STRENGTH TRAINING AND THE MENSTRUAL CYCLE: EFFECTS OF FOLLICULAR- AND LUTEAL PHASE-BASED TRAINING ON MUSCULAR STRENGTH AND MUSCLE DIAMETER IN SUBJECTS WITHOUT ORAL CONTRACEPTION

Sung, E., Han, A., Hinrich, T., Platen, P.
Ruhr-University Bochum

Purpose: The follicular and the luteal phase of the menstrual cycle (FO and LU) are 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 (E2), 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, investigated possible different effects of follicular phase-based versus luteal phase-based strength training (FT and LT) on strength parameters and muscle volume.

Methods: 16 healthy eumenorrheic untrained or moderately trained women (age: 24.9 ± 4.8 yrs, height: 162.5 ± 5.3 cm, weight: 56.7 ± 5.1 kg) completed a strength training program of the m. quadriceps femoris for each leg on the Leg Press for 3 menstrual cycles (approx. 12 weeks). The subjects were divided into group A and group B. Group A performed FT with the right leg and LT with the left leg and vice versa for Group B. FT was organized 4 times a week in FO and once in LU, and LT was organized 4 times a week in LU and once a week in FO. Blood samples were taken on 11th day in FO and on 25th day in LU of menstrual cycle to analyze values of E2, progesterone (Prg), FSH, LH, total testosterone (tT), free testosterone (fT), IGF-1, DHEA-S and hGH. Maximum isometric force (Fmax.iso) was measured for each right and left leg prior to, during (2 times per cycle), and after training. Muscle diameters (Mdm) were measured by means of ultrasound for M. quadriceps prior to and after training, and sum of Mdm of M. rectus femoris, M. vastus intermedius and M. vastus lateralis was calculated.

Results: LH, FSH, IT and IT were significant higher in FO as compared to LU, Prg was higher in LU, and E2, DHEA-S, hGH, and IGF-1 were not significantly different between the two phases. Fmax.iso increased significantly by 26.1 ± 11.6 kg (+43.9 %) after FT and by 19.3 ± 10.3 kg (+32.9 %) after LT. The increase of Fmax.iso after 3 month of follicular-based strength training (FT) was significantly greater than the increase after luteal-based training (LT). We found a clear trend (p=0.07) for a higher increase of Mdm after FT as compared to LT (+0.67 ± 0.55 cm (+11.7 %) vs. +0.46 ± 0.38 cm (+7.7 %) after FT and LT, respectively).

Conclusions: FT clearly showed more pronounced effects on muscle strength and muscle diameter as compared to LT. This is probably due to the specific hormonal milieu during each phase of the cycle. Further studies including detailed analysis of the hormonal profile though the menstrual cycle are needed in order to understand the underlying mechanisms on the cellular and molecular level of the skeletal muscle.

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Keywords:
menstrual cycle, hormone, strength training