

**THIS LITTLE PIGGY WENT RUNNING,
THAT LITTLE PIGGY STAYED HOME:
A FORELIMB PERSPECTIVE OF LIMB LOADING**

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Variation in mechanical loading is known to influence chondral modeling. However, the interaction between chondrocyte behavior, skeletal morphology, and ontogenetic variation in activity patterns are variably understood. This hinders our knowledge of limb formation and function, whether plasticity varies within/among skeletal joints, and the limits of paleobiological inference. Here, the role of endurance exercise on the development of articular and growth plate cartilage in the humeral head was examined in 14 miniature swine (*Sus scrofa domestica*). One group (n=7) was subjected to graded treadmill running over a period of 17 weeks. A matched group (n=7) was kept pen-confined sedentary. Gross and microanatomical dimensions between groups were compared multivariately. H&E and Safranin-O staining were performed for histomorphometry and evaluation of variation in proteoglycan content of the cartilage extracellular matrix, respectively. Versus sedentary pigs, exercised pigs possessed relatively increased cellularity, thinner cartilage zones, larger chondrocytes, and greater humeral proportions. While articular *and* growth plate cartilage demonstrated between-cohort differences, growth plate cartilage in the humerus exhibited a greater load-induced response. Likewise, external measures were less effective than histomorphometry in diagnosing group membership. When compared to similar data on the femur from the same individuals, humerus parameters evinced similar patterns of variation between loading cohorts. Given the primary role of growth plate cartilage in limb elongation, this constitutes further experimental evidence that ontogenetic variation in locomotor activity can influence limb length in mammals. These findings regarding joint plasticity during high endurance behaviors have important implications for understanding limb biomechanics and joint development.