ABSTRACT

Irisin is a proteolytically cleaved fragment of the FNDC5 protein and is classified as a myokine because of its association with skeletal muscle activity and its role in communication between muscle and other tissues. Previous studies indicate that irisin may affect energy metabolism, skeletal muscle function, and processes involved in bone modeling and remodeling. However, most available data concern adult animals, models of osteoporosis, limb unloading, aging, or metabolic disorders. Much less is known about the effects of exogenous irisin during maturation, when growth, mineralization, muscle fiber development, and the formation of biomechanical properties of the skeleton occur simultaneously. The aim of this study was to determine whether exogenous irisin modulates the development of the musculoskeletal system in young Wistar rats and whether the character of this response depends on the anatomical location, structure, and function of the analyzed tissues. The study was performed on male and female Wistar rats from 3 to 7 weeks of age. Animals from the experimental group received recombinant rat irisin at a dose of 100 μg/kg body weight, administered intraperitoneally once weekly for four consecutive weeks. The mandible, femur, lumbar vertebrae, masseter muscle, gastrocnemius muscle, and superior longitudinal muscle of the tongue were analyzed. In bone tissue, morphometry, trabecular volumetric bone mineral density, microarchitecture, dynamic indices of bone formation, and mechanical properties were assessed. In muscle tissue, fiber diameter, the number of fiber profiles per 1 mm² of fascicle area, and the proportion of individual fiber classes were evaluated. Administration of exogenous irisin induced a differentiated response in the analyzed muscles and bones, without a clear effect on body weight. The obtained results indicate that exogenous irisin modulates the development of the musculoskeletal system in young rats; however, its action does not represent a uniform anabolic response. The effect depends on anatomical location, the function of the analyzed structure, and sex.

Keywords: FNDC5, Wistar rat, muscle fibers, micro-CT, bone biomechanics.