PEDAGOGY of Physical Culture and Sports

ORIGINAL ARTICLE

The effect of animal movement exercises on improving upper and lower body muscles in children with down syndrome

Muhammad Asrul Sidik[1ABDE], Adi Pranoto[1,2BCD], Fransisca Januarumi Marhaendra Wijaya[1BD], I Made Sri Undy Mahardika[1BD], Andri Suyoko[1BD], Bayu Agung Pramono[1BCD], Achmad Rizanul Wahyudi[1BD], Mohammad Faruk[1BD], Nuril Sri Wulandari[1BD], Bekir Erhan Orhan[3CD]

[1]*Department of Sports Coaching Education, Faculty of Sport and Health Science, Universitas Negeri Surabaya, Indonesia*

[2]*Sport and Exercise Research Center, Universitas Negeri Surabaya, Indonesia*

[3]*Faculty of Sports Sciences, Istanbul Aydin University, Turkey*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim: Exercise is crucial for individuals with Down syndrome (DS) as it significantly enhances their physical fitness, motor skills, and overall well-being. Therefore, the aim of this study is to evaluate the effects of animal movement exercises on upper and lower body muscle strength in children with Down syndrome.

Material and Methods: This study used a pre-experimental one-group pretest-posttest design. It involved twelve male participants with Down syndrome, aged seven to fourteen years (mean age: 10.25 ± 2.31 years). They received an animal movement exercise intervention over six weeks, with a frequency of three sessions per week. Each session lasted one hour and included a warm-up, main activity phase, and cool-down. Exercises were performed at moderate intensity (60–70% HRmax), and heart rate was monitored using the Polar H10 device. Leg muscle strength, grip strength, coordination, and balance were assessed at baseline (pre) and after six weeks (post). Statistical analysis was conducted using the paired sample t-test with a 5% significance level.

Results: The results showed a significant increase in leg muscle strength (kg) between baseline and post-intervention ($p = 0.000$; ES = 0.955; 95% CI: -2.83, -1.84). Grip strength (kg) also increased significantly ($p = 0.000$; ES = 1.169; 95% CI: -3.34, -2.49). Coordination (repetitions) showed improvement ($p = 0.000$; ES = 1.404; 95% CI: -3.08, -2.25). Balance (seconds) increased as well ($p = 0.000$; ES = 0.715; 95% CI: -2.71, -1.13).

Conclusions: Animal movement exercises represent a developmentally appropriate and engaging form of physical activity for children with Down syndrome. Their playful, functional nature aligns well with inclusive approaches to therapy and education, and they may offer practical value in diverse settings, including those with limited resources.

Keywords: animal movement exercises, down syndrome, upper body muscle, lower body muscle

Introduction

Down syndrome (DS) is a genetic condition commonly associated with characteristic physical and cognitive challenges. These include muscle hypotonia, reduced strength, and impaired motor coordination. Such limitations can negatively affect mobility, postural control, and participation in daily activities. Therefore, exercise is not only beneficial but also essential for promoting functional independence and improving the overall well-being of individuals with DS.

A growing body of research supports the implementation of targeted exercise interventions to address motor deficits in individuals with Down syndrome. Strength training, in particular, has been shown to produce positive outcomes in muscle development and motor skills. Kashi et al. [1] demonstrated that structured physical exercise improved upper-limb strength and coordination. Raharjo et al. [2] reported significant increases in hand muscle strength following a range of motion training program. Gupta et al. [3] further highlighted the combined benefits of strength and balance exercises in enhancing both muscle capacity and postural stability in individuals with DS.

Beyond traditional modalities, recent attention has shifted to more dynamic and engaging approaches that appeal to younger populations or individuals with lower motivation thresholds. One such approach is animal movement exercises (AMEs), which are inspired by the natural locomotion patterns of animals such as frogs, bears, crabs, and ducks. These movements require coordinated actions across multiple joints and muscle groups, making them inherently full-body exercises. AMEs

doi:10.15561/26649837.2025.0306

are designed to be both playful and purposeful, combining functional fitness with imaginative play. This dual focus may be especially beneficial for individuals with DS, who often respond more positively to activities presented in an enjoyable and familiar context.

Despite anecdotal reports and their increasing use in occupational and physical therapy, empirical research on the impact of animal movement exercises (AMEs) in individuals with Down syndrome remains limited. Most existing studies focus on conventional training programs. This leaves a significant gap in the literature regarding alternative, play-based modalities that may offer similar or even greater benefits.

Supporting evidence for diverse forms of exercise is steadily growing. Puspitosari [4] showed that general physical activity interventions improved balance performance. Gupta et al. [3] confirmed that well-designed programs combining strength and balance components significantly enhanced motor function. Modesto et al. [8] reported improvements in both upper and lower limb strength following a 12-week intervention among young individuals with Down syndrome. These results highlight the cumulative effects of regular and targeted training. In addition, the findings of Raharjo [2] emphasized that even short-term programs, when implemented consistently, can contribute to measurable strength gains.

From a physiological standpoint, muscle weakness in individuals with Down syndrome has been associated with impaired muscle regeneration due to dysfunctional muscle stem cell activity [6]. This makes long-term strength-building programs not only beneficial but also necessary. Saquetto et al. [7] provided evidence that non-traditional training methods, such as whole-body vibration, can enhance both muscle function and bone density. Furthermore, accessibility plays a key role in exercise adherence. Community-based programs, as observed by Shields et al. [9], have successfully increased participation rates and physical strength in individuals with Down syndrome. These findings suggest that engaging and socially inclusive interventions hold particular promise.

An analysis of existing studies has shown that various forms of physical exercise positively influence motor function, strength, and balance in individuals with Down syndrome. The authors highlight the importance of structured, goal-oriented interventions and point to the potential benefits of non-traditional, play-based approaches such as animal movement exercises. Despite these findings, there remains a clear need for more in-depth investigation into the specific effects of such alternative methods.

Therefore, the aim of this study is to evaluate the effects of animal movement exercises on upper and lower body muscle strength in children with Down syndrome.

Materials and Methods

Participants

This study used a pre-experimental one-group pretest-posttest design. It involved twelve male children with Down syndrome, aged between seven and fourteen years. Anthropometric data such as body weight, height, and Body Mass Index (BMI) were recorded but are presented separately in the results section. The calculation of the required sample size was conducted using the Higgins–Kleinbaum formula, based on reference values from previous similar studies, resulting in a minimum sample size of twelve participants.

Study Design

In this study, a structured animal movement exercise (AME) protocol was used as the intervention program. AMEs are a form of functional movement training that mimic the natural locomotion patterns of animals. They are designed to improve strength, mobility, coordination, and balance. The following is a general outline of the protocol, which can be adjusted according to age, fitness level, or specific training objectives:

1. *Bear Crawl.* Crawling on hands and feet while keeping the hips low and the core engaged. This exercise improves coordination, strength, and stability in the core, shoulders, and legs.
2. *Frog Jumps.* Starting from a squat position, the participant jumps forward with hands touching the floor, landing softly. This movement enhances lower body strength, explosiveness, and coordination.
3. *Crab Walk.* Sitting on the floor with knees bent and feet flat, the participant places hands behind the body and walks forward or backward using both hands and feet while keeping the torso elevated. This exercise improves upper body strength, coordination, and core stability.
4. *Duck Walk.* The participant squats low, lifts the heels, and walks forward while maintaining the squat position. This targets the lower body, especially the quadriceps, and improves balance.
5. *Kangaroo Jumps.* Performing repeated two-footed jumps forward and backward, landing softly. This develops lower body strength, agility, and power.

All participants completed a six-week AME intervention, with training sessions held three times per week. Each session lasted one hour and included a warm-up, main exercise phase, and cool-down. The warm-up and cool-down periods each lasted five minutes and were performed at light intensity (50% HRmax). Exercise intensity during the sessions was maintained at a moderate level

(60–70% HRmax) and was monitored using the Polar Heart Rate Monitor H10.

Data collection

Assessments of upper and lower body muscles, including leg muscle strength, grip muscle strength, coordination, and balance, were conducted at baseline (pre) and after six weeks (post). A leg dynamometer was used to measure leg muscle strength, while a hand dynamometer was used to assess grip muscle strength. Coordination was evaluated using a ball tossing and catching test. Balance was measured through a standardized balancing test.

Statistical analysis

The normality of the data was tested using the Shapiro–Wilk test. Differences between pre- and post-intervention values for leg muscle strength, grip muscle strength, coordination, and balance were analyzed using a parametric paired sample t-test with a significance level of 5%. The effect size was evaluated using Cohen's *d*. Data are presented as mean ± standard deviation (SD).

Results

The characteristics of the research subjects are presented in Table 1. The study included twelve male children with Down syndrome, aged between seven and fourteen years. As shown in the table, participants displayed considerable variability in anthropometric parameters such as body height, weight, and Body Mass Index (BMI). On average, the group was within a healthy BMI range for their age, though individual values reflected a broad spectrum of physical development. This diversity underscores the importance of tailoring physical interventions to accommodate differing body compositions and growth stages among children with Down syndrome.

Assessments of upper and lower body muscle strength at baseline (pre) and after six weeks (post) are presented in Table 2. The results indicate significant improvements following the animal movement exercise intervention. Leg muscle strength (kg) increased significantly from baseline to post-intervention ($p = 0.000$; ES = 0.955). Grip muscle strength (kg) also showed a significant increase between baseline and six weeks ($p = 0.000$; ES = 1.169). Similarly, coordination (repetitions) improved significantly over the intervention period ($p = 0.000$; ES = 1.404). Balance (seconds) also increased significantly after six weeks of training ($p = 0.000$; ES = 0.715). As shown in Table 2, the effect sizes for all parameters ranged from moderate to large, suggesting that animal movement exercises had a substantial impact on muscular strength, coordination, and balance in children with Down syndrome.

Discussion

The present study aimed to evaluate whether animal movement exercises (AMEs) could serve as a practical and engaging strategy to improve motor performance in individuals with Down syndrome. The findings suggest positive changes in strength, coordination, and balance over the six-week intervention period. These outcomes are generally consistent with previous studies that support the role of structured physical activity in this population [11, 12, 13]. However, unlike prior interventions that rely on conventional gym-based routines or specialized therapy settings, AMEs offer a flexible and imaginative alternative that mimics natural animal movements. This approach may enhance participation and enjoyment, particularly among younger individuals.

Individuals with Down syndrome typically face

Table 1. Characteristics of research subjects

Parameters	n	Minimum	Maximum	Mean	Std. Deviation
Age, yrs	12	7.00	14.00	10.25	2.31
Body height, m	12	0.93	1.47	1.17	0.37
Body weight, kg	12	13.10	38.50	25.72	7.91
Body mass index, kg/m^2	12	14.10	18.15	16.12	1.50

Table 2. Assessment of upper body and lower body muscles baseline (pre) and 6 weeks (post)

Parameters	n	Animal Movement Exercises		95% CI	p-value	ES
		Pretest	Posttest			
Leg muscle strength (kg)	12	8.83±2.37	11.17±2.52*	-2.83, -1.84	0.000	0.955
Grip muscle strength (kg)	12	7.75±2.34	10.67±2.64*	-3.34, -2.49	0.000	1.169
Coordination (repetitions)	12	3.67±1.72	6.33±2.06*	-3.08, -2.25	0.000	1.404
Balance (seconds)	12	5.58±2.24	7.50±3.06*	-2.71, -1.13	0.000	0.715

Note: CI - Confidence interval; ES = Effect size. *Significant difference from baseline (pre) at $p \leqslant 0.001$. Data are presented as mean ± standard deviation (SD). *p*-values were calculated using the paired sample *t*-test.

challenges such as hypotonia, which can lead to reduced muscle strength and impaired balance [14, 15]. In this study, participants demonstrated increases in leg muscle strength (from 8.83 kg to 11.17 kg), grip strength (from 7.75 kg to 10.67 kg), and coordination scores (from 3.67 to 6.33 repetitions). These statistically significant improvements reflect meaningful gains in functional performance. Notably, the effect sizes for coordination (1.404) and grip strength (1.169) are considered large. In clinical contexts, such effect sizes are relatively uncommon in short-term interventions, which may highlight the motivational and integrative potential of AMEs.

Nevertheless, these outcomes should be interpreted with caution. External factors such as participant motivation, facilitator support, natural growth, or unrecorded physical activity may have contributed to the observed improvements. Moreover, the absence of a control group limits the ability to attribute changes solely to the intervention.

Regular physical activity is essential not only for enhancing muscle strength but also for promoting overall health and reducing the risk of obesity, which is prevalent among individuals with Down syndrome [4, 16, 17, 18]. Balance, a fundamental component of daily mobility and independence, also improved in this study, with static balance time increasing from 5.58 to 7.50 seconds. This change is particularly relevant given the elevated risk of falls associated with postural instability in individuals with Down syndrome [12, 19]. Similar improvements have been reported in structured programs that specifically target balance and motor control [20, 21].

Several previous studies support the broader finding that physical interventions can improve motor capabilities among individuals with Down syndrome. Moraes et al. [22] found that hippotherapy significantly improved postural balance, dynamic balance, and functional task performance, reinforcing the therapeutic value of sensorimotor activities. Piñar-Lara et al. [23], in a systematic review and meta-analysis, demonstrated that virtual reality-based therapy significantly enhances balance and muscular endurance in children and adolescents with Down syndrome. Kolibylu Raghupathy et al. [24] reported that traditional Indian dance forms such as Bharatanatyam led to improvements in locomotor skills and balance. Similarly, McGuire et al. [25] observed that adapted dance programs enhanced motor abilities and increased participation.

These studies emphasize the importance of engaging, structured, movement-based interventions. However, most require specialized equipment, trained facilitators, or controlled environments. In contrast, animal movement exercises (AMEs) represent a low-cost, accessible, and playful alternative that can be implemented in schools or community settings without the need for sophisticated tools. Rather than proposing an entirely new paradigm, the present study contributes by contextualizing established motor-play approaches into a format that is practical, adaptable, and developmentally aligned with children's natural movement tendencies.

The practical implications of these findings are particularly relevant in low-resource environments. The imaginative and dynamic nature of animal movement exercises (AMEs) may foster motivation and consistency, which are critical factors for success in pediatric therapy. By integrating functional training with playful elements, AMEs offer a holistic and enjoyable motor experience that may support not only physical outcomes but also emotional engagement.

Study Limitations

However, several limitations of this study must be acknowledged. The small sample size limits the generalizability of the findings, and the absence of a control or comparison group reduces internal validity and prevents causal interpretation. Although the study was exploratory in nature, future research should employ more rigorous designs to confirm these results. In addition, the relatively short duration of the intervention and the lack of follow-up assessments limit the ability to draw conclusions about the long-term sustainability of the observed improvements. The study also did not control for potential confounding variables such as home routines, nutritional status, emotional support, or unmonitored physical activity outside the intervention, all of which may have influenced the outcomes.

To build a stronger evidence base, future studies should employ randomized controlled trial designs with larger and more diverse samples. Longitudinal follow-ups would help assess the persistence of motor improvements over time. Incorporating qualitative methods, such as feedback from participants and caregivers, could provide deeper insights into the acceptability, motivation, and perceived benefits of animal movement exercises. Moreover, integrating AMEs into broader developmental programs that target cognitive, behavioral, or social skills may enhance their value as part of multidisciplinary intervention strategies for children with Down syndrome.

Overall, the findings of this study support the feasibility and effectiveness of animal movement exercises as a functional and engaging intervention for improving motor performance in children with Down syndrome. The observed improvements in strength, coordination, and balance suggest that such exercises may serve as a valuable component within pediatric motor development programs, particularly when implemented in accessible and child-friendly environments.

Conclusions

This study highlights the potential of animal movement exercises (AMEs) as a developmentally appropriate and engaging physical activity strategy for children with Down syndrome. As a playful and adaptable approach, AMEs align with inclusive education and therapy goals and may contribute meaningfully to multidisciplinary support programs aimed at improving functional outcomes and quality of life in this population.

Funding

This research was funded by Universitas Negeri Surabaya (Indonesia) in 2024.

Conflict of interest

The authors declare that they have no conflicts of interest.

References

1. Kashi A, Dawes H, Mansoubi M, Sarlak Z. The Effect of a Physical Exercise Package on the Motor Proficiency of Students with Down Syndrome. *Iranian Journal of Pediatrics*, 2023;33(1). https://doi.org/10.5812/ijp-120408
2. Raharjo S, Yunus M, Pelana R, Azidin RMFR. The benefit of a four-week range of motion exercise on hand muscle strength in children with Down Syndrome. *Pedagogy of Physical Culture and Sports*, 2023;27(6): 481–486. https://doi.org/10.15561/26649837.2023.0606
3. Gupta S, Rao BK, Kumaran S. Effect of strength and balance training in children with Down's syndrome: a randomized controlled trial. *Clinical Rehabilitation*, 2011;25(5): 425–432. https://doi.org/10.1177/0269215510382929
4. Puspitosari A. Sandsack Physical Activity Increasing Balance Score in Children with Down Syndrome. *Jurnal Keterapian Fisik*, 2021; 49–57. https://doi.org/10.37341/jkf.v0i0.254
5. Rahmayanti A, Rahman F, Herlinawati I. The Effect of Combination of Core Stability Training and Lower Extremity Strength Training on Static Standing Balance Ability in a Child with Down Syndrome. *Journal of Advanced Multidisciplinary Research*, 2022;3(2): 71. https://doi.org/10.30659/jamr.3.2.71-78
6. Pawlikowski B, Betta ND, Elston T, Williams DA, Olwin BB. Muscle stem cell dysfunction impairs muscle regeneration in a mouse model of Down syndrome. *Scientific Reports*, 2018;8(1): 4309. https://doi.org/10.1038/s41598-018-22342-5
7. Saquetto MB, Pereira FF, Queiroz RS, Da Silva CM, Conceição CS, Gomes Neto M. Effects of whole-body vibration on muscle strength, bone mineral content and density, and balance and body composition of children and adolescents with Down syndrome: a systematic review. *Osteoporosis International*, 2018;29(3): 527–533. https://doi.org/10.1007/s00198-017-4360-1
8. Modesto EL, Oliveira LDS, Seron BB, Almeida EWD, Greguol M. Influence of skeletal maturation on physical fitness of young people with Down syndrome. *Revista Brasileira de Educação Física e Esporte*, 2020;34(3): 373–383. https://doi.org/10.11606/issn.1981-4690.v34i3p373-383
9. Shields N, Taylor NF, Wee E, Wollersheim D, O'Shea SD, Fernhall B. A community-based strength training programme increases muscle strength and physical activity in young people with Down syndrome: A randomised controlled trial. *Research in Developmental Disabilities*, 2013;34(12): 4385–4394. https://doi.org/10.1016/j.ridd.2013.09.022
10. Higgins JK, Kleimbaun AP. *Design methodology for randomized clinical trials*. Arlington (VA): Family Health International; 1985.
11. Paul Y, Ellapen TJ, Barnard M, Hammill HV, Swanepoel M. The health benefits of exercise therapy for patients with Down syndrome: A systematic review. *African Journal of Disability*, 2019;8. https://doi.org/10.4102/ajod.v8i0.576
12. Melo GLR, Neto IVDS, Fonseca EFD, Stone W, Nascimento DDC. Resistance training and Down Syndrome: A narrative review on considerations for exercise prescription and safety. *Frontiers in Physiology*, 2022;13: 948439. https://doi.org/10.3389/fphys.2022.948439
13. Zolghadr H, Yahyaei M, Sedaghati P, Ahmadabadi S. The impact of exercise interventions on postural control in individuals with Down syndrome: a systematic review and meta-analysis. *BMC Sports Science, Medicine and Rehabilitation*, 2025;17(1): 35. https://doi.org/10.1186/s13102-025-01096-4
14. Lim PQ, Shields N, Nikolopoulos N, Barrett JT, Evans AM, Taylor NF, et al. The association of foot structure and footwear fit with disability in children and adolescents with Down syndrome. *Journal of Foot and Ankle Research*, 2015;8(1): 4. https://doi.org/10.1186/s13047-015-0062-0
15. Winders P, Wolter-Warmerdam K, Hickey F. A schedule of gross motor development for children with Down syndrome. *Journal of Intellectual Disability Research*, 2019;63(4): 346–356. https://doi.org/10.1111/jir.12580
16. Ruiz-González L, Lucena-Antón D, Salazar A, Martín-Valero R, Moral-Munoz JA. Physical therapy in Down syndrome: systematic review and meta-analysis. *Journal of Intellectual Disability Research*, 2019;63(8): 1041–1067. https://doi.org/10.1111/jir.12606
17. Basil JS, Santoro SL, Martin LJ, Healy KW, Chini BA, Saal HM. Retrospective Study of Obesity in Children with Down Syndrome. *The Journal of Pediatrics*, 2016;173: 143–148. https://doi.org/10.1016/j.jpeds.2016.02.046
18. González-Agüero A, Vicente-Rodríguez G, Gómez-Cabello A, Ara I, Moreno LA, Casajús JA. A 21-week bone deposition promoting exercise

programme increases bone mass in young people with Down syndrome. *Developmental Medicine & Child Neurology*, 2012;54(6): 552–556. https://doi.org/10.1111/j.1469-8749.2012.04262.x
19. Carter K. The Effect of Vestibular Stimulation Exercises on Balance, Coordination, and Agility in Children with Down Syndrome. *American Journal of Psychiatry and Neuroscience*, 2018;6(2): 28. https://doi.org/10.11648/j.ajpn.20180602.11
20. Nahla M I, Elham El-Sayed S, Ehab Ragaa AE, Amr Abd El Ghafar AEH. Mechanical vestibular stimulation versus traditional balance exercises in children with Down syndrome. *African Health Sciences*, 2022;22(1): 377–383. https://doi.org/10.4314/ahs.v22i1.46
21. Ur Rehman Cheema R, Hafeez T, Mannan A, Sarfaraz M, Rehan Amjad M, Azhar M. Comparative Effects of Core Stability Exercises and Retro-walk on Balance and Coordination in Down Syndrome. *Journal of Health and Rehabilitation Research*, 2023;3(2): 363–369. https://doi.org/10.61919/jhrr.v3i2.149
22. Moraes AG, Copetti F, Angelo VR, Chiavoloni LL, David AC. The effects of hippotherapy on postural balance and functional ability in children with cerebral palsy. *Journal of Physical Therapy Science*, 2016;28(8): 2220–2226. https://doi.org/10.1589/jpts.28.2220
23. Piñar-Lara M, Cortés-Pérez I, Díaz-Fernández Á, Montilla-Ibáñez MDA, Sedeño-Vidal A, Obrero-Gaitán E. Virtual Reality-Based Therapy Can Enhance Balance and Muscular Endurance in Children and Adolescents with Down Syndrome: A Systematic Review with a Meta-Analysis. *Bioengineering*, 2024;11(11): 1112. https://doi.org/10.3390/bioengineering11111112
24. Raghupathy MK, Divya M, Karthikbabu S. Effects of Traditional Indian Dance on Motor Skills and Balance in Children with Down syndrome. *Journal of Motor Behavior*, 2022;54(2): 212–221. https://doi.org/10.1080/00222895.2021.1941736
25. McGuire M, Long J, Esbensen AJ, Bailes AF. Adapted Dance Improves Motor Abilities and Participation in Children With Down Syndrome: A Pilot Study. *Pediatric Physical Therapy*, 2019;31(1): 76–82. https://doi.org/10.1097/PEP.0000000000000559

Information about the authors:

Muhammad Asrul Sidik: (Corresponding author); https://orcid.org/0009-0004-4282-1007; muhammadsidik@unesa.ac.id; Department of Sports Coaching Education, Faculty of Sports and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Adi Pranoto: https://orcid.org/0000-0003-4080-9245; adipranoto@unesa.ac.id; Department of Sports Coaching Education, Faculty of Sports and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Fransisca Januarumi Marhaendra Wijaya: https://orcid.org/0000-0002-3417-1305; fransiscajanuarumi@unesa.ac.id; Department of Sports Coaching Education, Faculty of Sports and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

I Made Sri Undy Mahardika: https://orcid.org/0000-0003-3280-513X; madeundy@unesa.ac.id; Department of Sports Coaching Education, Faculty of Sports and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Andri Suyoko: https://orcid.org/0000-0001-6836-8731; andrisuyoko@unesa.ac.id; Department of Sports Coaching Education, Faculty of Sports and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Bayu Agung Pramono: https://orcid.org/0000-0002-9308-1289; bayupramono@unesa.ac.id; Departemen of Sport Coaching Education, Faculty of Sport and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Achmad Rizanul Wahyudi: https://orcid.org/0000-0002-3499-0941; achmadrizanul@unesa.ac.id; Departemen of Sport Coaching Education, Faculty of Sport and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Mohammad Faruk: https://orcid.org/0000-0001-6334-4298; mohammadfaruk@unesa.ac.id; Departemen of Sport Coaching Education, Faculty of Sport and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Nuril Sri Wulandari: https://orcid.org/0009-0005-2609-5815; nuril.23356@mhs.unesa.ac.id; Departemen of Sport Coaching Education, Faculty of Sport and Health Science, Universitas Negeri Surabaya; Jawa Timur, Indonesia.

Bekir Erhan Orhan; https://orcid.org/0000-0002-3149-6630; bekirerhanorhan@aydin.edu.tr; Faculty of Sports Sciences, Istanbul Aydin University; Istanbul, Turkey.

Cite this article as:

Sidik MA, Pranoto A, Wijaya FJM, Mahardika IMSU, Suyoko A, Pramono BA, Wahyudi AR, Faruk M, Wulandari NS, Orhan BE. The effect of animal movement exercises on improving upper and lower body muscles in children with down syndrome. *Pedagogy of Physical Culture and Sports,* 2025;29(3):204–210. https://doi.org/10.15561/26649837.2025.0306

Received: 08.05.2025
Accepted: 15.06.2025; Published: 30.06.2025