NEW YORK INSTITUTE OF TECHNOLOGY
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The Effect of OMT on Insulin Sensitivity and Glucose Control in Rodent Models: A Pilot Study

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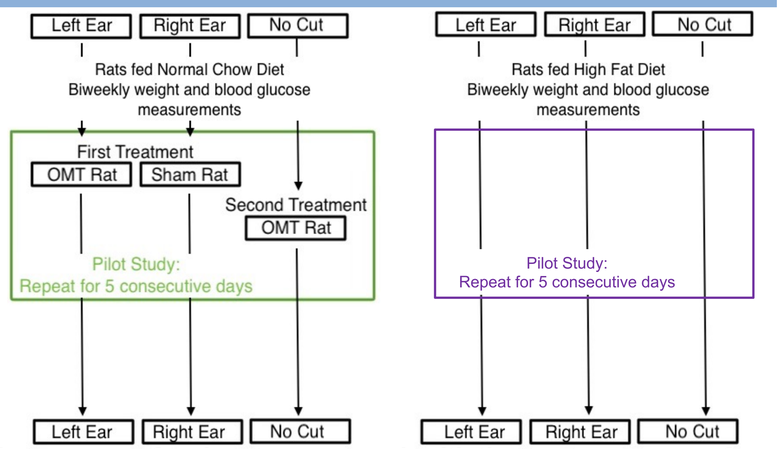
Introduction

Several rodent based studies have advanced our understanding of OMT's effects on Alzheimer's Disease,[1] migraines, the progression of infection (specifically S. pneumoniae)[2] and improvement in lymphatic flow with different pumps.[3] This introduces the conversation about the potential for using OMT to study insulin resistance in rats, with the goal of a translational study in humans.

Previous reports suggest blood glucose (BG) homeostasis is maintained via the autonomic nervous system, thoracolumbar diaphragm, abdominal lymphatic system, pancreas, liver, and adrenal glands.[4]

Our proof-of-concept study demonstrates the feasibility of performing osteopathic manipulative treatment (OMT) on adult rats, filling a gap in the literature as it pertains to animal OMT research. We hypothesized that osteopathic manipulation to the above areas in rodents will affect BG levels.

Methods and Materials



Two groups of male rats were used, with three rats per group for the pilot phase. One group was fed a normal chow diet, whereas the other was fed a high-fat diet to induce obesity and insulin resistance. The high-fat diet rats were weighed every two weeks and blood glucose measurements began one month after starting the high-fat diet.

During the pilot, rats were anesthetized daily with isoflurane followed by OMT (rib raising and thoracolumbar diaphragm, celiac ganglia, suboccipital, and thoracic outlet release). Glucose was measured using a glucometer on blood from the tail pre-OMT, 5 minutes post-OMT, and 15 minutes post-OMT. Sham rats were anesthetized in parallel and received light touch. Multiple regression was used to determine blood glucose significance.

Animal Model

Figure 2. Jordan Keys performing OMT on rat under anesthesia.

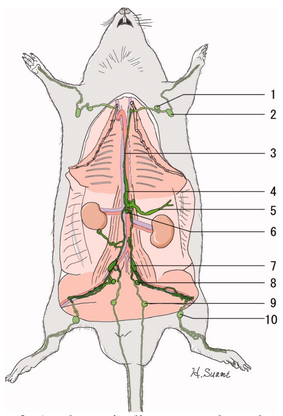
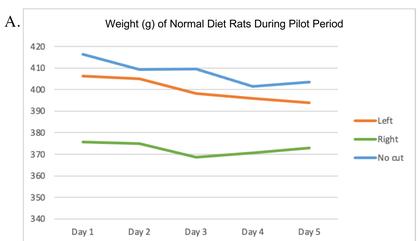


Figure 3. A schematic diagram to show the lymphatic system in a rat; (1) axillary node, (2) accessory axillary node, (3) thoracic duct, (4) cisterna chyli, (5) intestinal lymph trunk, (6) renal node, (7) lumber node, (8) hypogastric node, (9) lateral sacral node, and (10) popliteal node. [5]

Results



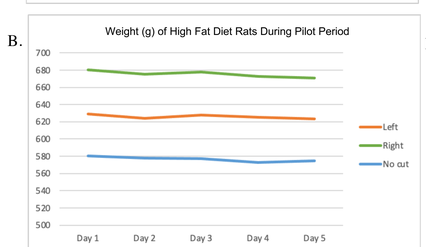
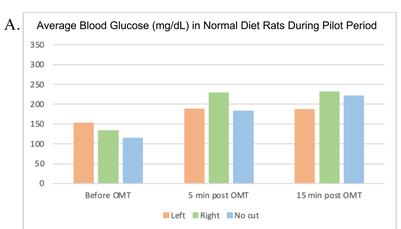


Figure 4. Plot of weights during pilot study



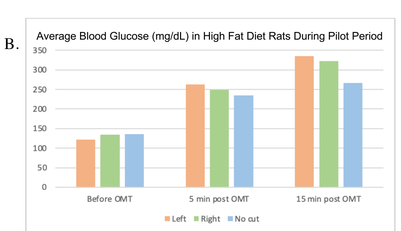


Figure 5. Plot of blood glucose during pilot study

Acknowledgement and IRB Approval

Funding for this study was provided by the NYIT College of Osteopathic Medicine In-House Grant Program (2022-2023). As this study did not include humans, it is exempt by the institution's Institutional Review Board (IRB); it did receive IACUC approval (Protocol #2022-WKC-04A2).

Results and Discussion

The rats were able to be anesthetized and OMT, sequential blood glucose drawings, and weighing could be performed. The practitioner palpated somatic dysfunctions, indicating OMT is possible in these animals.

OMT does not acutely alter blood glucose levels in male rats fed with normal chow diet; however, blood glucose was altered, possibly from the isoflurane gas. There was a significant increase in the blood glucose of high fat diet rats at times 5 and 15 minutes post-treatment ($p < 0.001$ for both).

As evidenced by Figure 4 (Plots A and B) the rat weights did not change substantially over the 5-day pilot. Figure 5 (Plots A and B) demonstrates the difference in BG at timepoints 5 and 15 minutes post-treatment compared to the baseline measurement prior to treatment. Additionally, a significant association was found between weight (g) and BG (mg/dL) using ANOVA ($F = 9.40$, $p < 0.005$).

Conclusions

This study demonstrates great promise in being able to study the efficacy of OMT in rats. The team has continued to assess both acute and long-term effects of OMT on insulin sensitivity and glucose homeostasis in normal and obese rats. Study limitations included rodent sex, age, weight, anesthesia usage, and sample size. Future studies will use both males and females to account for size and temperament differences accompanying sex.

A major takeaway from this study is that somatic dysfunctions can be palpated on animals of this size and that it is possible to perform OMT and assess outcomes on rats. Once expanded to rats under various disease states, there is limitless potential for demonstrating the utility of OMT in disease states and even to expand this research to the human model. Future work would demonstrate the role of OMT as a treatment or adjunctive treatment in the management of Diabetes Mellitus, both in rodent models and, down the line, humans.

References

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[5] Labeled rodent anatomy diagram and caption from Suami, H., Chang, D. W., Matsumoto, K. & Kimata, Y. Demonstrating the lymphatic system in rats with microinjection. Anat. Rec. (Hoboken) 294, 1566–1573 (2011).