

# EFFECT OF DIET AND EXERCISE ON COGNITIVE MEMORY

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## Background

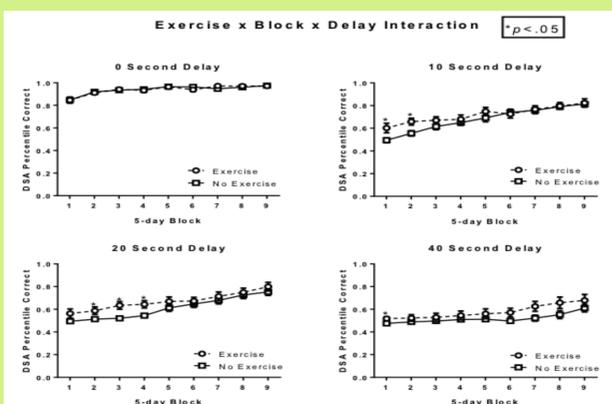
- **Daniel Fast** is a purified form of a vegan diet, which includes a high percentage of carbohydrates (~60%), moderate protein (~15%), and fat (~25%), of which saturated fats is essentially non-existent.
- **Western Diet** is a standard product produced to mimic a typical human diet containing 17% protein, 43% Carbohydrates, and 40% Fat.
- **Goal of the Study:** To test the influence of dietary modification with and without exercise measures on the health and cognitive performance of male rats.
- **Experimental Design:** Rats will either receive the Western or Daniel Fast diet and within these two diets half will undergo treadmill exercise. Twelve weeks after the initial intervention all of the rats will undergo a physical performance test and body composition/bone density scanning and in the following days 50% will be euthanized. The remaining rats will continue to receive diet/exercise treatment for the next 18 month period and will have physical assessments every 3 months. Working memory will also be tested in operate boxes until the rat is 20 months. Then they will be euthanized and tissue samples will be collected.

## DSA

**Method:** In order to test their spatial working memory the rats underwent a delayed spatial alteration. They were placed in operating chambers and two levers were projected at 0, 10, 20 and 40 second delays. The goal was to press them alternately. The delays themselves were what tested the memory because the rat had to remember what it had previously pressed. In order to prepare them for DSA the rats did cued alternation and non-cued alternation first. The delays were then put in later and that is when most differences among treatment groups appear.

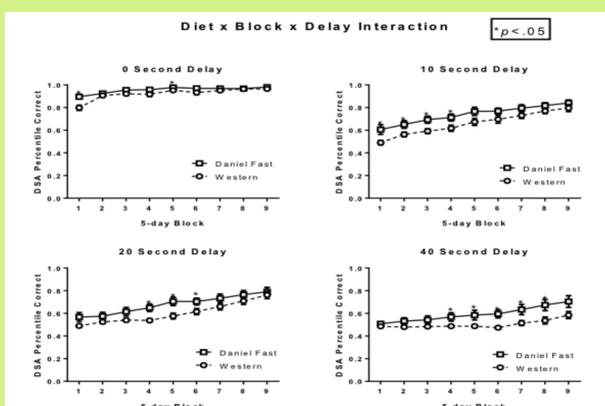
**Animals:** All rats began cognitive testing 3 months after they began their respective diets. Those that continued in the study beyond 12 weeks will be tested until they are approximately 20 months old. This allowed for memory to be evaluated in young, middle-age, and older animals.

## Results



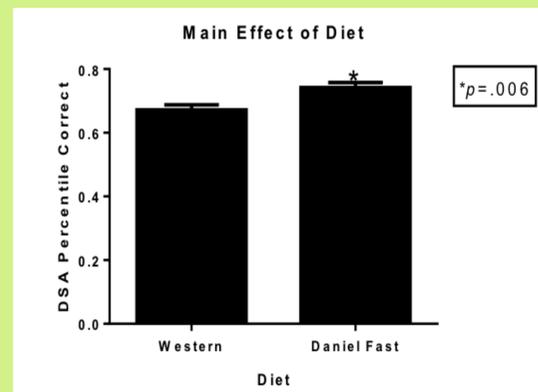
**Figure 3:** There is no difference in performance at the 0 sec delay that indicates rats in both exercise groups are equally capable of performing the task. Exercise rats sometimes did better during the 10 – 40 sec delays but only within the first 20 sessions. This suggests a mild working memory deficit in the sedentary rats that dissipates with practice.

**Figure 4:** As the task gets harder, the difference between the Western and Daniel Fast rats does not become evident until later sessions. Rats given a Western Diet require more sessions to exhibit the same level of performance demonstrated earlier in rats eating the Daniel Fast Diet.



## Diet and Exercise

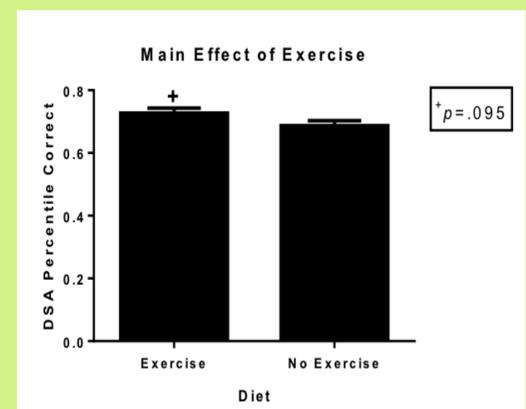
**Diet:** Animals were randomly assigned to two dietary intervention groups, either the Western diet or the Daniel Fast diet. Both diets were provided in pellet formed and the amount was based on how much the animal weighed in comparison to its target weight. Whether the animal was exercised or was sedentary also was a factor on how much food the rat received.



**Figure 1:** Rats consuming the Daniel Fast Diet have significantly better DSA performance overall (i.e., collapsed across exercise group) across the first 45 days.

**Exercise:** The animals who were sedentary were entirely excluded from any forms of exercise. But those who did exercise ran on a treadmill to exhaustion for cardiovascular endurance. Animals start by running at a speed of 20 m/min without incline for 15 minutes. The speed then increases by 5 m/min every 15 minutes until the animal is unable or unwilling to maintain pace with the treadmill belt.

**Figure 2:** The average DSA performance over the first 45 days in rats that exercise is better than performance in rats that do not regularly exercise, but this difference did not meet the criterion for statistical significance.



## Conclusion

The results show that the Daniel Fast diet improves performance. Rats eating a Western Diet require more sessions to do as well as rats eating the Daniel Fast diet. Overall, exercise appears to improve performance but the effect is very subtle. Rats eating a Western Diet require more sessions to do as well as rats eating the Daniel Fast diet, especially as the delay gets longer. Also, rats that exercise do better than rats that don't, but only within the first 20 sessions. Later there is no difference in the responses. This suggests that more sedentary rats can overcome mild working memory impairments with practice.

## References

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## Acknowledgments

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