The Pharmacological and Cognitive Effects of Propranolol on CD-1 Mice

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The purpose of my study is to investigate, the overall positive and negative effects of the beta-blocker propranolol on the body, specifically on blood pressure, body weight and kidney function.

Background

Currently, 31 million people in the United States have chronic kidney disease; with high blood pressure being the 2nd leading cause of kidney disease, and about 70 million people in the United States have high blood pressure. The importance of studying the conditions becomes more prevalent as the average individual, of recent times, has a diet consisting of preservatives, artificial ingredients, which in turn leads to a more consistent weight gain over time. For years medical professionals have recommended not only a complete lifestyle change for those that suffer from the aforementioned conditions, but have also prescribed beta-blockers for an even more effective control of high blood pressure. According to Consumer Reports, Propranolol is the 3rd most prescribed beta-blocker in the United States, even though many researchers concluded that the full physiological and cognitive effects are still widely unknown for such a heavily prescribed medication. While the blood pressure benefits of propranolol are for certain, other negative side effects have been reported but not widely studied such as severe cognitive deficits, especially over time and in the elderly, weight gain, as well as abnormal kidney function. After acute i.p. injections of propranolol over a 7-day period, subjects will be exposed to a noninvasive blood pressure machine, urinalysis to measure pH, as well as a radial arm maze to test for cognitive deficits in spatial memory.

Fig 1.

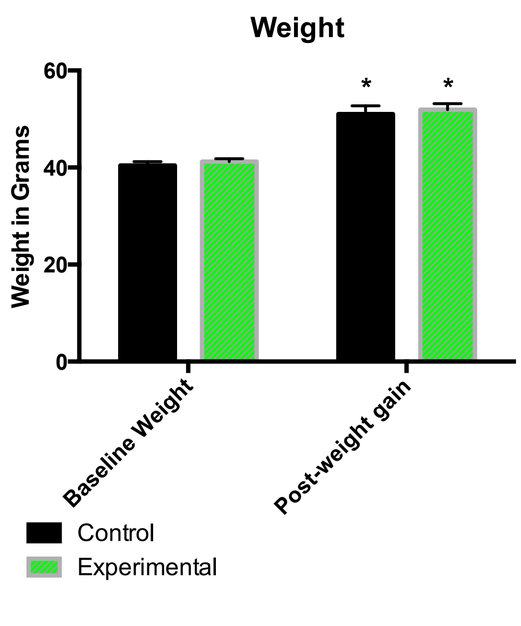


Fig 2.

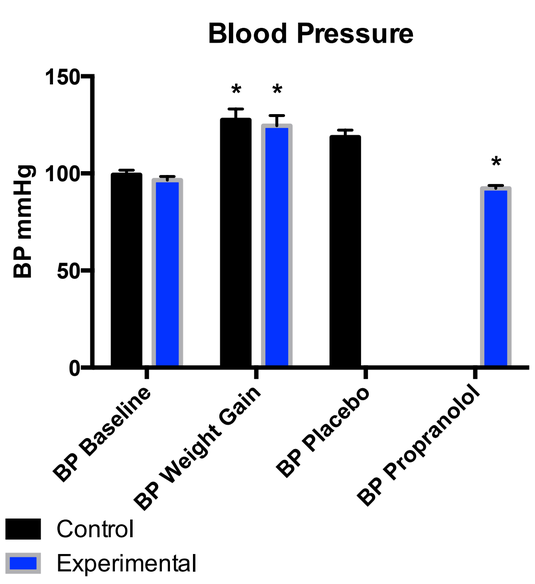


Fig 3.

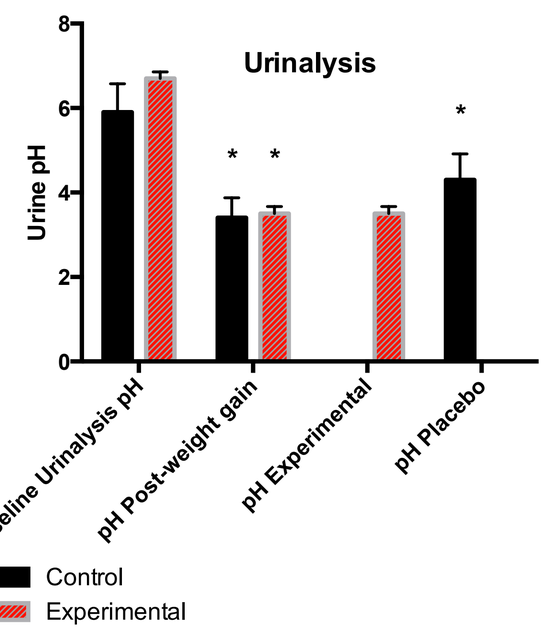


Fig 4.

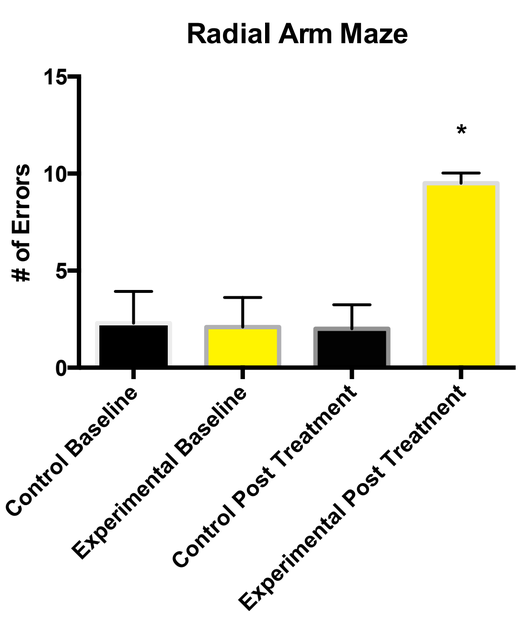


Fig. 1 Weight. Mice were given a diet of equal parts vegetable shortening to equal parts powdered sugar to increase body weight and blood pressure.

Fig. 2 Blood Pressure. Measured using a non-invasive blood pressure machine which showed a significant difference between baseline to weight gain, and weight gain to experimental.

Fig. 3 Urinalysis. Using pH sticks the graph shows a significant decrease in pH which means an increase in uric acid post weight gain, as well as a significant increase in pH of the control group.

Fig. 4/Fig. 5 Radial Arm Maze Errors & Time. Measured using number of errors as well as time in the radial arm maze there was a significant increase in both time and amount of errors in the experiment group post treatment.

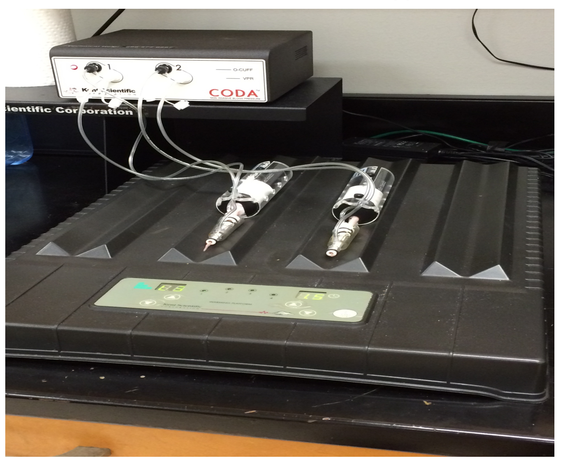
Materials & Methods

Subjects

20 adult male CD-1 were used in this study. All mice were purchased from Charles River Laboratories, and given at least 24 hrs to acclimate to the LIU Vivarium prior to testing. Mice were given food and water *ad libitum* and placed on a 24hr light-dark cycle, with lights on at 8am.

Procedures

Mice were separated into cages and baselined on each behavioral apparatus.
Mice were put on a diet of equal parts vegetable shortening to equal parts powdered sugar to not only increase weight but also cause diet induced hypertension for a period of 30 days.



Paradigm #1: *Non-invasive Blood Pressure Machine*
The mice were injected i.p. with a dose of 20uL over 7 days. They were then tested using the Kent Scientific Noninvasive Blood Pressure machine.

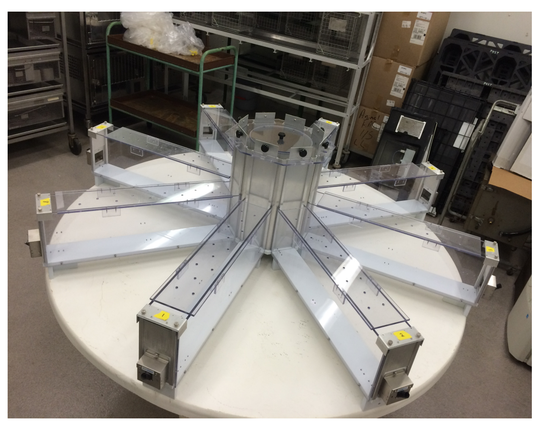
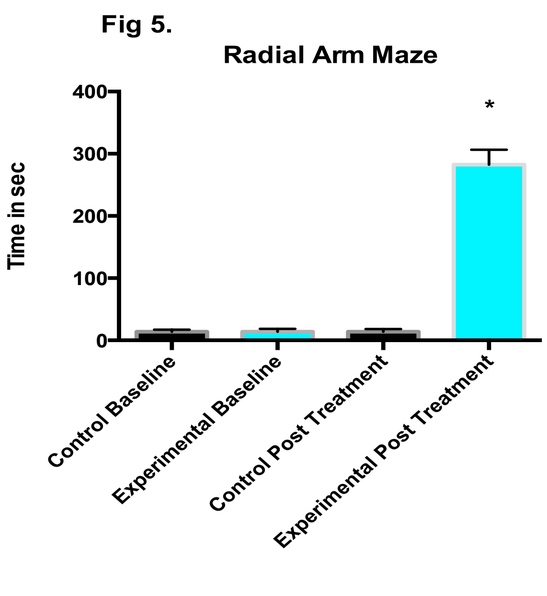


Fig 5.



Paradigm #2: *Radial Arm Maze*
Following 30 min. after i.p. injection mice were exposed to the maze with an incentive in one arm to measure spatial memory, and again at 60 min. Number of errors as well as time to find incentive were measured with a cut off at 8 errors and 5 minutes.

Paradigm #3: *Urinalysis*
24 hours following i.p. injection each mouse was place in a separate cage with an open grid bottom with a clean plastic contain underneath for urine collection. pH factor of each mouse was tested using pH strips during each phase of the experiment.

Results

Results showed that propranolol significantly decreased spatial memory and movement time leading to in increase in cognitive deficits both 30, and 60 min after injection. Results also showed that after mice had been taken off the experimental diet for 20 days the experimental subjects continued to gain weight.

Conclusion

Results showed that while Propranolol is effective in lowering high blood pressure, it does carry with it other physiological and cognitive risks.

Acknowledgements

All experiments were approved by the LIU-IACUC committee and all ethical procedures were adhered to as recommended by the AALAS. This project would not have been possible without the support of LIU Undergraduate Monetary Grant.