Biomarker Response After an Acute Running Bout in Participants with and without an Acute Knee Injury History

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Context: Individuals with an acute knee injury history (AKIH) are four times more likely to develop knee osteoarthritis (OA) than those without a prior knee injury. Unfortunately, we don’t know why AKIH patients develop OA. Changes in tissue turnover biomarkers after mechanical loading (e.g., running) may be related to abnormal tissue turnover but this has yet to be determined among young physically active individuals.

Objective: To determine biomarker concentration levels at pre exercise and concentration changes in response to an acute running bout in participants with AKIH in comparison to healthy control (CON) participants.

Design: Two-group pre-test/post-test. Setting: Research Laboratory. Participants: Based on a priori power computations, 22 physically active individuals between 18 to 25 years of age were recruited. AKIH participants (n=11, age: 20.1±1.1 years, height: 1.7±0.1 meters, weight: 74.4±14.0 kg, body mass index: 24.5±2.8 kg/m²) had an acute knee injury within 4 years of study participation and were medically cleared for physical activity. Eleven healthy CON participants with no AKIH (n=11, age: 19.9±1.6, height: 1.7±0.1 meters, weight: 73.4±14.4 kg, body mass index: 24.2±2.8 kg/m²) were matched by age, gender, mass, height, and physical activity level.

Interventions: The independent variable was group (AKIH or CON). Each participant provided a 7mL blood sample that was analyzed for biomarker concentrations pre and post a 30-minute run on a treadmill at 2.2 m/s. Wilcoxon Signed Rank Tests were conducted to determine if there were any significant group differences. Statistical significance was defined as \( p \leq 0.05 \), medians and [ranges] are reported.

Main Outcome Measures: Dependent variables of interest were serum biomarker concentrations for cartilage oligomeric matrix protein (COMP), pro-inflammatory marker interleukin (IL)-1β, and type II collagen synthesis marker (CPII). COMP, IL-1β, and CPII assays have mean intra-assay values of <8% and the mean inter-assay values <10% for all biomarkers.

Results: No significant group differences existed in serum biomarker concentrations pre exercise COMP (AKIH=610.30 [455.31-1252.21], CON=680.25 [285.92-1389.37]; \( p=0.424 \)), CPII (AKIH=2763.22 [1318.97-5691.86], CON=3153.37 [613.07-5491.43]; \( p=0.657 \)), and IL-1β (AKIH=2.48 [1.37-7.91], CON=1.81 [1.81-15.02], \( p=0.091 \)) or in serum biomarker changes pre to post exercise COMP (AKIH=9.60 [-565.79-881.25], CON= -283.92 [-744.09-970.41]; \( p=0.328 \)), CPII (AKIH= -1030.69 [-3025.95-15.02], CON = -283.92 [-3079.21-2052.84]; \( p=0.328 \)), and IL-1β (AKIH=1.50 [-5.13-5.81], CON= -0.49 [-3.58-1.36], \( p=0.182 \)) between groups.

Conclusions: The findings of this study indicate that an acute bout of moderate-intensity running is tolerated in a high-risk AKIH population and does not adversely affect knee biomarker metabolism. However, these findings should be interpreted with caution as it is yet to be determined if varied exercise types, frequencies, and/or intensities elicit adverse biomarker responses within this population or if these findings are replicable in other populations (e.g., older or younger). Word Count: 436