

# Evaluation of the Mechanical Properties of Cervidae Anterior Cruciate Ligaments, Patella Tendons, and Achilles Tendons

by

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The human anterior cruciate ligament (ACL) is in the knee joint and prevents the tibia (shin bone) from sliding in front of the femur (thigh bone). When the ACL is ruptured, the injury can be repaired using a replacement ligament in the form of an autograph, allograft, xenograft, or synthetic material. When replacement tissue is used it is important to understand and match the mechanical properties of the ACL tissue. In this study, deer tendons were tested to determine their ultimate strength, strain at fracture, and elastic modulus. These properties were compared across each tendon and with the physical properties of a human ACL. Cervidae (deer) tendons, including the ACL, patellar tendon, and Achilles tendon, were harvested from a local deer meat processor. The tendons were then frozen and tested later. To preserve the tendons after thawing, they were sprayed with a saline solution, and were tested for their tensile strength. The tensile test was conducted using an Instron universal testing machine. The machine recorded the force vs. displacement graph, which was used to determine the ultimate strength, strain at fracture, and elastic modulus of the tendons. The ACL had an ultimate strength of 20.7 MPa, a strain at fracture of 0.41, and an elastic modulus of 51.1 MPa. The Achilles had an ultimate strength of 16.6 MPa, a strain at fracture of 0.84, and an elastic modulus of 19.7 MPa. The Patellar tendon had an ultimate strength of 20.50 MPa, a strain at fracture of 0.467, and an elastic modulus of 43.89 MPa. It was determined that the ultimate tensile force for a human ACL was comparable to the maximum force for the patellar tendon, but higher than the Achilles or the ACL.