STRENGTH TRAINING AND THE MENSTRUAL CYCLE: A PILOT STUDY ON MUSCULAR STRENGTH, MACROSCOPIC AND MICROSCOPIC PARAMETERS

Han, A., Sung, E., Weber, S., Bloch, W., Platen, P.
Ruhr-University Bochum

Purpose: The menstrual cycle is divided into 2 main phases, the follicular and the luteal phase. Each phase is characterized by a certain profile of different hormones. Menstrual cycle specific regulation of many hormones is not clear so far. This is especially true for the interaction between estradiol, human growth hormone (hGH), and IGF-1, all of them possible anabolic hormones on the level of the muscular cell and therefore important supporting factors during strength training. We, therefore, decided to conduct a pilot study in order to investigate possible different effects of follicular phase-based (FT) versus luteal phase-based (LT) strength training on strength parameters, muscle volume and muscle cell type and diameters.

Methods: Two healthy eumenorrheic women (P1, P2) completed a strength training program for 3 menstrual cycles (approx. 12 weeks). Exercises included biceps curl, triceps press, leg extension, leg curl, calf raise and hip extension. The subjects performed FT with muscle groups of the right side of the body and LT with muscle groups of the left side of the body. FT was organized 4 times a week in the follicular phase and once a week in the luteal phase, and LT was organized 4 times a week in the luteal phase and once a week in the follicular phase. Maximum isometric force (ISOmax) and maximum dynamic force (DYNmax) were measured for each major muscle group prior to, during (5 times per cycle), and after training. Muscle diameters (DM) were measured by means of ultrasound in all respective muscle groups, and muscle fiber composition, fiber diameters and numbers of cell nuclei were analyzed in muscle biopsies from the musculus vastus lateralis of both legs, prior to and after the training program.

Results: Mean ISOmax values of all muscles increased by 29% after FT as compared to 19% after LT. Mean DYNmax values of all muscles increased by 46% after FT and by 38% after LT. Mean DM of all muscles increased by 5.3% after FT and by 3.3% after LT.

Analysis of fiber composition revealed unclear results. Fiber diameter, however, showed clear trends: type II muscle fiber diameters increased more after FT as compared to LT. Values were (prior to/after training): FT: P1 type IIa: 53/64 um, type IIb: 39/55 um; P2 type IIa: 43/57 um, type IIb: 37/49 um; LT: P1 type IIa: 64/54 um, type IIb: 48/42 um; P2 type IIa: 62/59 um, type IIb: 47/49 um. Type I fibers showed unclear developments.

Moreover, the increase in cell nuclei numbers was higher after FT (P1: +5.4%, P2: +20%) as compared to LT. (P1: -19%, P2: +6.5%)

Conclusions: A follicular phase-based strength training showed more pronounced effects on muscle strength as well as macroscopic and microscopic parameters as compared to a luteal phase-based training. This is probably due to the specific hormonal milieu during each phase of the cycle. More subjects have to be included in order to further analyze menstrual cycle specific training effects.

The study was supported by Bundesinstitut für Sportwissenschaft, Bonn (IIA1/070110/08)

Keywords:
Menstrual cycle, Strength training, muscle biopsy