Article

Hjalmarsson, E., Fernandez-Gonzalo, R., Lidbeck, C., Palmcrantz, A., Jia, A., Kvist, O., Pontén, E. & von Walden, F. RaceRunning training improves stamina and promotes skeletal muscle hypertrophy in young individuals with cerebral palsy. *BMC Musculoskeletal Disorders* 21, 193 (2020). https://doi.org/10.1186/s12891-020-03202-8

Adaptive Sport/Recreation Categories:

- Sports/physical activity performance,
- Exercise prescription.

Research Questions

- Does cardiorespiratory endurance increase with training in individuals with CP?
- Does skeletal muscle thickness increase with RaceRunning training?
- Is the passive range of motion of the hip, knee and ankle affected by RaceRunning training?

Methodology

- Fifteen adolescents/young adults (range 9–29 years) with cerebral palsy completed 2 sessions per week for 12 weeks of RaceRunning training in a community setting in Sweden. RaceRunning involves a specific 3 wheeled device with a saddle and chest support to promote high intensity exercise in individuals with limited ambulation capability.
- Measurements were collected pre and post intervention and included:
  - cardiovascular endurance reflected by 6-min RaceRunning test (6-MRT), average and maximum heart rate, rate of perceived exertion using the Borg scale (Borg-RPE) for cardiorespiratory endurance.
  - skeletal muscle thickness through ultrasound of vastus lateralis, vastus intermedius and medial gastrocnemius muscle of the more-affected leg for skeletal muscle thickness.
  - hip, knee and ankle passive range of motion.

Results

- After 12 weeks of RaceRunning training results were:
- All participants increased running distance on average 34% following training (6-MRT distance; pre 576 ± 320m vs. post 723 ± 368 m, $p < 0.001$) and increased mean top speed by an average of 21%. No other cardiovascular changes occurred.
- The thickness of the medial gastrocnemius muscle on the more-affected leg increased by 9% in response to training ($p < 0.05$) but no significant change occurred in other muscles.
- Passive hip flexion increased ($p < 0.05$) on the less-affected side and ankle dorsiflexion decreased ($p < 0.05$) on the more-affected side after 12 weeks of RaceRunning training.

Discussion/Conclusion

- Positive cardiorespiratory gains occurred following RaceRunning training twice a week.
- Unexpected skeletal muscle gains following endurance training may be due to low activity level starting point of participants and trainable skeletal muscle properties of muscle in cerebral palsy.

- Range of motion findings may not be clinically significant.
- Overall, results support the efficacy of RaceRunning as a training modality for young people with cerebral palsy GMFCS I-IV in promoting cardiorespiratory and peripheral adaptations.

Article Strengths
- Involved adolescents and young adults with GMFCS level I-IV – both age and GMFCS range are seldom studied.
- Participants recruited were all interested and motivated to RaceRun and all had experience in RaceRunning previously (between 3 months to 3 years) but none in structured programme.
- All participants were able to work at moderate intensity and achieved high training zone heart rates.

Article Weaknesses
- Small heterogeneous sample size.
- Assessors not blinded for any outcome measures but were consistent.
- Training was not individualised or based on participant goals.
- Improved skeletal muscle size does not indicate improved strength or function, neither of which were tested.
- No follow up data beyond the intervention.
- Measures focused at body structure and function level. No measures of changes in participation, ADLs, or quality of life therefore unsure of functional, everyday benefits.
- No training adverse events noted.

Take Home Messages
- RaceRunning may provide an opportunity for young people with cerebral palsy GMFCS I-IV to improve cardiorespiratory endurance and skeletal muscle size.
- However, the carryover to functional tasks, participation, or quality of life is unknown and requires additional research.