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EFFECT OF OBESITY ON GAIT SYMMETRY FOLLOWING ANTERIOR CRUCIATE LIGAMENT TRANSECTION

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INTRODUCTION

High fat diet and the resulting obesity are associated with chronic inflammation, which is thought to exacerbate osteoarthritis (OA) [1]. Also, obesity has been suggested to increase gait asymmetry [2]. To our knowledge, no one has evaluated the added effect of obesity in an instability OA progression model such as anterior cruciate ligament transection (ACL-X). The purpose of this study was to assess the effect of obesity on the progression of gait asymmetry, when factors are normalized for body weight following an ACL-X protocol. We hypothesized that High-fat diet ACL-X animals will experience greater asymmetry than low-fat ACL-X animals over time.

METHODS

Twenty-eight male Sprague-Dawley rats were randomly assigned to either a high fat diet (HFD) or a low fat diet (LFD) group. The HFD group (n=18) received high fat sucrose food (40% fat, Diet #102412, Dyets, Inc) and the LFD group (n=10) received lean chow (13.5% fat, LabDiet 5001). Twelve weeks post diet induction, baseline 2-D kinematics and 3-D kinetic measurements were collected on a runway with two embedded side-by-side 7.5 x 30 cm force plates (Bertec, Columbus, OH). A minimum of two successful kinematic and kinetic trials for each limb were included in this analysis. Then, all animals were randomly assigned to receive an ACL-X (HFD n=12, LFD n=5) or surgical sham (HFD n=6, LFD n=5). Kinematic and kinetic data were collected 1-week post surgery, and again at 8 weeks post surgery. An Asymmetry Index (AI) was used to compare differences normalized to body weight (BW) between limbs. The AI was calculated by:

$$\frac{\text{(Contralateral (BW) – Experimental (BW))}}{\text{Contralateral (BW)}} \times 100\%$$

All data sets were compared for AI changes due to diet, surgery, diet*surgery, and over time using non-parametric statistics.

RESULTS

Twenty animals successfully met the inclusion criteria and were analyzed. In Figure 1, the normalized AI vertical impulse result for all groups is shown. The LFD ACL-X group (n=5) normalized AI vertical impulse (mean±SE) was 12% (±15%), 20% (±7.2%), and 17% (±5.7%) respectively. The HFD SHAM group normalized AI vertical impulse was 16% (±17.2%), 34% (±7.2%), and 44% (±13%) respectively. The HFD ACL-X normalized AI vertical impulse was 17% (±13%), 37% (±5.4%) and 44% (±10%) respectively.

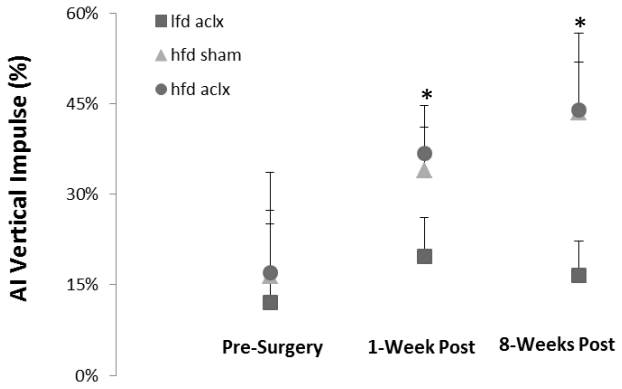

Figure 1. Normalized AI vertical impulse is demonstrated over time for three time points: Pre-Surgery, 1-week post surgery and 8-weeks post-surgery. Bars demonstrate SE, *indicates differences between LFD and HFD, $p<0.05$.

DISCUSSION AND CONCLUSIONS

AI impulse increased in all groups 1-week post surgery, but the HFD ACL-X had an increased AI when compared with LFD ACL-X ($p<0.05$). Both HFD groups had a greater normalized AI vertical impulse when compared with the LFD ACL-X group 8-weeks post surgery ($p<0.05$). The rats were first introduced to the runway and force plate at baseline testing, which contributes to the large variability seen pre-surgery. In conclusion, gait asymmetry is exacerbated over time for normalized AI vertical impulse after obesity induction. Conversely, a trend was evident towards recovery, or decreased AI in the LFD animals. A fourth data set, 16 weeks post surgery, will be analyzed to further characterize the effect of diet and surgery on this measure in ACL-X animals over time.

REFERENCES

1. Gregor MF et al. *Ann Rev Imm.* **29**:415-445, 2011.
2. Hills AP, et al. *Obes Rev.* **1**:35-43, 2002.