Hypermobility Characterization in Participants with Down Syndrome Attending an Instructor Led Controlled Adaptive Exercise Setting

Bradley D. Clark[1,2], Amy L.B. Valdez[1], Daniela A. Rubin[1], FACSM

[1]Department of Kinesiology, California State University Fullerton, CA, [2]No Limits Learning Center, Brea, CA

Introduction

Down Syndrome (DS) is a chromosomal disorder present in 1 out of 800 life births, with 95% of cases presenting an extra copy of the 21st chromosome creating trisomy (1). Joint hypermobility (JHM) and hypotonia are features shown in people with DS potentially accounting for poor joint dynamic stability and difficulty in daily functions (2). Resistance training has potential for reducing joint hypermobility and improving functional strength (3). Adaptive Exercise Programs adapt not only to the physical limitations of people with disabilities, but also to behavioral and intellectual challenges.

Purpose

This study characterized JHM and related measures of range of motion and muscle strength in a sample of adults with DS attending an adaptive exercise program

Methods

- Participants included thirteen adults with DS.
- Participants attended an adaptive exercise program twice a week for >9 months. The program incorporated adaptive fitness by using progressions while implementing core and joint stabilizing exercises through group exercise.
- Active range of motion (AROM) measured a minimum of three times (median score reported) for: shoulder extension, hip extension, shoulder flexion, shoulder abduction, shoulder medial rotation, shoulder lateral rotation, hip flexion, hip abduction, hip adduction), hip medial rotation, hip lateral rotation, ankle dorsiflexion, ankle plantarflexion, subtalar inversion, and subtalar eversion in that order.
- The nine – point Beighton scale determined the prevalence of JHM.
- Isometric strength was measured using hand-grip dynamometry on the dominant side.
- Lower body strength was measured using the 30-second sit-to-stand test.

Table 1. Participant characteristics presented as frequency (N) and mean (standard deviation)

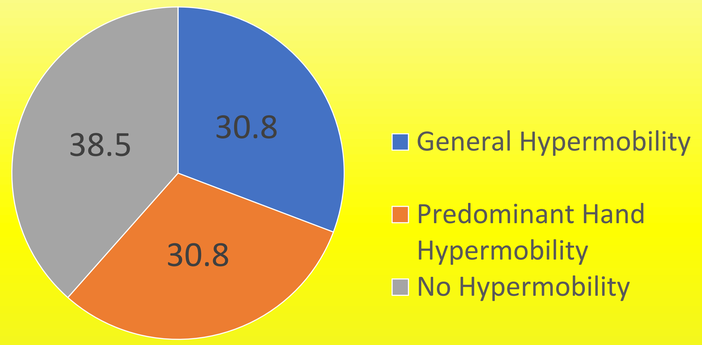
N = 13	Frequency Mean (SD)	Minimum	Maximum
Male/Female (N)	11/2		
Age (y)	28.46 (3.2)	24	34
Height (cm)	138.58 (45.8)	153	167
Body Mass (kg)	78.22 (15.0)	52	109

Table 2. Participants active range of motion and strength

	Mean	Minimum - Maximum	Norms for Healthy Adults
Shoulder Extension	21 (9)	10 – 37	50 – 60
Shoulder Flexion	179 (10)	160 – 202	150 – 180
Shoulder Abduction	175 (8)	160 – 184	180
Shoulder Medial Rotation	59 (13)	38 – 79	70 – 90
Shoulder Lateral Rotation	86 (12)	67 – 113	90
Hip Extension	14 (6)	0 - 26	30
Hip Flexion	94 (14)	67 – 119	100 – 120
Hip Abduction	28 (8)	12 – 37	40 – 45
Hip Adduction	17 (5)	10 – 24	20 – 30
Hip Medial Rotation	32 (3)	23 – 44	40 – 45
Hip Lateral Rotation	32 (6)	22 – 38	45 – 50
Ankle Dorsiflexion	17 (8)	8 – 38	20
Ankle Plantarflexion	45 (8)	33 – 60	40 – 45
Subtalar Inversion	26 (6)	16 – 33	30 – 35
Subtalar Eversion	19 (10)	8 – 36	15 – 20
Hand Grip (kg)	26.4 (6)	16.1 – 36.1	53.1 (10.4) (M) 33.1 (6.4) (F)
30s sit-to-stand (reps)	20 (6)	13 – 33	23 (M) 21 (F)

*All range of motion measurements are measured in degrees (5). Hand Grip Dynamometer norms are means for 20 – 29 years old Males (M) and Females (F) (4). Thirty seconds sit-to-stand test reference include 60 – 64 years old M and F that scored in the 95th percentile (5).

Figure 1. Joint hypermobility prevalence (%)



Discussion

Participants showed lower AROM for some joints and movements compared to published norms in healthy adults (5) potentially because of the persistent hypotonia (2). Most participants presented JHM in their hands (50% of 8) compared to participants who presented JHM in most joints (30.8%). Most participants did not show general JHM (69.3%) potentially because the strengthening exercises in the program focused on large muscle groups with less emphasis on muscles of the wrist or hand.

As expected, strength values were much lower than norms in healthy adults, likely due to hypotonia (2). Values of grip strength were comparable; values of lower body strength were 25% higher than in previous studies in DS (6). Possibly because the adaptive program focused on core and multi-joint strengthening exercises. Future studies should evaluate potential changes in JHM, AROM and muscle strength in response to adaptive exercise training including hand or wrist exercises.

Conclusion

Adults with DS who attended an adaptive exercise program show need to improve flexibility despite the presence of hypermobility. Participation in strengthening exercises likely contributed to fair-good lower body strength.

References

1. Rogers, K, (2011). *New thinking about genetics* (1st ed.). New York, NY: Britannica Educational Publishing.
2. Galli, M., Rigoldi, C., Brunner, R., et al. (2008). Joint stiffness and gait pattern evaluation in children with Down syndrome. *Gait & Posture*, *28*(3), 502-506.
3. Smith, T. O., Bacon, H., Jerman, E., et al. (2014). Physiotherapy and occupational therapy interventions for people with benign joint hypermobility syndrome: A systematic review of clinical trials. *Disability and Rehabilitation*, *36*(10), 797-803.
4. Beam, W.C., & Adams, G.M. (2019). *Exercise physiology: Laboratory Manual* (8th ed.). New York, NY: McGraw-Hill Education.
5. Heyward, V. H. (2010). *Advanced Fitness Assessment and Exercise Prescription* (6th ed.). Champaign, IL: Human Kinetics.
6. Boer, P.H., & Moss. S.J. (2016). Test-retest reliability and minimal detectable change scores of twelve functional fitness tests in adults with Down syndrome. *Research in Developmental Disabilities, 48*, 176-85.