Improving Active Range of Motion of Athletes with Down Syndrome Through Strength Training

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Introduction

• Successful athletes typically possess a combination of strength and dynamic flexibility
  – *Active Range of Motion (AROM):* the range of motion that athletes can produce themselves; significantly correlated with sport performance (Brandon, 2002).
  – Flexibility and strength both contribute to the AROM (Roberts & Wilson, 1999).

• This presents a unique challenge for athletes with Down syndrome due to various physical limitations and health issues associated with each of these components.
Down Syndrome

• Affects more than 300,000 individuals in the US alone.
  – In 95% of those with Down syndrome, trisomy 21 (three rather than 2 genes on the 21\textsuperscript{st} chromosome) is the cause (Hayes & Batshaw, 1993).

• Gross motor developmental delays due to:
  – 1. Hypotonia
  – 2. Ligamentous laxity
  – 3. Deficient muscular strength
  – 4. Short limbs

• Potentially limits AROM and, ultimately, performance in the Special Olympics athlete.
Previous Research

• Strength training has been found to result in increased passive flexibility and AROM in older women (Raab et al., 1988) and older men (Fatouros et al., 2001).

• Application of resistance in training also resulted in increased AROM in youth gymnasts (Sands & McNeal, 2000) — but strength was not measured as an outcome.

• Application and efficacy for a unique population such as the athlete with Down syndrome has not been investigated.
  – Weight training programs have been successfully applied to the Special Olympics athlete (e.g., Wekesa & Onsongo, 1992), but the only measured outcome has been medals won.
Purpose

• To determine the effects of a dynamic resistance and flexibility training program on strength and AROM in Special Olympics Athletes with Down syndrome.
Method

- **Participants:**
  - Active Special Olympics participants diagnosed with Down syndrome ($N = 11$). All participants were preparing for their Summer Games.
Method

**Measures:**

- **Strength:**
  - 8RM Bench Press
  - 8RM Leg Press
- **Upper Body AROM:**
  - Shoulder Flexion
  - Shoulder Extension
- **Lower Body AROM:**
  - Hip Flexion
  - Hip Extension
  - Hip Abduction
Method

• Procedures:
  – 1 week orientation period prior to initial testing
  – Each testing session consisted of a 5-10 minute general warm-up followed by AROM measurements and then 8RM testing.
  – After the initial testing, the athletes participated in an 8 week resistance training program.
    • 2 days/week (1 upper, 1 lower)
    • 3 sets of 6 exercises
    • 90-100% of 8RM with 60s rest between sets
Sample Workouts

- **Upper Body**
  - Bench Press
  - Seated Row
  - Shoulder Press
  - Post. Deltoid
  - Triceps Pushdown
  - Biceps Curls

- **Lower Body**
  - Leg Press
  - Leg Extension
  - Wall Squat
  - Leg Curls
  - Abduction
  - Adduction

+ Core/Ab

+ Core/Ab
### Results: Strength

#### Bench Press

- **Pre:** 30 kg
- **Post:** 40 kg
- **Change:** 6.4 ± 1.2 kg
  - *P* < .001; ES = 0.27

#### Leg Press

- **Pre:** 6.4 kg
- **Post:** 14.0 kg
- **Change:** 14.0 ± 2.2 kg
  - *P* < .001; ES = 0.33
Results: Shoulder AROM

Shoulder Extension

29.9 ± 3.7°

P < .001; ES = 1.64
Results: Hip AROM

**Hip Flexion**

- **Pre:** 20.4 ± 5.8°
- **Post:** 13.4 ± 3.5°

*P* < .01; ES = 0.87

**Hip Extension**

- **Pre:** 70
- **Post:** 80

*P* < .01; ES = 1.19
Results: Hip AROM

Hip Abduction

Time of Assessment

20.3 ± 3.5°

P<.001; ES = 1.15
Discussion

• Findings suggest that athletes with Down syndrome can tolerate and adapt to a high-intensity resistance training program and experience significant improvements in both strength and AROM.
  – This may impact joint laxity concerns due to muscular stabilization.
  – Increased AROM & strength can enhance performance.
Health Implications

• For the individual with Down syndrome, decreasing joint laxity and hypotonia may decrease the chances of:
  – 1. Developing hip abnormalities (i.e., dysplasia & dislocation)
  – 2. Developing degenerative arthritis
  – 3. Injury

(Angelopoulou et al., 1999; Gannon & Bird, 1999; Hayes & Batshaw, 1993; Shaw & Beals, 1989)
Lifestyle Considerations

• Opportunity to become healthier and feel stronger
• Way of becoming integrated into the community
  – Enjoyment working out with friends
• Increased independence
• Enhanced confidence?
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