

Acute Changes in Matrix Metalloproteinase Following Exercise in Smokers and Non-Smokers

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ABSTRACT

Matrix metalloproteinases (MMPs), also known as matrixins, are involved in the degradation of extracellular matrix of the tissue. Cigarette smoking and exercise may influence these molecules in the circulation. PURPOSE: The current study investigated the responses of MMP-1, -2, and -9 before and after a single bout of exercise performed at lower- and higher-intensity in smokers and non-smokers. METHODS: Physically inactive (N=18, physical activity < 2 days per week) male smokers (N=8, carbon monoxide \geq 16 ppm, smoking history > 2 years, smoking > 10 cigarettes per day) and non-smokers (N=10), the ages between 20 and 30, participated in the study. Participants exercised on a treadmill for 3 miles at two different intensities in random order (lower-intensity: 55% VO₂max and higher-intensity: 75% of VO₂max). Overnight fasting blood samples were collected before (PRE), immediately post-exercise (IPE), and 1-hr PE to examine the responses of MMP-1, -2, and -9. All data were analyzed using an ANOVA with repeated measure. If necessary, the Sidak's pairwise multiple comparisons and a follow-up simple effects test were used as post-hoc tests ($p < 0.05$). RESULTS: Only smokers significantly increased MMP-1 at IPE (1.88 \pm 0.19 ng/mL) by 22.08% from PRE (1.54 \pm 0.16 ng/mL, $p=0.014$), which then returned to the baseline value at 1-hr PE (1.45 \pm 0.15 ng/mL, $p=0.001$). The significant main effect for time indicated that MMP-2 at IPE (43.71 \pm 5.65 ng/mL) was significantly higher than PRE (25.68 \pm 3.27 ng/mL, $p= 0.011$) and 1-hr PE (28.04 \pm 3.34 ng/mL, $p=0.036$). Additionally, smokers had significantly higher MMP-9 (45.77 \pm 6.48 ng/mL, $p=0.037$) as compared with non-smokers (31.17 \pm 3.41 ng/mL). CONCLUSION: Regardless of exercise intensity, a single bout of exercise acutely increased both MMP-1, particularly in smokers, and MMP-2. However, this exercise-induced acute elevation of MMP-1 and MMP-2 returned to baseline values at 1-hour post exercise. A significantly higher level of MMP-9 observed in smokers may indicate that habitual cigarette smokers, as compared with non-smokers, may be more susceptible to a structural damage of extracellular matrix, endothelial inflammation, and an atherosclerotic event.