



BASES EXPERT STATEMENT

THE ROLE OF PRESCRIBED EXERCISE FOR PROMOTING PHYSICAL AND COGNITIVE HEALTH FOR PEOPLE LIVING WITH DOWN SYNDROME

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Dan Gordon, Dr Marie Gernigon, Dr Matt Jewiss, Dr Nicolas Oreskovic and Miss Laura La Chance

Down Syndrome (DS) is the most prevalent global chromosomal disorder attributed to ~1 in every 700 births annually. Often referred to as Trisomy-21, it is the result of the presence of either the whole or part of an additional duplication of chromosome-21 which has been attributed to alterations in physiological, biochemical, anatomical, cognitive, and metabolic profiles. Such characteristics include chronotropic incompetence, neuromuscular conditions such as hypotonus, reduced lung function, immunological suppression as well as impaired decision making, verbal reasoning, processing, attention, and problem solving (Klotzbier *et al.*, 2022). However, the degree of intellectual disability and the severity of DS classification may vary within individuals. For instance, one individual may have mild characteristics associated with attention and memory whereas

a second individual may have more profound characteristics. An increased risk for co-occurring medical conditions in DS including conditions such as autism spectrum disorder, obesity, sleep apnoea, joint arthropathies, and early onset dementia can further impact health and mobility (Barr & Shields 2011). There is also strong evidence that, as a population, people living with DS do not meet the recommended minimum for daily exercise or physical activity (Oreskovic *et al.*, 2020). Yet when people living with DS are provided with the necessary support and resources, they flourish within society (Down Syndrome UK., 2020). The purpose of this Expert Statement is to present current evidence as to the benefits of prescribed exercise for those living with DS on both physical and cognitive health and to reflect upon the challenges faced by this community.

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THE GENERATIONAL CLOCK IS TICKING

The comorbidities associated with DS would appear to change in accordance with phases of the lifespan. Life expectancy has improved considerably increasing from just 5 years in the 1950's to roughly 60 years in the 2020's which is a marked improvement but still represents a survival deficit of around 20 years when compared to the general population (Lulita *et al.*, 2022). This will be the first generation of those living with DS who will outlive their parents and primary caregivers, hence as a scientific community we need to be proactive in providing exercise guidelines that meet the needs of this community.

The World Health Organisation (WHO) recommend that all adults, including those with atypical development, should engage in at least 150 min of moderate intensity exercise or 75 min of vigorous intensity exercise per week. Despite these recommendations, it has been observed that adults with DS engage in as little as 10.1 ± 13.5 min of moderate intensity coupled with 1.7 ± 9.8 min of vigorous activities per day. Additionally, adults with DS were engaged in 412.7 ± 216.6 min of sedentary time per day (Oreskovic *et al.*, 2020). These values are comparable to age matched non-DS populations who undertake similar amounts of sitting but complete slightly more moderate intensity exercise (Hagstromer *et al.*, 2010).

MISCONCEPTIONS ABOUT EXERCISE FOR ADULTS LIVING WITH DS

The benefits of exercise for physical and cognitive health in the general population are well understood (Bernstein *et al.*, 2018). However, for people living with DS, clear misconceptions exist. One common misconception is that people living with DS cannot or should not exercise (Canadian Down Syndrome Society, 2024). Some parents are even warned by healthcare providers against their child overexerting themselves or are told that there are physical actions their child will never be able to perform. While there are exceptions to every rule (e.g., an individual living with DS could have a medical diagnosis that prevents them from exercising "too vigorously"), current data shows that, for most people living with DS, regular exercise is beneficial (Bahiraei *et al.*, 2023; Merzbach *et al.*, 2023; Merzbach *et al.*, 2024). These misconceptions in childhood pervade through to habits in adulthood reflecting the poor exercise adherence and engagement characteristics. Hence, related to these misconceptions, the challenge is thus threefold:

1. Overcome misconceptions about the efficacy of exercise for individuals with DS.
2. Provide clear informed guidance on the physical, and cognitive, benefits of exercise.
3. Work with people living with DS to provide support on the role of exercise in lifestyle enhancement.

EXERCISE RECOMMENDATIONS FOR PEOPLE LIVING WITH DS

A recent meta-analysis (Bahiraei *et al.*, 2023) highlighted that there is a dearth of well-controlled studies examining the impact of prescribed exercise on physical and psychosocial health in adults with DS. Of the initial 1510 articles identified only 389 referred to exercise and DS, and only 10 of these met the criteria for inclusion in the review, such as adopting randomised controlled trials. Of those articles selected only 292 participants were included, which decreases to just 128 when controls are removed, with most studies also failing to report characteristics such as the severity of the intellectual impairment. Building from this, more recent evidence (Merzbach *et al.*, 2023; Merzbach *et al.*, 2024), which reflects collaborations with the DS community, and wider stakeholders, underpins a stronger argument for prescribed exercise in promoting physical and cognitive health for people living with DS. Prescribed exercise in the form of walking for just 30 min a day three times a week over an eight-week period, has demonstrated significant and life changing responses. Specifically, cardiorespiratory health was shown to increase by nearly 11.5%, improvements in cognitive processing skills such as vigilance increased by 32%, and selective attention was increased by 38% (Merzbach *et al.*, 2023). Moreover, prescribed exercise was associated with improved self-efficacy scores from significantly below

the international standards before the exercise intervention to exceeding international standards post-intervention. (Merzbach *et al.*, 2024). Mood states were also shown to be improved with tension, depression, anger, fatigue, and confusion all decreasing because of prescribed exercise (Merzbach *et al.*, 2024). The benefits though go beyond just the physical and cognitive with prescribed exercise being associated with both autonomy and quality of life, both of which are crucial when considered in the context of the increasing lifespan of this population.

WHY DO WE SEE THESE EXERCISE-RELATED BENEFITS FOR PEOPLE LIVING WITH DS?

There are profound issues of coordination and motor control within people living with DS that decline with age (Rigoldi *et al.*, 2011). Ambulatory exercise such as walking acts as a cerebral modulator stimulating the direct and indirect locomotor pathways of the brain. Walking necessitates that people living with DS remain attentive to the immediate task, activating the information-movement cycle resulting in increased vigilance. Consequently, walking demands heightened awareness from participants regarding their actions, as evidenced by the results of cognitive tests for sustained attention in relation to optic flow (Merzbach *et al.*, 2023).

CONCLUSIONS AND RECOMMENDATIONS

Reducing health risks and maintaining a healthy lifestyle through the application of exercise are paramount as people with DS continue to age (Canadian Down Syndrome Society, 2024). There has been a dramatic increase in the life expectancy for people living with DS, a statistic that should be celebrated. However, it also means that continued research into physical and cognitive health is more vital than ever. High quality data specific to individuals with DS will only serve to provide

greater insight into this population's healthcare needs, allowing caregivers the opportunity to foster healthier routines earlier in life. Current recommendations should be to utilise exercise that requires locomotive control that can be undertaken in a group or community or family setting (Mahy *et al.*, 2010). Walking seems an obvious low cost, minimal resource solution aiming for around 90 min per week.

The challenges to the exercise science community and people living with DS are clear and future research should more robustly determine:

- The optimal intensity of exercise to promote both physical and cognitive development?
- The nature of the exercise [task complexity] increase the degree of cognitive development?
- Do exercise patterns promoted in childhood lead to sustained habits in adulthood? ■



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REFERENCES

- Bahiraei, S. et al. (2023).** Effects of exercise programs on cardiovascular responses in individuals with down syndrome: A systematic review and meta-analysis. *Preventive Medicine Reports*, p. 102521.
- Barr, M.A.S.N. et al. (2011).** Identifying the barriers and facilitators to participation in physical activity for children with Down syndrome. *Journal of Intellectual Disability Research*, 55, 1020-1033.
- Bernstein, E.E. et al. (2018).** Exercise as a buffer against difficulties with emotion regulation: A pathway to emotional wellbeing. *Behaviour Research and Therapy*, 109, 29-36.
- Canadian Down Syndrome Society. (2024).** 3 :21 Canadian Down Syndrome Society Magazine. Available: <https://cdss.ca/wp-content/uploads/2024/02/321-magazine-Bridging-The-Knowledge-Gap-Spring-2024.pdf>
- Down Syndrome Society UK. (2020).** Written evidence from the Down's Syndrome Association (DEG0125). Available: <https://committees.parliament.uk/writtenevidence/19198/pdf>
- Hagstromer, M. et al. (2010).** Comparison of a subjective and an objective measure of physical activity in a population sample. *Journal of Physical Activity and Health*, 7, 541-550.
- Klotzbier, T.J. et al. (2022).** Associations of motor performance and executive functions: comparing children with Down Syndrome to chronological and mental age-matched controls. *Children*, 9, 73.
- Iulita, M.F. et al. (2022).** Association of Alzheimer disease with life expectancy in people with Down syndrome. *JAMA network open*, 5(5), pp.e2212910-e2212910.
- Mahy, J. et al. (2010).** Identifying facilitators and barriers to physical activity for adults with Down syndrome. *Journal of Intellectual Disability Research*, 54, 795-805.
- Merzbach, V. et al. (2023).** Impact of Prescribed Exercise on the Physical and Cognitive Health of Adults with Down Syndrome: The MinDSets Study. *International Journal of Environmental Research and Public Health*, 20, 7121.
- Merzbach, V. et al. (2024).** The Effects of Prescribed Physical and Cognitive Exercise on Life Satisfaction, Self-Efficacy and Mood States in Adults with Down Syndrome: The MinDSets Study. *International Journal of Environmental Research and Public Health*, 25, 610.
- Oreskovic, N.M. et al. (2020).** Physical activity patterns in adults with Down Syndrome. *Journal of Applied Research in Intellectual Disabilities*, 33, 1457-1464.
- Rigoldi, C. et al. (2011).** Postural control in children, teenagers and adults with Down syndrome. *Research in developmental disabilities*, 32, 170-175.

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