

## Effects of Dietary Fish-oil Supplement and Acute Eccentric Exercise on Inflammatory Markers during Different Phases of Menstrual Cycle

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### ABSTRACT

Fish-oil supplementation may play a positive role in inflammation. Matrix Metalloproteinases (MMPs) are important in controlling tumor growth, metastasis, angiogenesis, and inflammation. Several tissue inhibitors of MMPs (TIMPs) are known to regulate the activity of specific MMPs. **PURPOSE:** To examine the effects of dietary fish-oil supplementation and acute eccentric exercise on MMP-1, -2, -9, and -10 and TIMP-1, -2, -3, and -4 during two different phases of menstrual cycle. **METHODS:** As a randomized, double-blind, and placebo-controlled design, 22 college-aged women (age= 20.86 ± 1.39 years) were randomly assigned to either a fish oil (FOG, N=11) or a placebo group (PG, N=11). Participants in the FOG ingested 6 capsules of fish oil per day (total 6.0g, containing 2.4g eicosapentaenoic acid and 1.8g docosahexaenoic acid), while the PG took 6 capsules of safflower oil per day for 3 weeks. Participants in each group performed an acute bout of eccentric single-leg exercise (10 sets of 10 repetitions with a 3-min rest between sets at an isokinetic speed of 30<sup>0</sup>/second) during the mid-follicular (MF) and mid-luteal (ML) phases. The leg exercised for the MF phase was randomly selected and the opposing leg exercised during the ML phase. Overnight blood samples were collected at baseline, 6-hr post-exercise (6hr-PE), and 24-hr PE during the MF and ML phases. Data were analyzed by a separate 2 x 2 x 3 ANOVA with repeated measures along with an appropriate post-hoc test for any significant interactions ( $p < 0.05$ ). **RESULTS:** A significant interaction effect ( $p=0.005$ ) in MMP-1 indicated that MMP-1 in the FOG (193.71±21.72 pg/mL) was higher than that of the placebo group (120.79±21.72 pg/mL) during the MF phase. Both TIMP-1 and -3 were significantly higher ( $p=.043$  and  $p=.037$ , respectively) in the FOG (68674.71±2238.56 and 3827.12±193.67 pg/mL, respectively) than the placebo group (62119.26±2178.86 and 3238.94±186.73 pg/mL, respectively). **CONCLUSION:** Acute eccentric exercise did not affect MMPs and TIMPs in healthy, young females. MMP-1 was the only proteinase affected by the menstrual cycle and a decrease in MMP-1 during the ML phase might be related to elevated estradiol levels. Elevated TIMP-1 and -3 following the 3-weeks of fish-oil supplementation suggested a potential anti-inflammatory effect of the fish-oil supplementation by inhibiting activation of MMPs. It is recommended that an extended period of fish oil supplementation be implemented to further examine its anti-inflammatory effect on other inflammatory biomarkers in different sample groups including both pre- and post-menopausal women.