

Relationship Between Matrix Metalloproteinases and Tissue Inhibitor of Metalloproteinases Following High-fat Diet and Acute Exercise

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ABSTRACT

Matrix metalloproteinases (MMPs) are involved in the degradation of the extracellular matrix of the tissue and inflammation. Several tissue inhibitors of MMPs (TIMPs) are known to inhibit the activity of MMPs.

PURPOSE: The current study investigated the responses of MMP-1, -2, -9, and -10 and TIMP-1, -2, -3, and -4 after a 3-week high-fat, low-carbohydrate (HFLC) diet following an acute aerobic exercise.

METHODS: Physically active (unprofessional, competitive marathon runners) male subjects (N=8, age= 39.5 ± 9.9 years) volunteered for the study. Subjects maintained their habitual high carbohydrate (HC) diets before switching to the HFLC diet (70% total caloric intake from fat, not exceeding 50 g of carbohydrates) for 3 weeks. Subjects performed an acute bout of aerobic exercise before and 24 hours after each HC and HFLC diet trial. The exercise protocol consisted of treadmill running at varying paces (personal race paces) for 50 minutes (split into 5, 10-minute periods with 2 minutes of rest in between). Following a 20-minute recovery, subjects additionally performed a 5-km time trial on an outdoor course. Overnight fasting blood samples were collected at pre- and 24-hours post-exercise for each diet trial to analyze changes in MMPs and TIMPs. The data were analyzed using an ANOVA [(HC and HFLC) X (pre- and post-exercise)]. If a significant interaction was found, a Tukey's post-hoc test was performed ($p < 0.05$). **RESULTS:** There was no significant difference in MMPs or TIMPs between the HC and HFLC diet trials, and an acute bout of aerobic exercise did not alter MMPs or TIMPs. There were, however, significant positive correlations between MMP-2 and TIMP-2 ($r(14) = 0.51, p = 0.01$) and MMP-9 and TIMP-2 ($r(14) = 0.49, p = 0.01$). Additionally, a significant negative correlation was found between TIMP-4 and MMP-4 ($r(14) = -0.57, p = 0.02$). **CONCLUSION:** A relatively short-term high-fat diet and an acute aerobic exercise did not influence serum MMPs or TIMPs in healthy, trained male runners. The activity of MMP-4 may be related to TIMP-4, while the activity of both MMP-2 and -9 may be dependent on TIMP-2. It is highly recommended that future studies focus on examining the effects of a long-term HFLC diet on metabolic pathways of circulating or tissue MMPs and TIMPs in a variety of populations.