

## **Effect of Trail Running Pack Weight on Lower Extremity Biomechanics**

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### **ABSTRACT**

In the sport of ultrarunning there are a variety of ways runners carry the equipment and nutrition that is required. Many of the faster athletes will be seen with handheld bottles or minimal packs, however the size and weight of packs may vary based on the length of the race, nutritional needs, and pacing. **PURPOSE:** To date, no research has been conducted to understand what biomechanical adaptations occur with packs of varying weight. **METHODS:** Kinematic and kinetic data were collected using a 16 camera Vicon Nexus System (Vicon Inc. Denver, CO) and the Bertec instrumented treadmill (Bertec, Inc., Columbus, OH) system for 2 female, and 4 male runners averaging 10-30 miles a week. Reflective markers were placed on the lower extremities and chest. Condition 1 consisted of running at no pack weight and then three more conditions of 3, 6, and 9 percent body weight respectively. Participants would run for 5 minutes with a Salomon running vest at each weight. The study will focus on the changes in GRF and moments of the hip, knee, and ankle. **RESULTS:** The peak ground reaction force (GRF) had a slight increase in all weighted conditions in comparison to condition 1 (2-5%). Anterior and posterior GRF increased by about 7% in condition 3 and 4 compared to conditions 1 and 2. Hip flexion and extension moments increased in condition 4 compared to all other conditions (13.3% and 11.5%). Knee extensions increased incrementally through conditions 1 and 4. The plantar flexion moment increased 9% in condition 3 and 4 compared to conditions 1 and 2. **CONCLUSION:** With the increase of weight added into the vest it was hypothesized that biomechanical variables would have incremental changes associated with the change in pack weight. However, each variable was affected differently. Through each variable there was a contrasting point that a significant change was observed. With this evidence, it can be explained that each joint excepted and balanced the weight differently. Evidently, the hips were affected more at the higher weights and the ankle was affected at the lower weight. Condition 2 had little to no effect on biomechanical variables and may not negatively affect performance.