CHANGES IN FLEXIBILITY DO NOT INFLUENCE RUNNING MOVEMENT PATTERNS OR ECONOMY
Moltubakk Marie, Eriksrud Ola, Smith Gerald (Norwegian School of Sport Sciences, Norway)

Previous studies suggest that one factor contributing to the wide range of running economies observed within a group is runner flexibility. Runners with greater flexibility tend to have poorer economy than runners with more restricted ranges of motion. Flexibility training programs aim to increase joint ranges of motion (ROM). Does this affect running economy at the same time?

**Methods:** 17 active subjects (TRA) participated in 18 ± 2 bouts of stretching across 6 weeks. Each subject performed 1 – 4 exercises, depending on initial flexibility criteria: <25° ankle dorsiflexion, <90° hip flexion (straight leg raise), <0° hip extension (Thomas test), <50° inwards hip rotation as measured by goniometry in supine or sitting positions. Each exercise consisted of 4 x 1 minute passive stretching and 3 x 10 dynamic motions towards end range, all performed in standing positions without support and on both sides. The total load was 4290 ± 391 seconds per exercise/side. Standard measurements of running economy and kinematics (2D sagittal model) during treadmill running at 60, 70, 80% of VO2max were recorded. Regression across speeds was used to predict VO2 at a common speed of 3.5 m/s. Training group characteristics were compared to a control group of 9 active subjects (CON).

**Results:** The training group had significant increases of passive ROM at the ankle (5.8 ± 1.4°), and hip internal rotation (7.1 ± 4.6°) compared to CON (p < .05), while hip flexion increases (11.5 ± 9.4°) and hip extension increases (1.6 ± 2.9°) were not significantly different from CON. Running economy did not change in TRA compared to the CON group over the training period (p=.30). Kinematic characteristics during running (min and max joint angles, ankle angle at heel strike and heel off, hip angle at toe off, stance time and step length) did not systematically change over the training period for either group.

**Discussion:** Although the stretching program was designed to imitate positions and motions of running, the observed changes in passive ROM were not reflected in running kinematics or economy. In subjects with restricted ROM, stretching might be thought to contribute to a longer running stride with increased hip and ankle ROM. But, though passive ROM increased with flexibility training, running kinematics were unaltered. Factors influencing running economy are complex and include biomechanical, physiological and psychological contributions. From results of the present study, passive joint ROM does not appear to be a major contributor to running economy.

**Conclusion:** A 6-week stretching program did not influence economy or kinematics in runners.

**Keywords:** Flexibility/Range of Motion, Economy

12th Annual Congress of the ECSS, 11–14 July 2007, Jyväskylä, Finland