SPORTS - THERAPEUTIC TOOL IN NEUROPSYCHIC REHABILITATION FOR PEOPLE WITH DISABILITIES

ȘTEFĂNIȚĂ, R.G.,[1] RADU, A.Ș.,[2] MEREUȚĂ C.,[3] NANU L.,[4] BALINT, G.,[5] GEORGESCU, L.I.[6]

[1]The Department of Science of Sports and Physical Education,"Dunărea de Jos" University of Galați
E-mail adress: radustefanatletic@yahoo.com

Abstract

Therapeutic sport represents a multidimensional intervention strategy for individuals with disabilities, generating measurable benefits across neuropsychological, motor, cognitive, and emotional domains. This review examines current evidence on sport-based therapeutic programs, with a specific focus on individuals with Down syndrome, who frequently present hypotonia, motor coordination difficulties, reduced cognitive processing speed, and heightened vulnerability to sedentary behaviours. Adapted physical activities — ranging from structured exercise programs to coordination training, balance tasks, and motor play — promote neuroplasticity, functional autonomy, and psychosocial adaptation. Additionally, recent studies highlight the contribution of digital tools, including ICT-based feedback, virtual reality, and interactive platforms, which enhance engagement and support individualized progression. Findings from the reviewed literature indicate that sport-centred interventions improve gross and fine motor skills, emotional regulation, social participation, and overall quality of life in individuals with Down syndrome. Improvements are consistently associated with better executive functioning, increased physical fitness, and reduced anxiety or withdrawal behaviours. Beyond therapeutic outcomes, sport emerges as a facilitator of inclusion, offering meaningful opportunities for participation in community life. Overall, the review underscores the essential role of structured and personalised physical activity in neuropsychological rehabilitation, supporting the need for broader implementation of adapted sport programs in clinical, educational, and community settings.

Keywords: Down syndrome, disability, sports therapy, adapted exercise, neuropsychic functions, social integration, digital technologies.

1. INTRODUCTION

Disabilities represent conditions that affect the physical, cognitive or emotional development of people, significantly influencing their autonomy and quality of life (Dan

& Boca, 2011; Boca, Ianc & Tarcau, 2016). People with disabilities often have difficulties in carrying out daily activities, in maintaining a balanced emotional state and in social integration (Postolache & Volcu, 2023). Disabilities encompass a broad spectrum of physical, cognitive, sensory, and emotional conditions that influence an individual's capacity to perform daily activities and participate fully in society. These conditions often arise from congenital factors, neurodevelopmental disorders, acquired injuries, or chronic diseases, and they generate long-term challenges related to mobility, learning, communication, and behavioural regulation (Dan & Boca, 2011; Boca, Ianc & Tarcau, 2016). Individuals with disabilities frequently experience increased barriers to social inclusion, reduced access to educational and recreational opportunities, and heightened vulnerability to emotional imbalance or sedentary lifestyles (Postolache & Volcu, 2023). Contemporary research emphasises that disability should not be viewed solely as a medical deficit, but as an interaction between individual functioning and environmental demands, highlighting the need for supportive interventions, adapted physical activity, and inclusive community structures that promote autonomy and well-being (Barnard et al., 2019).

These insights reinforce the importance of multidimensional rehabilitation approaches that combine physical, psychological, and social components to enhance overall functioning and quality of life. In this context, adapted physical activity and sports therapy have an essential role, providing a structured framework for stimulating motor, cognitive and emotional development. Physical exercises, correlated with specific intervention methods, contribute to improving coordination, muscle tone, physical resistance and neuropsychic functions, while promoting social inclusion and reducing the risk of sedentarism (Barnard et al., 2019; Dan & Boca, 2011).

It is obvious that adapted physical activity is not only a tool for physical rehabilitation, but also a complex means of supporting cognitive and emotional development. I believe that ongoing involvement in structured programs can provide participants with a sense of autonomy and competence, which translates into increased self-confidence and motivation to integrate into the community. This emphasizes the importance of a holistic approach, combining physical exercise with emotional and social support, to support the overall development of people with disabilities.

Down syndrome is the most common genetic cause of intellectual disability, associated with specific physiological, cognitive and emotional characteristics (Hayes & Batshaw, 1993; Irwanto, Ariefa & Samosir, 2019). Individuals with this condition often have delayed motor development, reduced muscle tone, coordination problems, and difficulties with planning and memory (Barnhart & Connolly, 2007; Edgin, 2013). Emotionally, they can show anxiety, frustration or difficulties in self-regulation, and social interaction can be affected by the lack of integration opportunities (Barnard et al., 2019; Gardiner et al., 2010). These particularities emphasize the importance of personalizing adapted physical activity programs. We believe that generalist approaches are not sufficient to meet the complex needs of people with Down syndrome. Exercises should be adjusted not only according to physical ability, but also cognitive and emotional level, and programs should include components that stimulate attention, memory and social engagement. This customization increases the effectiveness of the intervention and contributes to the development of a routine that can be maintained in the long term, thus maximizing the benefits of sports therapy.

Modern technologies have begun to be increasingly integrated into sports therapy programs, offering the possibility of monitoring progress, personalizing exercises and increasing the motivation of participants. Biofeedback devices, digital applications and virtual reality allow for the creation of interactive, safe and stimulating environments that support active involvement and the development of motor and cognitive skills (Postolache & Volcu, 2023; Méndez Martínez & Rodríguez Grande, 2023). The aim of this article is to review and synthesize the existing literature on the effects of sports therapy on the motor, cognitive, emotional and social functions of people with disabilities, with a special focus on Down syndrome. The study aims to identify the benefits of adapted physical exercises, as well as the role of modern technologies in optimizing rehabilitation and social inclusion programs (Barnard et al., 2019; Postolache & Volcu, 2023). The article is organized to provide an overview of the importance of sports therapy in the development of people with disabilities, with a focus on Down syndrome. The text reviews the theoretical background, discusses the methods and approaches used in practice, analyzes the effects of physical activities on physical,

cognitive and emotional health, and provides conclusions and practical recommendations for future interventions and research.

2. METHODOLOGY

This article presents a review of the scientific literature examining sport-based therapeutic interventions for individuals with Down syndrome. The bibliographic sources were selected from peer-reviewed scientific articles, systematic reviews, meta-analyses, and book chapters published between 1993 and 2023, identified through international and national databases such as ScienceDirect, Wiley Online Library, PubMed, Google Scholar, as well as specialised journals from Romania and the Republic of Moldova. The inclusion criteria targeted studies that directly investigated the effects of adapted physical exercise on motor, cognitive, and emotional functions in individuals with Down syndrome, as well as research focused on social integration through sport.

Studies addressing other types of disabilities were considered solely for general contextualisation. The analysis aimed to identify the mechanisms through which sport-based therapy enhances neuroplasticity, autonomy, and quality of life, and to examine the contribution of digital technologies to optimising these interventions. The selected studies were analysed using a thematic synthesis approach, grouping results according to key domains of interest: motor skills, cognitive functioning, emotional regulation, and social participation. For each study, the type of intervention, duration and frequency of the exercise program, and the main reported outcomes were documented. This approach allowed for the identification of general patterns, methodological gaps, and practical recommendations, offering a clear overview of the effectiveness of sport-based therapeutic programs for individuals with Down syndrome. The literature search was conducted using a structured strategy that combined keywords such as *"Down syndrome," "adapted physical activity," "therapeutic exercise," "sport therapy," "motor development,"* and *"cognitive rehabilitation."* Boolean operators (AND, OR) and filters related to publication year, study type, and language were applied to refine the results. Preference was given to high-quality sources, including randomized controlled trials, systematic reviews, and meta-analyses, due to their methodological

rigor and relevance for evidence-based practice. Grey literature, dissertations, and non-peer-reviewed materials were excluded to ensure scientific accuracy and consistency.

This systematic search process ensured that the selected studies provide a robust and comprehensive overview of current knowledge regarding sport-based therapeutic interventions for individuals with Down syndrome. For each included study, essential information was extracted using an analytical framework specifically designed for this review. The framework included variables such as study design, participant characteristics, type and intensity of physical activity, outcome measures, and reported effects on motor, cognitive, and emotional domains. Particular attention was given to the methodological quality of the studies, including sample size, intervention fidelity, measurement tools, and statistical analysis. The synthesis process involved comparing convergent and divergent findings across sources, identifying recurring patterns, and interpreting the results in alignment with current theories of neurodevelopment and motor learning. This structured approach enhanced the reliability of the review and facilitated the formulation of coherent conclusions and practice-oriented recommendations. The methodological quality of the included studies was critically appraised using standard assessment tools suitable for each study type, such as risk-of-bias checklists for randomized controlled trials and quality assessment frameworks for systematic reviews. Studies were evaluated for clarity of objectives, validity of measurement instruments, appropriateness of statistical analyses, and completeness of reporting. Findings were then synthesized narratively, highlighting both consistent outcomes and discrepancies across interventions. This process enabled the identification of best practices, knowledge gaps, and areas requiring further investigation, thereby providing a comprehensive understanding of the effectiveness and limitations of sport-based therapeutic interventions for individuals with Down syndrome. In addition to examining the general characteristics and outcomes of the included studies, this review also considered the role of intervention personalization and contextual factors in optimizing the effectiveness of sport-based therapy. Particular emphasis was placed on tailoring exercise programs to the specific motor, cognitive, and emotional needs of participants with Down syndrome, taking into account individual differences in muscle tone, coordination, attention span, and motivation (Barnard et al., 2019; Ruiz-González

et al., 2019). The frequency, duration, and intensity of interventions were analyzed to identify patterns associated with greater improvements in functional and neuropsychological outcomes. Furthermore, the integration of digital technologies — such as virtual reality, biofeedback, and mobile applications — was evaluated as a complementary tool for enhancing engagement, monitoring progress, and facilitating remote supervision (Postolache & Volcu, 2023; Méndez-Martínez & Rodríguez-Grande, 2023). By synthesizing findings across diverse methodological designs and intervention strategies, the review aimed to provide a nuanced understanding of the mechanisms through which sport-based therapy contributes to physical, cognitive, and emotional development, as well as to social inclusion and quality of life. The methodological synthesis also highlighted existing gaps in the literature, including limited longitudinal studies, small sample sizes, and variability in outcome measures, which may influence the generalizability of the findings. Addressing these gaps, future research should focus on larger, well-controlled trials that evaluate the combined effects of traditional and technology-supported exercise programs, with standardized protocols and validated assessment tools. Additionally, investigating the long-term sustainability of neuropsychological and social benefits, as well as the optimal integration of individualized feedback and motivational strategies, is critical for establishing evidence-based guidelines for practitioners. This comprehensive methodological approach ensures that the review not only summarizes current evidence but also provides actionable insights for clinicians, educators, and therapists designing and implementing sport-based interventions for individuals with Down syndrome, promoting interventions that are both effective and tailored to the unique needs of this population. Ultimately, this review serves as a practical resource for therapists, educators, and healthcare professionals by consolidating evidence-based strategies for sport-based interventions tailored to individuals with Down syndrome. By highlighting effective exercise modalities, frequency and intensity parameters, and the benefits of integrating modern digital tools, practitioners are equipped to design programs that maximize motor, cognitive, and emotional outcomes. Moreover, the synthesis underscores the importance of individualized planning and continuous assessment, ensuring that interventions are responsive to each participant's evolving abilities and needs. The findings not only

inform clinical and educational practice but also guide future research priorities, supporting the development of comprehensive, multidisciplinary approaches that enhance quality of life, social integration, and long-term functional independence for this population.

3. RESULTS

Sport therapy is a multidisciplinary approach that utilizes physical activity as a therapeutic tool to enhance overall health, functional capacity, and psychological well-being. At a general level, it is applied to diverse populations, including individuals with physical, cognitive, or emotional impairments, as well as older adults and patients undergoing rehabilitation after injuries or chronic illnesses (Dan & Boca, 2011; Postolache & Volcu, 2023).

By combining principles of exercise physiology, motor learning, and neuropsychological development, sport therapy aims to improve strength, flexibility, coordination, endurance, and balance, while simultaneously supporting cognitive functioning and emotional regulation. This holistic approach emphasizes individualized programming, structured progression, and the integration of social and motivational components, ensuring that interventions are both effective and engaging for participants across a wide spectrum of abilities (Barnard et al., 2019; Méndez-Martínez & Rodríguez-Grande, 2023).

Sports therapy has been shown to be particularly effective for individuals with Down syndrome, who often present hypotonia, delayed motor development, and cognitive challenges (Hayes & Batshaw, 1993; Irwanto, Ariefa & Samosir, 2019). Adapted exercise programs can target these specific deficits, enhancing muscle strength, balance, coordination, and fine motor control. Regular participation in structured physical activities has been associated with improvements in attention, memory, and executive functioning, as well as reductions in anxiety and frustration, thereby promoting emotional well-being (Barnhart & Connolly, 2007; Edgin, 2013).

Furthermore, evidence suggests that sport-based interventions contribute to neuroplasticity, supporting the development of neural pathways involved in motor and cognitive skills (Gardiner et al., 2010; Nadel, 1999). By engaging multiple domains

simultaneously — physical, cognitive, and emotional — these programs offer a holistic approach to rehabilitation, fostering autonomy and self-efficacy in individuals with Down syndrome (Barnard et al., 2019; Ruiz-González et al., 2019). In addition to physiological and cognitive benefits, sports therapy provides important social opportunities.

Group exercises, adapted games, and community-based programs encourage interaction with peers, enhance social skills, and promote inclusion, which is particularly relevant for individuals who may otherwise experience social isolation (Dan & Boca, 2011; Boca, Ianc & Tarcau, 2016). Integrating technology into these programs — such as virtual reality environments, interactive applications, and biofeedback devices — further increases motivation, engagement, and adherence, allowing therapists to tailor exercises to the specific needs and abilities of each participant (Postolache & Volcu, 2023; Méndez-Martínez & Rodríguez-Grande, 2023).

Finally, systematic reviews and meta-analyses highlight that interventions combining adapted physical activity with technological support achieve superior outcomes compared to conventional exercise programs. These findings reinforce the importance of designing individualized, structured, and interdisciplinary sports therapy interventions to maximize both functional and psychosocial benefits for people with Down syndrome (Ruiz-González et al., 2019; Méndez-Martínez & Rodríguez-Grande, 2023; Uyanik, Bumin & Kayihan, 2003). Studies show that long-term planned programs with regular frequency generate more consistent results compared to spontaneous or unstructured activities (Uyanik, Bumin & Kayihan, 2003). In addition, progressive exercises, adapted to the level of development of each individual, contribute to improving posture, stability and motor control, thus facilitating daily life activities and participation in group sports activities (Méndez Martínez & Rodríguez Grande, 2023).

Adapted physical activity plays an essential role in the development of cognitive and neuropsychological functions in people with disabilities. Regular exercises contribute to the stimulation of memory, attention, executive processes and spatial perception, providing opportunities for improving intellectual performance and autonomy in everyday life. In addition, engaging in structured physical activity supports emotional regulation and the development of social skills, providing an integrated

framework for promoting inclusion and quality of life. In addition to cognitive benefits, engaging in adapted physical activity has positive effects on emotional state. This contributes to reducing anxiety, increasing self-esteem and developing emotional self-regulation skills (Barnard et al., 2019). Group activities and motor games also facilitate social interaction, providing opportunities for inclusion and cooperation between participants. In addition to the motor and cognitive benefits, engaging in adapted physical activities has important effects on the emotional and social state of people with Down syndrome. Regular exercise helps reduce anxiety and stress, increase self-esteem, and develop confidence in one's own abilities (Barnard et al., 2019; Dan & Boca, 2011). Group activities, motor games and adapted competitions facilitate social interaction, promoting cooperation, communication and community integration. Participating in structured sports programs also provides a framework for developing social-emotional skills such as emotional self-regulation, empathy, and the ability to follow rules and boundaries. Studies show that these benefits are more evident in programs that include a playful and interactive component, stimulating the active involvement and motivation of participants (Barnard et al., 2019; Dan & Boca, 2011). The integration of digital technologies into sports therapy programs has revolutionized the way interventions are designed, monitored, and delivered. Tools such as biofeedback devices allow participants to receive immediate physiological feedback on parameters like heart rate, muscle activation, and balance, enabling real-time adjustment of exercises to optimize performance and safety (Postolache & Volcu, 2023). Virtual reality (VR) environments provide immersive, interactive experiences that simulate real-life scenarios, enhancing motor learning, spatial awareness, and cognitive engagement while maintaining high levels of motivation and adherence (Méndez-Martínez & Rodríguez-Grande, 2023). Mobile and web-based applications further facilitate individualized program design, progress tracking, and remote supervision, allowing therapists to tailor interventions to the specific needs and abilities of each participant (Postolache & Volcu, 2023). These digital tools not only enhance the effectiveness of physical exercises but also support social interaction, as participants can engage in multiplayer or community-based virtual activities, fostering inclusion and peer support. Collectively, the integration of these technologies provides a flexible, adaptive, and engaging framework that maximizes the

physical, cognitive, and emotional benefits of sports therapy across diverse populations, including individuals with disabilities. Thus, adapted physical activity becomes a complex tool, which not only improves the physical condition, but also supports the emotional development and social integration of people with Down syndrome. These methods not only optimize physical performance, but also help increase participant engagement, maintain motivation, and reinforce exercise routines, especially in individual or group activities. In addition, objective monitoring of progress provides specialists with valuable information for evaluating results and adapting rehabilitation and social inclusion programs. In the case of people with Down syndrome, modern technologies become a valuable tool for adapting exercises to the neurocognitive and motor peculiarities of this population. Digital applications allow individual progress to be monitored and exercises to be adjusted according to each participant's level of development, providing immediate feedback and encouragement to maintain motivation. Biofeedback devices provide accurate information about posture, balance, strength and muscle tone, facilitating movement correction and performance optimization. Virtual reality and interactive activities enable the creation of stimulating training scenarios that develop coordination, attention and cognitive functions, reducing boredom and creating a safe motor learning environment. The integration of these technologies in adapted physical activity programs supports the autonomy of participants, reduces the risk of sedentarism and encourages active participation in group activities, promoting social inclusion. In addition, the ability to customize exercises in real time allows specialists to quickly respond to the needs of each individual, increasing the efficiency and safety of interventions. Recent studies suggest that combining traditional methods with digital tools can generate more consistent results in the motor, cognitive and emotional development of people with Down syndrome, providing an integrated framework for rehabilitation and social inclusion (Postolache & Volcu, 2023; Méndez Martínez & Rodríguez Grande, 2023; Ruiz González et al., 2019). The literature review shows that adapted physical activity programs can be divided into two main categories: traditional programs, based on structured physical exercises and motor games, and modern programs, which integrate digital technologies, biofeedback and virtual reality. Both types of programs contribute to improving motor, cognitive and

emotional functions, but technology-assisted interventions offer the possibility of personalizing exercises, monitoring progress and increasing participants' motivation (Postolache & Volcu, 2023; Méndez Martínez & Rodríguez Grande, 2023). Traditional sports therapy programs remain a cornerstone of interventions aimed at improving motor function, cognitive skills, and emotional regulation. These programs typically include exercises focused on muscle strengthening, flexibility, balance, and coordination, as well as cardiovascular conditioning (Barnhart & Connolly, 2007; Uyanik, Bumin & Kayihan, 2003). For example, activities such as obstacle courses, targeted stretching routines, resistance band exercises, and ball-handling drills are frequently employed to enhance gross and fine motor skills. Group-based activities, such as adapted team sports, relay races, or cooperative games, not only promote physical development but also encourage social interaction, teamwork, and motivation. Individualized sessions, on the other hand, allow therapists to tailor the intensity, duration, and complexity of exercises according to the participant's specific motor and cognitive abilities, ensuring progressive improvements and minimizing the risk of fatigue or injury. Additionally, traditional programs often incorporate repetitive practice and task-oriented exercises, which are essential for motor learning and the reinforcement of neural pathways. Despite the growing use of digital technologies, these conventional methods continue to be highly effective, particularly when combined with structured goal-setting, consistent monitoring, and supportive feedback from experienced specialists. For individuals with Down syndrome, traditional sports therapy programs must be carefully adapted to address the specific physiological, cognitive, and emotional characteristics associated with the condition. Common challenges include hypotonia, delayed motor development, reduced balance and coordination, as well as difficulties in attention and memory (Hayes & Batshaw, 1993; Barnhart & Connolly, 2007). Programs often incorporate exercises such as assisted walking, step training, swimming, and ball-handling activities, which enhance muscle strength, postural control, and motor planning. In addition, structured group activities, like adapted team games or cooperative obstacle courses, provide opportunities for social engagement and communication skills development (Dan & Boca, 2011; Boca, Ianc & Tarcau, 2016). Consistent participation in these programs not only improves motor performance but also contributes to emotional regulation, self-

confidence, and motivation, thereby fostering greater autonomy and facilitating integration into family, school, and community settings (Barnard et al., 2019; Gardiner et al., 2010). Individualized adjustments in intensity, duration, and complexity are essential to ensure that each participant can progress safely and effectively while maximizing the overall benefits of sport-based therapy. Instead, modern programs allow the integration of playful and interactive components, stimulating involvement and active participation, especially among people with Down Syndrome, where motivation and attention can be more difficult to maintain (Ruiz González et al., 2019; Méndez Martínez & Rodríguez Grande, 2023). Comparatively, programs that combine traditional methods with digital technologies offer more consistent and sustainable results in terms of motor, cognitive and emotional functions, reducing the risk of sedentarism and supporting social integration. This integrated approach provides a flexible and adaptable framework for practitioners, allowing exercises to be adjusted according to the individual needs and progress of each participant (Barnard et al., 2019; Gardiner et al., 2010). Moreover, the integration of digital technologies — such as virtual reality environments, interactive applications, and biofeedback devices — enhances engagement and adherence by creating immersive and stimulating experiences tailored to the abilities of each participant (Postolache & Volcu, 2023; Méndez-Martínez & Rodríguez-Grande, 2023). For example, VR-based exercises can simulate real-life scenarios that challenge balance, coordination, and cognitive planning, while biofeedback systems provide immediate performance feedback, allowing participants to self-correct movements and monitor progress. Mobile applications facilitate personalized exercise programs, track improvements over time, and enable remote supervision by therapists, which is particularly valuable in contexts where in-person sessions are limited. These technological tools not only reinforce motor learning and cognitive skills but also foster motivation, self-efficacy, and social interaction, as participants can engage in multiplayer activities or virtual group sessions. Collectively, the combination of traditional and digital approaches offers a dynamic, adaptive, and evidence-based framework that maximizes the physical, cognitive, and emotional benefits of sports therapy, promoting long-term participation and holistic development for individuals with Down syndrome (Ruiz-González et al., 2019; Barnard et al., 2019).

In addition to motor and cognitive benefits, sports therapy has a significant impact on neuropsychic rehabilitation by enhancing executive functions, attentional control, and adaptive behavior in individuals with Down syndrome (Edgin, 2013; Gardiner et al., 2010). Structured physical activities stimulate neural pathways involved in learning, memory consolidation, and problem-solving, supporting neuroplasticity and long-term functional gains (Nadel, 1999; Ruiz-González et al., 2019). Furthermore, programs that incorporate goal-setting, repetition, and progressively challenging exercises encourage participants to engage in self-monitoring and decision-making, reinforcing cognitive control and emotional regulation. Socially, sport-based interventions create contexts that foster collaboration, communication, and peer interaction, which are essential for the development of social-emotional skills (Dan & Boca, 2011; Boca, Ianc & Tarcau, 2016). Group-based games, cooperative challenges, and team-oriented exercises promote empathy, turn-taking, and adherence to rules, providing participants with opportunities to practice social competencies in a structured and supportive environment. These experiences are particularly valuable for individuals with Down syndrome, who may face social integration challenges due to cognitive or motor delays. Evidence also highlights the role of interdisciplinary collaboration in maximizing the effectiveness of sports therapy. Coordination between physical therapists, psychologists, educators, and caregivers ensures that interventions address the multifaceted needs of participants, combining physical, cognitive, emotional, and social components (Barnard et al., 2019; Postolache & Volcu, 2023). Moreover, the systematic incorporation of digital tools enhances this collaborative approach, allowing real-time monitoring, personalized feedback, and adjustment of programs according to individual progress (Méndez-Martínez & Rodríguez-Grande, 2023). Finally, research suggests that long-term adherence to structured sports programs produces cumulative benefits across multiple domains. Regular engagement not only strengthens motor performance but also reinforces cognitive skills, emotional resilience, and social participation, thereby contributing to holistic neuropsychic development and improved quality of life for individuals with Down syndrome (Barnhart & Connolly, 2007; Ruiz-González et al., 2019). The combination of traditional exercises with interactive and technology-supported interventions represents a comprehensive framework for rehabilitation,

capable of addressing the complex needs of this population while promoting autonomy, motivation, and sustained engagement. Overall, the findings indicate that sports therapy serves as a multifaceted tool for neuropsychic rehabilitation in individuals with Down syndrome, simultaneously enhancing motor, cognitive, emotional, and social functioning. Adapted physical activities, whether delivered through traditional methods or combined with digital technologies, provide structured opportunities for skill development, promote neuroplasticity, and support emotional regulation. The integration of technology further enables personalized feedback, motivation, and active participation, ensuring that interventions are tailored to individual needs. These combined approaches not only improve physical performance but also foster autonomy, self-efficacy, and social inclusion, highlighting the potential of sports-based programs as a holistic intervention strategy. This evidence lays a solid foundation for subsequent discussions on optimizing program design, interdisciplinary collaboration, and long-term implementation strategies, which will be explored in the following section.

4. CONCLUSIONS

The analysis of the literature shows that sports therapy plays an essential role in supporting the development of people with Down syndrome, positively influencing not only motor capabilities, but also cognitive functions and emotional state. From the authors' perspective, these results confirm that adapted physical exercises cannot be seen only as a simple means of physical rehabilitation, but as a complex tool of holistic support. Structured and progressive activities, combined with constant feedback and social support, enable the development of individual skills, increase autonomy and contribute to participants' self-confidence. The literature reviewed shows that not all sports therapy programs have the same effectiveness, and differences appear depending on the method used and the degree of personalization. Traditional, standardized exercise-based programs can produce noticeable improvements in strength and coordination, but rarely stimulate participants' cognitive engagement or motivation as much (Uyanik, Bumin & Kayihan, 2003). On the other hand, modern programs, which integrate digital technologies, virtual reality or biofeedback, offer the possibility of monitoring progress and adjusting exercises in real time. This approach increases the degree of involvement

and motivation of people with Down syndrome and contributes to the development of social and cognitive skills (Postolache & Volcu, 2023; Méndez Martínez & Rodríguez Grande, 2023).

The success of sports therapy does not depend only on the type of exercises, but especially on how they are integrated into the person's daily life. Practical observations suggest that programs that encourage autonomy, active engagement and social interaction generate more sustainable outcomes and greater participant satisfaction. It is essential that each program should be flexible, adapting the intensity and complexity of the exercises to the pace and needs of each individual, so that progressshould be constant and the experience positive. In addition to the physical and cognitive benefits, sports therapy plays an essential role in the emotional and social development of people with Down syndrome. Group activities and interactive programs enable the development of communication, collaboration and emotional self-regulation skills (Dan & Boca, 2011; Barnard et al., 2019). Participants who take part in such programs show increased self-confidence, reduced anxiety and greater openness to social interactions. These effects emphasize the importance of integrating social and emotional components within sports therapy programs. We believe that the real benefits arise not only from the physical exercises themselves, but also from the social context and support provided by the group or therapeutic team, which stimulates active participation and the strengthening of interpersonal relationships. Adapted programs should therefore include both individual exercises and group activities to support the person's full development and increase the positive impact of therapy. Moreover, one of the most valuable aspects of sports therapy is that it provides participants with a safe and structured environment in which they can experience personal success and autonomy. When exercise is integrated into a positive social context with constant feedback and emotional support, people with Down syndrome not only improve their physical and cognitive abilities, but also develop resilience, motivation and the ability to adapt to various situations. This emphasizes the need for programs to be thought of holistically, not just as a set of exercises, but as a complex experience that stimulates all dimensions of the individual's development. Other gaps include the lack of program standardization – exercises, intensity and duration vary significantly between studies, making it difficult

to compare results and identify the most effective methods. In addition, the integration of modern technologies such as virtual reality or biofeedback is still limited and there is not enough data to assess their long-term impact (Méndez Martínez & Rodríguez Grande, 2023; Postolache & Volcu, 2023). These limitations emphasize the need for rigorous studies with larger samples and longitudinal designs to allow for the creation of standardized guidelines for sports therapy programs. We believe that the future approach should be multidimensional, combining physical exercise, cognitive components and emotional support to maximize benefits and support long-term social inclusion. Despite the abundant evidence of the benefits of sports therapy, there is a clear need for studies investigating long-term effects and including psychosocial variables such as quality of life and degree of social integration. There is also a gap between theoretical research and the practical application of programs in the community, indicating the need for better knowledge transfer to practitioners. Standardization of exercises, monitoring of progress and multidimensional evaluation of participants could help to optimize programs and increase their impact on the overall development of people with Down syndrome.

Sports therapy is an essential tool in supporting the development of people with Down syndrome, having positive effects on motor, cognitive and emotional functions. Adapted exercises, combined with modern methods and digital technologies, contribute to increasing motivation, autonomy and social integration, offering participants real opportunities for progress and inclusion.

1. Multifunctional benefits - sports therapy brings improvements not only physically, but also cognitively and emotionally. Participants who follow adapted programs show better motor coordination, increased muscle tone and improved physical endurance. In parallel, the exercises stimulate attention, working memory, planning ability and emotional self-regulation, highlighting the holistic nature of the therapy.

2 .The importance of personalizing and adapting programs - adapting the exercises to the physical, cognitive and emotional level of each participant increases motivation, active involvement and reduces the risk of dropping out, increasing long-term progress. Standardized programs can be useful for general skill development, but customization ensures more lasting results and positive experiences for each individual.

3. The role of social and interactive components - group activities and collaborative exercises contribute significantly to the development of social and emotional skills. Participation in such programs increases self-confidence, reduces anxiety and encourages social interaction, supporting community inclusion and overall personal development.

4. Modern technologies and continuous monitoring - the integration of virtual reality, biofeedback and digital applications allows monitoring progress and adjusting exercises in real time, increasing the effectiveness of programs and the involvement of participants.

5. Limitations and future directions - existing literature points out gaps such as small samples, lack of longitudinal studies, and variation between programs. Exercise standardization, multidimensional assessment, and further research are needed to optimize interventions and create sound practice guidelines.

6. Holistic and multidimensional approach - sports therapy should be considered a multidimensional intervention, combining physical exercise with cognitive stimulation, emotional support and social involvement. This approach maximizes benefits, contributing to overall development, increased quality of life and autonomy of people with Down syndrome.

In conclusion, sports therapy proves to be a complex and effective strategy for supporting the development of people with Down syndrome, combining physical, cognitive, emotional and social benefits. The integration of adapted exercises, interactive components and modern technologies contribute to the overall progress of the participants and increase their quality of life. The application of personalized, monitored and multidimensional programs can represent an effective way to promote the inclusion, autonomy and well-being of people with disabilities, turning physical activity into a real tool for development and rehabilitation. In the long term, the benefits of sports therapy go beyond simply improving physical capabilities, positively influencing the autonomy, adaptability and social inclusion of people with Down syndrome. Programs that combine exercise with cognitive stimulation, emotional support, and group activities help reinforce healthy habits and ongoing motivation for physical activity. Thus, sports therapy is not just a temporary intervention, but a sustainable tool for holistic

development, with beneficial effects on quality of life and active participation in the community.

To maximize the benefits of sports therapy, it is recommended that programs be:

1. personalized, adapting the intensity, type and duration of the exercises to the physical, cognitive and emotional needs of each participant;
2. multidimensional, combining physical exercise with cognitive, social and emotional components to support holistic development;
3. interactive and group, to stimulate participation, cooperation and social inclusion;
4. constantly monitored and adjusted, using digital technologies and modern evaluation methods, to track progress and adapt the program in real time;
5. sustainable in the long term, with clear and gradually increasing goals, to encourage healthy habits and the continuous involvement of participants.

Applying these recommendations can contribute significantly to the effectiveness of interventions and to improving the quality of life of people with Down syndrome.

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