (2010) affirms that motor developmental delays—including difficulties with walking, balance, and coordination—are characteristic features of intellectual disability (Al-Rousan, 2010, p. 77).

Given the pronounced functional limitations associated with intellectual disability, sustained training and tailored intervention programs are essential to support rehabilitation and social integration. Through professional experience working directly with this population, the researcher observed marked deficits in body balance compared to typically developing peers of the same age. These deficits appear closely linked to underlying cognitive and perceptual impairments that adversely affect motor coordination and postural control. Consequently, there is a pressing need for scientifically grounded, adaptive recreational programs that empower these children to engage more naturally in daily activities.

This context gives rise to the central research question: **Does the proposed recreational physical program have a significant effect on body balance development among children with mild intellectual disability aged 8–1 0 years?**

Sub-Questions:

1. Are there statistically significant differences between pre- and post-test scores in dynamic balance for the experimental group?
2. Are there statistically significant differences between pre- and post-test scores in static balance for the experimental group?

Hypotheses

General Hypothesis: The proposed recreational physical program is effective in enhancing body balance among children with mild intellectual disability (aged 8–10).

SpecificHypotheses:

- There are statistically significant differences between pre- and post-test scores in dynamic balance, favoring the post-test.
- There are statistically significant differences between pre- and post-test scores in static balance, favoring the post-test.

Research Objectives. The study aims to:

- Examine the impact of the proposed recreational physical program on dynamic balance in children with mild intellectual disability.
- Assess the program's effect on static balance in the same population.

- Evaluate the overall effectiveness of the program in improving body balance as a composite construct.

Terminological Clarifications

1. **Recreational Physical Program.** According to TahānīʿAbd al-Salām (2001), a recreational physical program comprises a set of structured leisure and physical activities supervised by a qualified recreation specialist, designed to foster optimal behavior during free time through the development of knowledge, skills, and positive attitudes (ʿAbd al-SalāmMuḥammad, 2008, p. 233). Salāmah and Al-Baṣrāwī (2013) further define it as a scientifically designed set of activities tailored to participants' physical, cognitive, psychological, social, and health profiles to achieve defined recreational objectives (Salāmah& Al-Baṣrāwī, 2013, p. 53).
2. **Body Balance.** Balance is defined as "the ability to maintain the body or its segments in a specific position through the coordinated activity of multiple physiological systems working against external forces" (Al-Sayyid, 1991, p. 23). Al-SayyidʿAbd al-Maqṣūd further describes it as a specialized coordinative capacity that enables efficient and rapid execution of motor tasks while balancing on a very small support surface.
    - **Static balance**: The ability to maintain equilibrium while stationary, with the center of gravity kept within the base of support.
    - **Dynamic balance**: The ability to maintain postural control during movement, such as walking on a balance beam (ʿAlī, 1999, p. 151).
3. **Mild Intellectual Disability.** Mild intellectual disability is characterized by intellectual functioning approximately two standard deviations below the population mean, accompanied by significant limitations in adaptive behavior. These deficits manifest during the developmental period, from birth to age 18 (Al-Rousan, 2010, p. 23).

RelatedLiterature

1. **Ahmad Bouskara (2002).** *Title:* Recreational Physical Activity among Children with Mild Intellectual Disability in Psycho-Educational Centers: A Field Study on Children Aged 9–12
This study examined the role of recreational physical activity in the lives of children with mild intellectual disability. Findings indicated that team sports were the most preferred leisure activities. Using a mixed-methods (experimental and descriptive) design with a sample of 40 children, caregivers, and teachers, the study revealed that care centers rely primarily on non-specialist educators and lack scientifically structured programs or certified specialists in therapeutic recreation.
2. **MarinezAmna (2012).** *Title:* The Impact of a Proposed Recreational Program on the Development of Fundamental Motor Skills in Educable Children with Intellectual Disability
Employing an experimental design with 16 participants, this study demonstrated statistically significant improvements in fundamental motor skills (locomotor, non-locomotor, and object-manipulation skills) in the experimental group, confirming the positive effect of structured recreational interventions on motor development.
3. **AwsSaʿdḤusayn (2020).** *Title:* The Effect of a Recreational Physical Program on Sensorimotor Perception in Educable Children with Intellectual Disability Aged 6–9 Years
This experimental study involved 14 children with IQ scores between 50 and 70. Results showed statistically significant gains in sensorimotor perception from pre- to post-test, indicating that the proposed recreational physical program effectively enhanced sensorimotor integration in this population.

Practical Aspect of the Study

1. Pilot Study

A pilot (or exploratory) study is conducted by researchers to gain preliminary insights into a phenomenon, refine the research problem, or formulate hypotheses (Sulaym al-Basūnī, 2013, p. 112). It constitutes the initial phase of any experimental investigation. Accordingly, the researcher carried out a pilot study at the Psycho-Pedagogical Center for Children with Intellectual Disability in Biskra Province.

Pilot Study Procedures. The pilot phase was implemented between **September and November 2024**, during which the researcher:

- Selected the Psycho-Pedagogical Center for Persons with Intellectual Disability in Biskra.
- Met with the center's director to present the research objectives, who subsequently facilitated access to the pedagogical and psychological staff for consultation.
- Attended supervised sessions with educators and specialists to better understand the target population and refine sampling criteria.
- Identified a tentative sample of **eight children (both male and female)**.
- Ultimately selected **five children** as the pilot sample for preliminary testing.

Pilot Sample. The pilot sample comprised **five children** diagnosed with mild intellectual disability, enrolled at the Psycho-Pedagogical Center in Biskra. Their IQ scores ranged between **50 and 75**, as assessed using the **Columbia Mental Maturity Scale**, the standard diagnostic tool employed by the center's psychological team.

Pilot Study Instruments. The researcher relied on **physical balance tests**—specifically for static and dynamic balance—as the primary instruments, which later formed the core assessment tools of the main study.

Pilot Study Outcomes. The pilot phase yielded valuable insights that significantly enhanced the design and execution of the main study:

- Finalized the characterist [illegible] sample.
- Refined and validated the research instrument to ensure accuracy and relevance.
- Carefully selected recreational physical activities aligned with both the balance assessment dimensions and the participants' developmental needs.
- Designed the recreational physical program in accordance with participants' chronological and mental ages, e[illegible]priate[illegible]

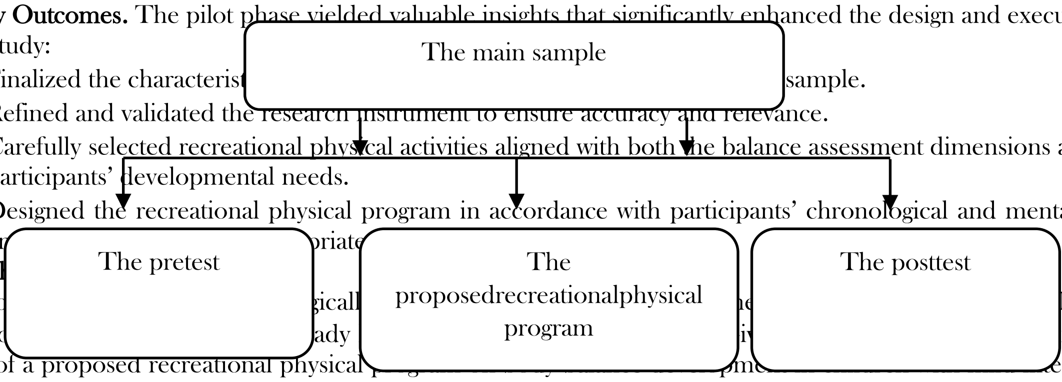

Figure 4 illustrates the experimental design adopted in the study.

2. Researc[illegible]

Methodolo[illegible]icall[illegible]known, or to dem[illegible]ady[illegible]xamine the effect of a proposed recreational physical [illegible]ellectual disability—the researche[illegible]

Specifically, a **single-gr**[illegible]measurements were conducted on the same[illegible]

- **Pretest:** Admi[illegible]
- **Posttest:** Administered after completing the program.

3. Study Population and Sample

The target population consisted of **56 children** with mild intellectual disability at the center. The main experimental sample comprised **8 children**, selected via **purposive sampling** based on the following criteria:

- Diagnosis of **mild intellectual disability** (IQ 50–75).
- Absence of additional physical, sensory, or neurological impairments that could interfere with program participation.
- No prior exposure to structured physical or recreational interventions at the center.
- No engagement in any organized physical activity inside or outside the center.
- No concurrent behavioral, psychological, or counseling interventions during the study period.

A diagram illustrating the experimental design adopted in the study.

Table 2 presents the demographic profile of the main sample:

Participant No.	Gender	Chronological Age (years)
01	Male	8
02	Male	8
03	Male	10
04	Male	9
05	Female	10
06	Female	10
07	Female	9
08	Female	10
Total	**8**	

Source:Prepared by the researcher

4. Study Variables

- **Independent variable**: The proposed recreational physical program.
- **Dependent variable**: Body balance, operationalized through two sub-dimensions:
  - Static balance
  - Dynamic balance

5. Study Scope

- **Human scope**: 8 children with mild intellectual disability, aged **8–10 years**.
- **Temporal scope**: The intervention was implemented from **October 1, 2024, to December 14, 2024**, encompassing the pretest, program delivery, and posttest phases.
- **Spatial scope**: All sessions were conducted in the **sports hall** of the Psycho-Pedagogical Center in Biskra.

6. Research Instruments

Instrument 1: Dynamic Balance Test – Beam Walking. *Purpose*: To assess balance during movement. *Materials*: A balance beam (4 m long, 10 cm wide, 3–5 cm thick), flat surface, stopwatch. *Procedure*: Upon a verbal signal, the participant walks the full length of the beam, turns around, and returns to the starting point as quickly as possible without stepping off the beam. *Scoring*: Time is recorded to the nearest 0.1 second. Each time any body part touches the floor outside the beam, **1 second is added** to the total time.

Instrument 2: Static Balance Test – Heel-to-Toe Stand. *Purpose*: To evaluate static postural control. *Materials*: Stopwatch. *Procedure*: The participant stands on one foot (preferred take-off leg), places the free foot against the inner knee of the supporting leg, and holds both arms at waist level. Upon signal, they raise the heel of the supporting foot and maintain balance for as long as possible without moving the foot or lowering the heel. *Scoring*: The best of **three trials**is recorded, measured from heel lift until loss of balance or foot movement.

7. Psychometric Properties of the Instruments

To verify reliability and validity, the tests were administered twice to the **pilot sample (n = 5)** under identical conditions, with a one-week interval.

Table 2: Psychometric Properties of Balance Tests

Test	Mean (1st)	SD (1st)	Mean (2nd)	SD (2nd)	Reliability (ICC)	Validity (Pearson *r*)
Dynamic Balance	12.00	1.37	9.16	0.75	0.724	0.675
Static Balance	5.00	1.04	9.83	1.94	0.823	0.835

Source:Prepared by the researcher

Results indicate **high reliability** (ICC = 0.72 for dynamic; 0.82 for static) and **strong validity** (Pearson r = 0.67 and 0.83, respectively), confirming the instruments' suitability for assessing body balance in this population.

8. The Proposed Recreational Physical Program

The program was developed based on:

- A comprehensive review of Arabic and international literature on recreational physical activity and motor development in children with intellectual disability.
- Analysis of prior studies focusing on motor interventions for this population.
- Consultation of specialized online resources offering evidence-based activities for motor rehabilitation.

Content Validity. The program was reviewed by a panel of **three experts** in adapted physical activity, recreational sports, and motor training. They evaluated the proposed activities, session duration, weekly frequency, safety protocols, and alignment with program objectives. While all experts affirmed the program's relevance, minor modifications were suggested to enhance safety and developmental appropriateness—recommendations that were incorporated by the researcher.

Program Specifications

- **Duration**: 8 weeks
- **Frequency**: 3 sessions per week
- **Session length**: 90 minutes
  - Warm-up: 10 minutes
  - Main activity: 70 minutes
  - Cool-down: 10 minutes

Implementation Phases

1. **Pretest Phase**: Baseline balance assessments were conducted.
2. **Intervention Phase**: The program was delivered from **October to December 2024**. Prior to implementation, the researcher built rapport with participants to foster trust and cooperation.
3. **Posttest Phase**: Balance tests were re-administered upon program completion.

MaterialsUsed

- Sports hall at the Psycho-Pedagogical Center
- Equipment: Bowling pins, LEGO sets,Radt's games, colored medicine balls, mini trampoline, small soft balls, and other adapted recreational tools.

9. Statistical Analysis

Data were analyzed using **SPSS (Statistical Package for the Social Sciences, version 26)**. The followingstatisticalprocedureswereapplied:

- Descriptive statistics (mean, standard deviation)
- **Shapiro-Wilk test** for normality
- **Paired-samples *t*-test** to compare pretest and posttest scores
- **Pearson correlation coefficient** to assess instrument validity

Presentation and Interpretation of Results

1. Testing the First Sub-Hypothesis

There are statistically significant differences between the pretest and posttest scores of the single experimental group in dynamic balance, favoring the posttest.

To test this hypothesis, a **paired-samples *t*-test**was conducted. The results are presented in **Table 4**.

Table 4. Pretest–Posttest Comparison of Dynamic Balance Scores (n = 8)

Measure	n	Mean	SD	Shapiro-Wilk$p$	t	p (Sig.)
Pretest	8	12.50	1.41	0.191	10.42	0.000
Posttest	8	9.12	0.83	0.212		

*Note.*Significantat α = 0.05.

The results show that the **pretest mean (M = 12.50, SD = 1.41)** was significantly higher than the **posttest mean (M = 9.12, SD = 0.83)**, indicating improved performance (lower time = better balance). The Shapiro-Wilk test confirmed normality for both pretest (p = 0.191) and posttest (p = 0.212) scores (p> 0.05). The paired t-test revealed a **highly significant difference** (t = 10.42, p = 0.000 < 0.05), supporting the hypothesis. The improvement in dynamic balance is attributed to the implementation of the **proposed recreational physical program.2. Testing the Second Sub-Hypothesis**

There are statistically significant differences between the pretest and posttest scores of the single experimental group in static balance, favoring the posttest.

Table 4. Pretest–Posttest Comparison of Static Balance Scores (n = 8)

Measure	n	Mean	SD	Shapiro-Wilk$p$	t	p (Sig.)

Pretest	8	5.50	0.92	0.820	-9.466	0.000
Posttest	8	9.50	1.77	0.452		

*Note.*Significantat $\alpha = 0.05$.

For static balance, a **higher mean score indicates better performance** (longer balance duration). The **posttest mean (M = 9.50, SD = 1.77)** was markedly higher than the **pretest means (M = 5.50, SD = 0.92)**. Normality was confirmed (pretest $p = 0.820$; posttest $p = 0.452$). The paired *t*-test yielded a **statistically significant improvement** ($t = -9.466$, $p = 0.000 < 0.05$), confirming the hypothesis. This enhancement is directly linked to the structured activities in the **proposed recreational physical program**.

Discussion of Findings

Dynamic Balance

The significant improvement in dynamic balance supports the effectiveness of the proposed recreational physical program. The reduction in beam-walking time reflects enhanced postural control during movement—a critical skill for daily functioning. This finding aligns with prior research emphasizing the therapeutic role of structured physical play in motor development among children with intellectual disability.

For instance, **Bouskara (2002)** found significant differences in sensorimotor development between children who participated in recreational activities and those who did not, favoring the active group. Similarly, **AwsSa'dḤusayn (2020)** demonstrated that a recreational physical program significantly improved sensorimotor perception in educable children with intellectual disability. These studies collectively affirm that **recreational physical activity serves as a therapeutic modality** that enhances cognitive-motor integration, thereby supporting adaptation in school and family settings.

Theoretical frameworks further substantiate these outcomes. **Piaget's theory of cognitive development** posits that play is the primary medium through which children develop cognitive, moral, and value-based reasoning. Play, in this view, is intrinsically linked to the maturation of intelligence. Additionally, **Cart's theory of physical development** suggests that play stimulates neural maturation: through coordinated movements, cerebral centers are activated, promoting the myelination of nerve fibers. This biological process enhances neural transmission, thereby improving both motor control and cognitive functioning. Thus, the observed gains in balance likely stem from neurophysiological adaptations facilitated by the program's playful, movement-rich activities.

Static Balance

The significant increase in static balance duration further validates the program's efficacy. The ability to maintain a stable upright posture is foundational for executing complex motor tasks. The improvement observed here resonates with **MarinezAmna (2012)**, who reported significant gains in fundamental motor skills—including non-locomotor skills like balance—following a recreational intervention. Her findings confirm that structured, adapted recreational activities can effectively refine both locomotor and stability-related motor competencies.

Again, Piaget and Cart's theories provide a robust explanatory lens: the program's playful structure not only reduced anxiety and emotional tension but also created an optimal context for neuro-motor learning. By embedding balance challenges within enjoyable games, children engaged voluntarily and persistently, fostering neural and muscular adaptations that translated into measurable performance gains.

Collectively, these results confirm that **recreational physical programs are not merely supplementary but essential components** of holistic intervention strategies for children with mild intellectual disability.

General Conclusion

In light of the findings, the study successfully addressed all research questions and hypotheses:

- Statistically significant improvements were observed in dynamic balance (pretest vs. posttest, $p = 0.000$).
- Statistically significant improvements were observed in static balance (pretest vs. posttest, $p = 0.000$).
- The proposed recreational physical program demonstrated significant efficacy in enhancing overall body balance among children with mild intellectual disability aged 8–10.

These outcomes underscore the program's potential as a practical, low-cost, and highly effective intervention for motor development in this population.

Recommendations and Future Research Directions

Based on the study's findings, the researcher proposes the following recommendations:

PracticalRecommendations

- Develop tailored recreational physical programs aligned with the severity of intellectual disability and individual cognitive profiles, given their effectiveness in reducing psychological stress and enhancing motor competence.
- Equip psycho-pedagogical centers with adequate sports facilities, adapted equipment, and pedagogical resources to support diverse recreational activities.
- Promote social inclusion by fostering societal acceptance, emotional support, and active participation of children with intellectual disability in community life.
- Design activities using a play-based pedagogical approach, as learning is most effective for this population when embedded in enjoyable, game-like contexts.

- Customize activities to address daily-life challenges faced by each child, thereby fostering self-confidence, optimism, and positive self-concept.
- Involve specialists in adapted physical activity and recreational therapy in program design to ensure scientific rigor and developmental appropriateness.

Suggestions for Future Research

- Replicate this study with other disability groups, including children with moderate/severe intellectual disability or autism spectrum disorder.
- Investigate the impact of similar programs on other motor impairments (e.g., coordination, gait, reaction time) not addressed in this study.
- Develop and evaluate therapeutic motor programs specifically targeting movement disorders in children with intellectual disability.
- Design recreational interventions aimed at reducing behavioral, emotional, and neurological disturbances associated with varying degrees of intellectual disability.
- Systematically explore the use of structured play and quasi-sports gamesas therapeutic tools in both individual and team-based settings for individuals with special needs.

Ethical Considerations

This study was conducted in accordance with internationally recognized ethical standards for research involving human participants. Ethical approval was obtained from the relevant institutional authorities prior to data collection. Written informed consent was secured from the parents or legal guardians of all participating children, and verbal assent was obtained from the children themselves. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any stage without any consequences. Confidentiality and anonymity of all participants were strictly maintained, and all data were used exclusively for scientific research purposes. The intervention posed no physical or psychological risk and was implemented under professional supervision, respecting the dignity, safety, and well-being of the children throughout the study.

Author Contributions

- **Dr. Sabah Bouras**: Conceptualization, study design, development of the recreational physical program, data collection, and supervision of the intervention.
- **Dr. Imane Bensaada**: Methodology, statistical analysis, interpretation of results, and drafting of the manuscript.
- **Dr. Zineb Ben Messaoud**: Literature review, critical revision of the manuscript, and contribution to discussion and conclusion sections.

All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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