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Original article

Recreational sports strategy for the inclusion of students with Down syndrome

[*Estrategia deportiva recreativa para la inclusión de estudiantes con síndrome de Down*]

[*Estratégia esportiva recreativa para inclusão de alunos com síndrome de Down*]

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Abstract

Introduction: People with Down syndrome face multiple barriers to participating in sports and recreational activities, affecting their physical, social and emotional development. These barriers include discriminatory attitudes, lack of adequate infrastructure and shortage of trained personnel. Down syndrome, caused by a triplication of chromosome 21, involves various physical alterations and a delay in mental development.

Objective: The general objective was to determine sports and recreational activities that stimulate the development of motor, cognitive and social skills necessary for learning in children with Down syndrome.

Materials and methods: A mixed approach was adopted, integrating different data collection and analysis techniques, where the research questions were addressed from multiple angles and a more holistic understanding of the topic under study was obtained

Results: Recreational sports strategies seek to encourage active participation and promote the physical, emotional and social well-being of these students. Sports practice offers benefits such as improvements in cardiovascular health, motor coordination and social skills. For effective inclusion, it is necessary to design and implement strategies adapted to individual needs, promoting an inclusive environment.

Conclusions: the implementation of sports strategies has shown significant improvements in the motor, cognitive and social skills of students with Down syndrome. Schools and Physical Education programs should consider the inclusion of adaptive strategies to encourage the participation and comprehensive development of all students.

Keywords: Down Syndrome, Inclusion, Activity, Physical Education.

Resumen

Introducción: las personas con síndrome de Down enfrentan múltiples barreras para participar en actividades deportivas y recreativas, afectando su desarrollo físico, social y emocional. Estas barreras incluyen actitudes discriminatorias, falta de infraestructura adecuada y escasez de personal capacitado. El síndrome de Down, causado por una triplicación del cromosoma 21, implica diversas alteraciones físicas y un retraso en el desarrollo mental.

Objetivo: se planteó como objetivo general determinar actividades deportivas, recreativas que estimulen el desarrollo de habilidades motoras, cognitivas y sociales necesarias para el aprendizaje en niños con Síndrome de Down.

Materiales y métodos: se adoptó un enfoque mixto, integrando diferentes técnicas de recolección y análisis de datos, donde se abordó las preguntas de investigación desde múltiples ángulos y se obtuvo una comprensión más holística del tema en estudio

Resultados: las estrategias deportivas recreativas buscan fomentar la participación activa y promover el bienestar físico, emocional y social de estos estudiantes. La práctica deportiva ofrece beneficios como mejoras en la salud cardiovascular, coordinación motora y habilidades sociales. Para una inclusión efectiva, es necesario diseñar y aplicar estrategias adaptadas a las necesidades individuales, promoviendo un ambiente inclusivo.

Conclusiones: la implementación de estrategias deportivas ha mostrado mejoras significativas en las habilidades motoras, cognitivas y sociales de los estudiantes con síndrome de Down. Las escuelas y programas de Educación Física deben considerar la inclusión de estrategias adaptativas para fomentar la participación y el desarrollo integral de todos los estudiantes.

Palabras clave: síndrome de Down, inclusión, actividad, Educación Física.

Resumo

Introdução: Pessoas com síndrome de Down enfrentam múltiplas barreiras para participar de atividades esportivas e recreativas, afetando seu desenvolvimento físico, social e emocional. Essas barreiras incluem atitudes discriminatórias, falta de infraestrutura adequada e escassez de pessoal treinado. A síndrome de Down, causada pela triplicação do cromossomo 21, envolve diversas alterações físicas e um atraso no desenvolvimento mental.

Objetivo: O objetivo geral foi determinar atividades esportivas e recreativas que estimulem o desenvolvimento de habilidades motoras, cognitivas e sociais necessárias à aprendizagem em crianças com Síndrome de Down.

Materiais e métodos: Foi adotada uma abordagem mista, integrando diferentes técnicas de coleta e análise de dados, onde as questões de pesquisa foram abordadas de múltiplos ângulos e uma compreensão mais holística do tópico em estudo foi obtida.

Resultados: As estratégias esportivas recreativas buscam incentivar a participação ativa e promover o bem-estar físico, emocional e social desses alunos. A prática esportiva traz benefícios como melhora da saúde cardiovascular, coordenação motora e habilidades sociais. Para uma inclusão efetiva, é necessário elaborar e implementar estratégias adaptadas às necessidades individuais, promovendo um ambiente inclusivo.

Conclusões: A implementação de estratégias esportivas demonstrou melhorias significativas nas habilidades motoras, cognitivas e sociais de alunos com síndrome de Down. Escolas e programas de educação física devem considerar incluir estratégias adaptativas para incentivar a participação e o desenvolvimento abrangente de todos os alunos.

Palavras-chave: síndrome de Down, inclusão, atividade, Educação Física.

Introduction

People with Down syndrome (DS) face various barriers to participating in sports and recreational activities, which limit their physical, social, and emotional development. Discriminatory attitudes, lack of adequate infrastructure, and a shortage of trained personnel are some of the obstacles that hinder their inclusion in these spaces. Down syndrome is a genetic disorder caused by a chromosomal alteration involving the triplication of chromosome 21. This condition causes various physical alterations and delayed mental development. It is not a disease, but rather a set of signs and symptoms. Those who suffer from this disease present difficulties in creating and establishing mental images, difficulties in establishing relationships, difficulties in generalizing learning, difficulties with abstraction, language difficulties, and psychomotor difficulties (Chiva Bartoll) . *et al,* 2015)

Recreational sports strategies for the inclusion of these students not only seek to encourage their active participation in sports but also promote their physical, emotional, and social well-being. (Fonseca *et al.,* 2018) Participating in sports offers numerous benefits for individuals with Down syndrome, including improvements in

cardiovascular health, motor coordination, self-esteem, and social skills. However, to ensure effective inclusion, it is necessary to design and implement specific strategies that adapt to the individual needs of each student and promote an inclusive and respectful environment (Bravo *et al.,* 2017).

In many countries, Gutiérrez believes, (2017)the need to develop effective strategies to ensure that people with Down syndrome have equitable access to recreational and sports opportunities, in line with the principles of equality and diversity, has been recognized. In recent years, various initiatives have been implemented around the world to promote the inclusion of people with Down syndrome in sports. Countries such as the United States, Canada, Australia, the United Kingdom, and several European countries have led efforts to develop adaptive sports programs that provide inclusive opportunities for people with intellectual disabilities, including Down syndrome.

According to Ortega and Sánchez (2022), these initiatives focus on creating accessible and friendly sports environments, as well as training coaches and staff to adapt sports activities to the individual needs of participants with Down syndrome. Active participation and the development of sports skills are promoted, while fostering an environment of acceptance and mutual support among all participants. Ibarra (2018) and Torres *et al.* (2024) agree on this criterion.

The lack of inclusive recreational sports strategies for students with Down syndrome generates a series of negative consequences, including limitations in physical development and barriers to learning. (Alarcón & Lázaro, 2022)In this regard, the overall objective is to identify sports and recreational activities that stimulate the development of motor, cognitive, and social skills necessary for learning in children with Down syndrome.

Materials and methods

To carry out the research, a mixed-method approach was adopted, integrating different data collection and analysis techniques, where the research questions were approached from multiple angles and a more holistic understanding of the topic under study was obtained. For Sampieri (2010), the mixed-method approach allows to complement the strengths of each approach (qualitative and quantitative) and compensate for their limitations, which can lead to more rigorous and robust research. This approach included the analysis of various variables related to perception (knowledge and skills), practices and methodologies that characterized and illustrated the inclusion of students with Down syndrome in Physical Education classes.

The population included 1,480 students from the school, 15 students with Down syndrome, parents, and 46 teachers. A non-probability convenience sample was selected due to the accessibility and availability of participants. Fifteen physical education teachers were selected, divided between morning and afternoon classes, and four caregivers or family members (informants) of adolescents with Down syndrome.

Results and discussion

The research was conducted in three phases. The first phase involved administering the Developmental Profile Test-3 (DP3), which is used to estimate children's developmental level in the areas of motor skills, adaptive behavior, socioemotional skills, cognition, and communication. When choosing the DP3 assessment instrument, author Alpern (2018),The questionnaire was considered, as it offers high levels of reliability and validity, equivalent to the interview method, but requires less time to administer. Furthermore, in this phase, family members or caregivers who meet the following characteristics were considered informants: informants with frequent contact with the person being evaluated, long-term contact, and recent contact.

In the second phase, the physical and sports activities described in Table 1 were integrated into the curriculum for two months. they prepared six sessions of job, having always into account the sequence of the various contents that are intended to be worked on, as well as the context in which they will be carried out.

Table 1- *Methodological strategies for class work*

Session	Intervention	Development of the exercise	Goals	Techniques	Resources	Factors to evaluate
1	Introduction and warm-up	Presentation games and group dynamics.	Promote empathy among classmates towards physical activities in class.	Games with displacement	balls	Participation and adaptation to the game.
2	Coordination exercises	Obstacle courses and walking	Improve students' motor coordination and balance. Remember the three basic rules that must be followed during the sessions: rules of conduct, order, and respect for others.	Obstacle courses, L-walks.	Ribbons, obstacles, mattresses	Coordination and balance
3	Dancing to the rhythm of music, brisk walking, relay games	Dancing to the rhythm of the music, walking.	Implement activities such as four corners, cross the lake, and identify difficulties presented in groups for analysis.	Bachelor of arts	Music, tapes, stopwatch.	resistance and rhythm
4	Light weight lifting and manual resistance with elastic bands	Lifting light and heavy weights	Strengthen major muscle groups.	Light weightlifting	Light weights, bands	muscle strength
5	Ball games and team relays	Games	Maintain the rules and enforce complex ball play and cone-based laps. Maintain a fair game where everyone participates equally.	displacement	balls	Collaboration and motor skills
6	Breathing techniques and gentle stretching, followed by a progress assessment.	Breathing techniques and gentle stretching, followed by u.	Evaluate progress and encourage relaxation	Breathing techniques, stretching.	Mats, relaxing music.	Relaxation level and student feedback.

Source: *Data taken from the Methodological Guide to Enhance Adaptive Skills in*

Adolescents with Down Syndrome(2023)

Finally, in the third phase, DP3 was applied to observe possible improvements in motor, cognitive, and social development skills. By tabulating the test results, the before-and-after results of implementing the strategies can be observed and compared (Figure 1).

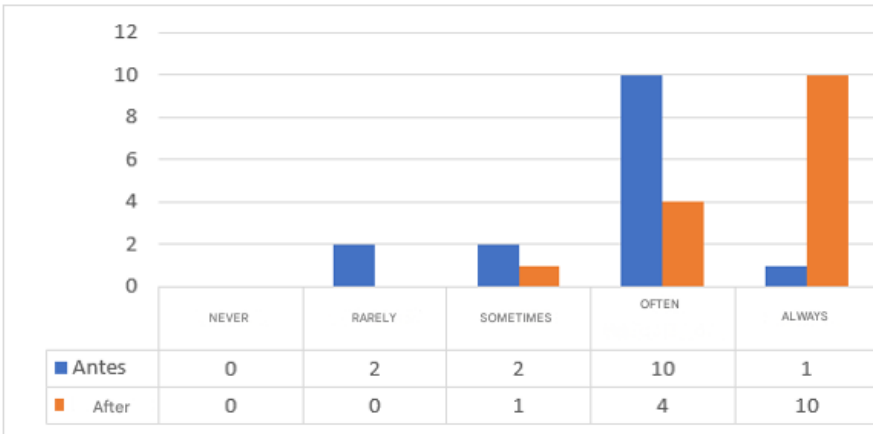

Fig. 1- *The adolescent can maintain balance while standing.*

Source: *The figure shows before-and-after figures for the strategies implemented through 2024.*

Analysis of the graph shows that the implemented strategy has had a positive effect on the balance ability of adolescents with Down syndrome (Figure 2).

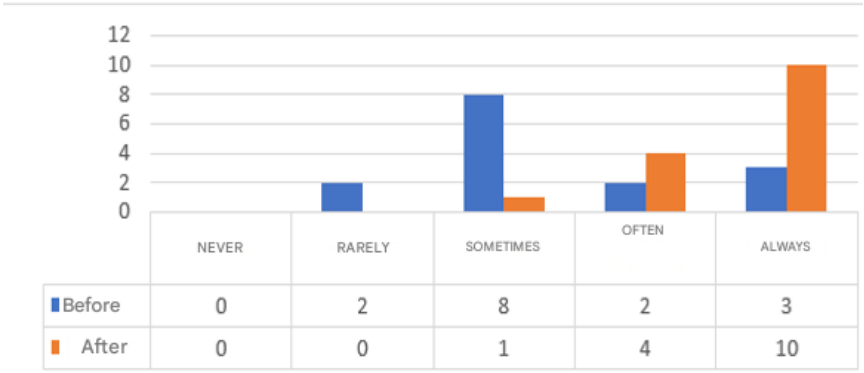

Fig. 2- *The adolescent can walk unaided.*

Source: *The figure shows before-and-after figures for the strategies implemented through 2024.*

Analysis of the graph reveals that the implemented strategy has had a significant positive impact on the ability to walk unaided among adolescents with Down syndrome (Figure 3).

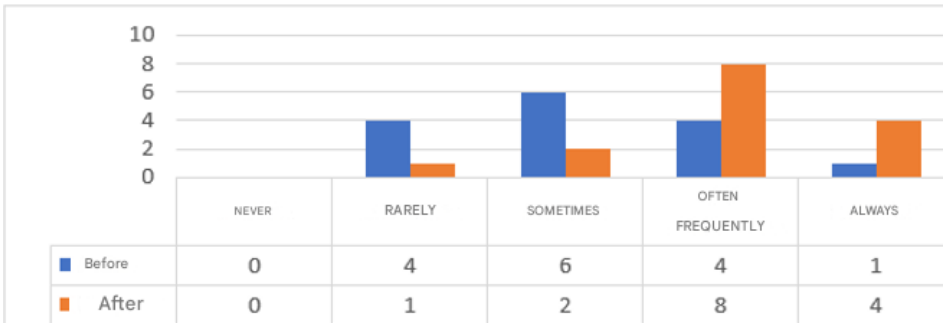

Fig. 3- *The adolescent can go up and down stairs without assistance.*

Source: *The figure shows before-and-after figures for the strategies implemented through 2024.*

Analysis of the graph suggests that the implemented strategy has had a positive effect on the ability of adolescents with Down syndrome to go up and down stairs without assistance (Figure 4).

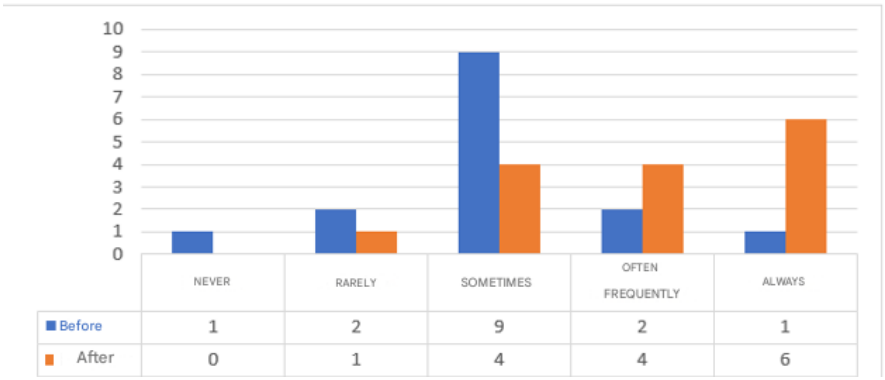

Fig. 4. *- The teenager can run without difficulty*

Source: *the figure shows the before and after figures of the strategies applied during the year 2024.*

Analysis of the graph indicates that the implemented strategy has had a significant positive effect on the ability to run without difficulty among adolescents with Down syndrome (Figure 5).

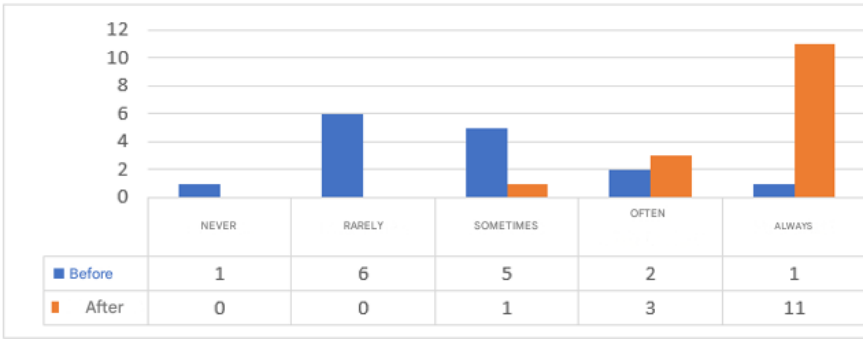

Fig. 5. - *The teenager can jump with both feet together*

Source: The *figure shows the before and after figures of the strategies applied during the year 2024.*

Analysis of the graph reveals that the implemented strategy has had a significant positive effect on the ability to walk unaided among adolescents with Down syndrome. The dramatic improvement in the percentage of those who can do so "always" and "frequently" and the decrease in those who could do so "rarely" or "never" are clear indicators of progress (Figure 6).

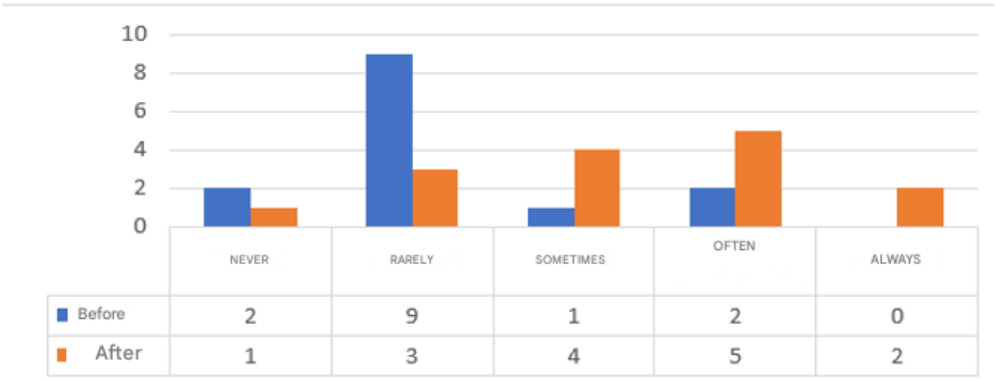

Fig. 6. - *The adolescent can write his/her name legibly*

Source: *the figure shows the before and after figures of the strategies applied during the year 2024.*

Analysis of the graph indicates that there is improvement in the percentage of those who can do it "always" and "frequently", together with the general increase in writing skills, reflecting the success of the intervention (Figure 7).

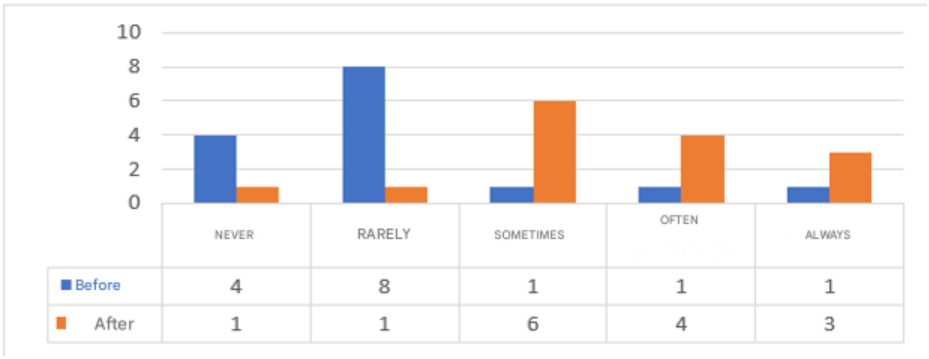

Fig. 7. - *The teenager can perform basic mathematical operations*

Source: *The figure shows the before-and-after figures for the strategies implemented during 2024.*

Analysis of the graph reveals that the implemented strategy has had a positive effect on the ability of adolescents with Down syndrome to perform basic math operations. The improvement in the percentage of those who can do so "always" and "frequently," along with the increase in overall math ability, highlights the effectiveness of the intervention (Figure 8).

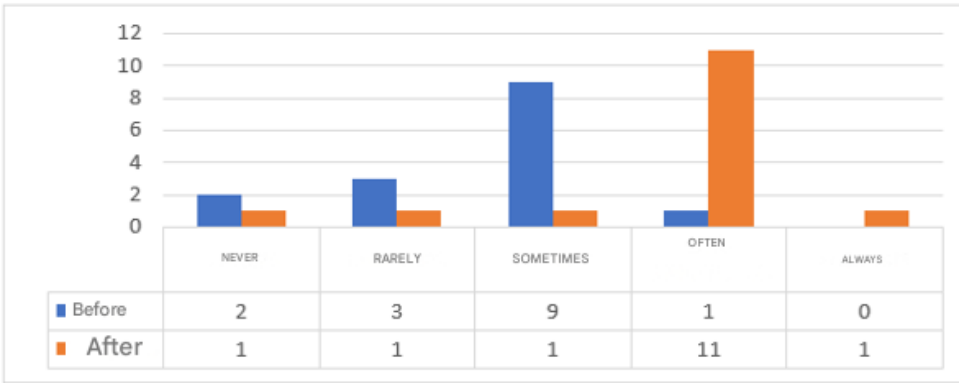

Fig. 8. - The *teenager can solve simple problems*

Source: *The figure shows the before-and-after figures for the strategies implemented during 2024.*

Analysis of the graph suggests that the implemented strategy has had a considerable positive effect on the ability to walk unaided among adolescents with Down syndrome (Figure 9).

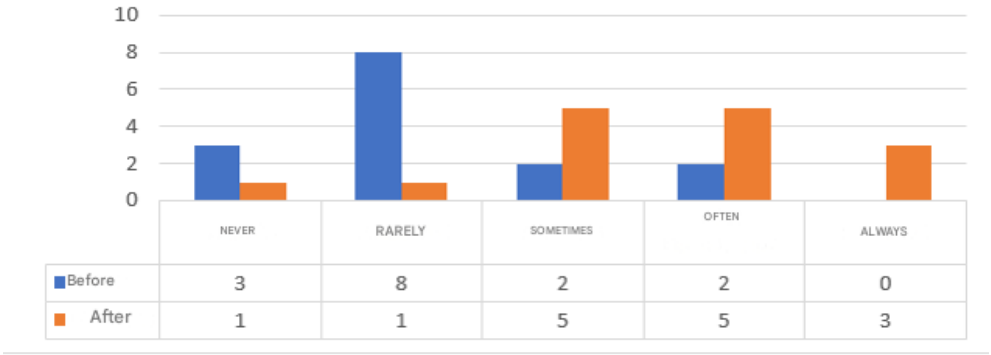

Fig. 9. - *Adolescents can learn new things independently.*

Source: *The figure shows before-and-after figures for the strategies implemented through 2024.*

Analysis of the graph suggests that the implemented strategy has had a considerable positive effect on the ability to walk unaided among adolescents with Down syndrome (Figure 10).

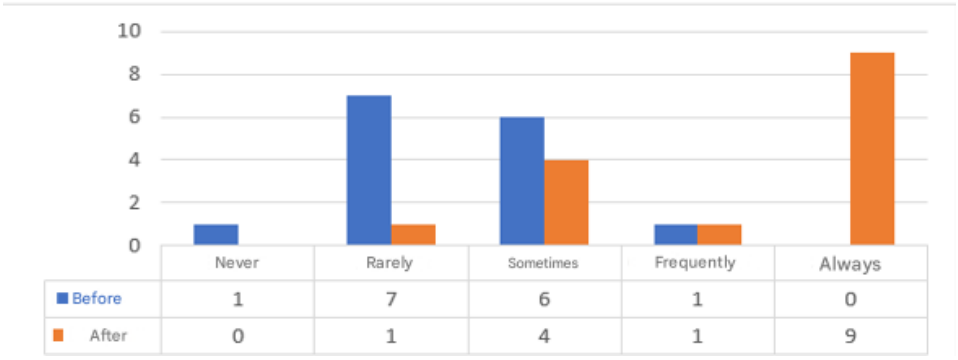

Fig. 10. - *The adolescent can apply what he or she has learned in new situations*

Source: The *figure shows the before and after figures for the strategies applied during the year 2024.*

Analysis of the graph indicates that the implemented strategy has had a significant positive effect on the ability of adolescents with Down syndrome to apply what they have learned in new situations.

To create a statistical table of the results before and after the application of sports strategies using the DP3 test, it is necessary to present the average scores in the different areas evaluated (Table 2).

Table 2- *Statistical Table of Results of the DP3 Test for Parents*

Development Area	Before (Average)	After (Average)	Difference
Motor skills	55	70	+15
Adaptive Behavior	50	65	+15
Socio-emotional	45	60	+15
Cognition	48	62	+14
Communication	52	67	+15

Note: *Data obtained by Cesar Coello*

The implementation of sports strategies resulted in a significant increase of 15 points in the area of motor skills, indicating a considerable improvement in students' coordination and balance. In adaptive behavior, students showed a 15-point improvement in their ability to perform daily activities independently, reflecting greater autonomy. Socioemotional: Scores increased by 15 points, suggesting improvements in social interaction and emotional management. Cognition: An increase of 14 points was observed, indicating advances in attention, memory, and problem-solving. Communication: Students improved their communication skills, both verbal and nonverbal, with a 15-point increase in communication scores.

The statistical table shows a significant improvement in all areas of development assessed by the DP3 test after implementing sports strategies. These results highlight the effectiveness of inclusive physical activities in promoting the comprehensive development of students with Down syndrome.

To carry out the sports strategies classes, the following measures were taken:

1. Cover running areas with non-slip surfaces to prevent falls and injuries.
2. Adapt goals, baskets, and nets to the specifications of the adapted sport.
3. Provide training and awareness programs for sports facility staff, ensuring inclusive and respectful treatment.

Strategies for students with Down syndrome in Physical Education:

- Ramps and non-slip surfaces: These adaptations facilitate the mobility and safety of students with Down syndrome during physical activity.
- Adaptive equipment: Modifying sports equipment such as goals and baskets can help students with Down syndrome participate more effectively and safely.
- Staff training: Staff training in inclusion and respectful treatment is crucial to creating a positive and motivating environment.
- Guides and personalized support: Assigning guides or helpers to assist students during physical exercises can improve their participation and confidence.
- Clear manuals and rules: Providing manuals and rules tailored to teachers and students helps them better understand activities and participate inclusively.

Procedure

Fifteen participating teachers were selected, and a questionnaire was administered at the beginning of the research to diagnose and assess the current status of the activities of students with Down syndrome. The questionnaire, authorized by the institution's authorities, was developed in one week, taking into account the teachers' schedules. The planned strategy was then implemented during Physical Education classes. This strategy consisted of six sessions, conducted over a period of four months, depending on the complexity of the exercise and technique. The sports games were conducted with students with Down syndrome and students without comorbidities, with the goal of analyzing their progress and inclusion during the class.

Statistical analysis

Quantitative and qualitative data collection was carried out:

Quantitative analysis: descriptive statistics (mean, median, standard deviation) for pre- and post-intervention results of DP3, paired samples t-test to compare pre- and post-intervention scores, analysis of the validity of the assessment instrument (DP3).

Analysis qualitative:

- Content analysis of interviews and observations.
- Identification of themes and patterns related to the perception, practices, and methodologies of inclusion.

Integrating results: Combining quantitative and qualitative findings to gain a holistic understanding of the inclusion of students with Down syndrome in physical education classes.

DP3 Pre-Intervention Scores (teachers): Mean: 76.47, Median: 77.0, Standard Deviation: 3.38, Minimum: 70, Maximum: 82.

DP3 Post-Intervention Scores (teachers): Mean: 88.47, Median: 88.0, Standard Deviation: 2.36, Minimum: 85, Maximum: 93, Paired Samples t-Test

Post-intervention scores, a paired samples t-test was performed:

The p-value is significantly less than 0.05, indicating a statistically significant difference between the pre- and post-intervention scores. This suggests that the recreational sports strategy had a significant impact on teachers' perceptions, knowledge, and skills regarding the inclusion of students with Down syndrome.

Effect size

The effect size was calculated using Cohen's d:

- *d de Cohen*: 4.12

An effect size of 4.12 is considered very large, indicating that the recreational sports strategy not only had a significant impact, but that the magnitude of this impact is considerable.

The results demonstrate the effectiveness of the recreational sports strategy in improving motor skills through the implementation of adapted sports strategies resulted in a significant improvement in the motor skills of adolescents with Down syndrome, evidenced by an increase of 15 points in motor assessments (Pitetti *et al.,* 2022; Houwen *et al.,* 2021; Horvat, M 2023). Through sports activities, they also fostered the social and emotional development of the participants, improving their ability to interact with their peers and increasing their self-esteem (Eichstaedt 2023) Adapting activities and creating an inclusive environment increased the participation and enjoyment of students with Down syndrome in physical education classes (Shields *et al.,* 2021).

These findings underscore the importance of adapting sports activities to meet the specific needs of students with Down syndrome. Regarding balance, the frequency with which adolescents could stand without losing their balance increased significantly, from 67% to 67%. This result underscores the importance of structured recreational activities to strengthen stability and postural control in this population (Carmeli Unaided 2022) walking also showed significant improvement, with the frequency of "always" increasing from 46% to 67% and the frequency of "sometimes" and "rarely" decreasing. This improvement suggests that the sport-based strategy *not* only increases students' confidence and independence, but also improves their overall mobility.

In terms of inclusion, the implementation of non-slip surfaces, adapted equipment, and staff training contributed to creating a safe and motivating environment for students with Down syndrome (Lieberman *et al.,* 2021). The integration of students with and without comorbidities during sports sessions fostered social interaction and empathy, promoting a culture of inclusion and respect. The combined quantitative and qualitative analysis provided a holistic view of the effects of the sports strategy.

According to Foley & Lieberman (2021), future research recommends expanding the sample size and considering a longer implementation period to assess the long-term effects of adaptive sports strategies. Furthermore, it would be beneficial to explore the impact of these strategies on other aspects of development, such as academic performance and mental health.

Conclusions

The research conducted demonstrates that the implementation of recreational sports strategies has a significant positive impact on the development of motor, cognitive, and social skills in adolescents with Down syndrome. The results showed notable improvements in essential motor skills such as maintaining balance, walking unaided, ascending and descending stairs, and running without difficulty. Additionally, progress was observed in cognitive and academic skills, such as legible handwriting and basic math skills. The inclusion of students with Down syndrome in sports activities not only improved their physical and cognitive abilities but also fostered an inclusive and respectful environment, promoting social interaction and empathy among all students. Adaptations to sports equipment and staff training played a crucial role in creating a safe and accessible environment.

Adaptive recreational sports strategies are a valuable tool for improving the holistic development of students with Down syndrome, contributing not only to their physical and cognitive progress but also to their social inclusion and overall well-being. These findings suggest that adapted sports activities can be an effective tool for promoting the inclusion and holistic development of students with Down syndrome.

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***Conflict of interest*:**

The authors declare no conflicts of interest.

Authors' contributions:

The authors have participated in the writing of the work and analysis of the documents.