



Short- and long-term effects of dietary manipulations on impulsive choice behavior and motivation in rats

Catherine C. Hill* & Kimberly Kirkpatrick
Kansas State University



Introduction

- Impulsive choice underlies maladaptive behaviors such as gambling, substance abuse, and obesity
- People with higher percent body fat make more impulsive decisions¹
- The correlation between obesity and impulsive choice could be due to: (1) trait impulsivity as the cause of obesity; (2) obesity as the cause of trait impulsivity; or (3) another related factor, such as diet, causing both
- A previous study showed that rats on a high-fat diet were *less* impulsive than rats on a normal chow diet²
 - Energy budget was not controlled
 - Used an adjusting procedure, which can result in random behavior³
 - Impulsive choice task occurred while the rats were off their diet
- Current study: determine the effects of a high-fat and high-sugar diet on impulsive choice and motivation while on and off high-fat and high-sugar diets

Methods

24 male SD rats

8 week diet manipulation

Chow

n=8

Fat

n=8

Sugar

n=8



On Diet

Impulsive choice task

Progressive ratio task



Off Diet

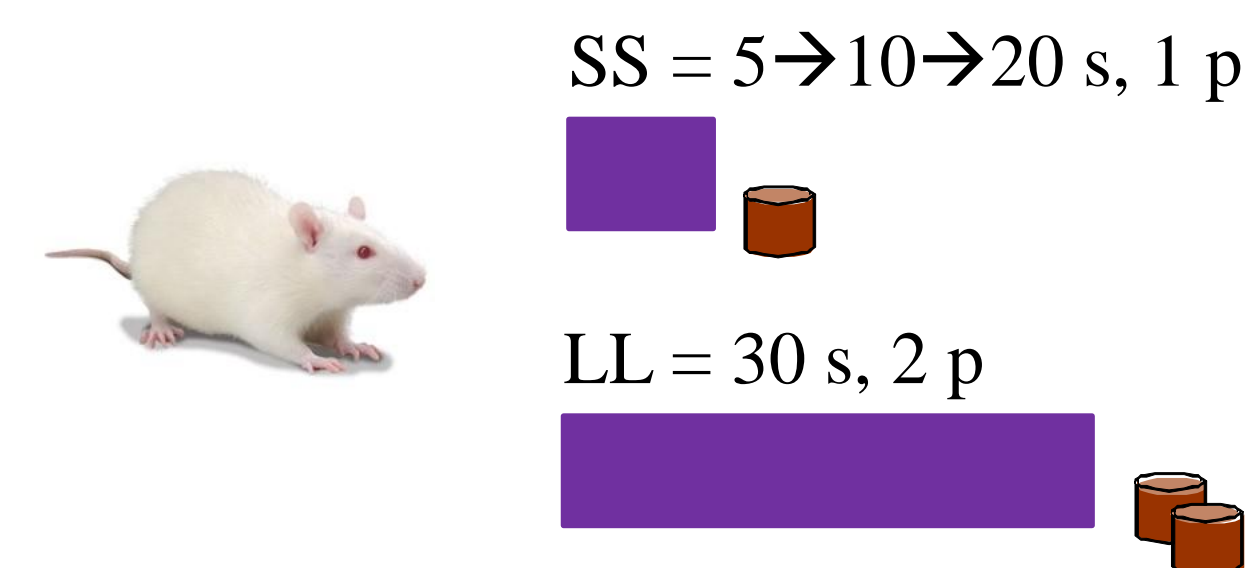
Impulsive choice task

Progressive ratio task



Choice

Impulsive Choice Task



Data analysis

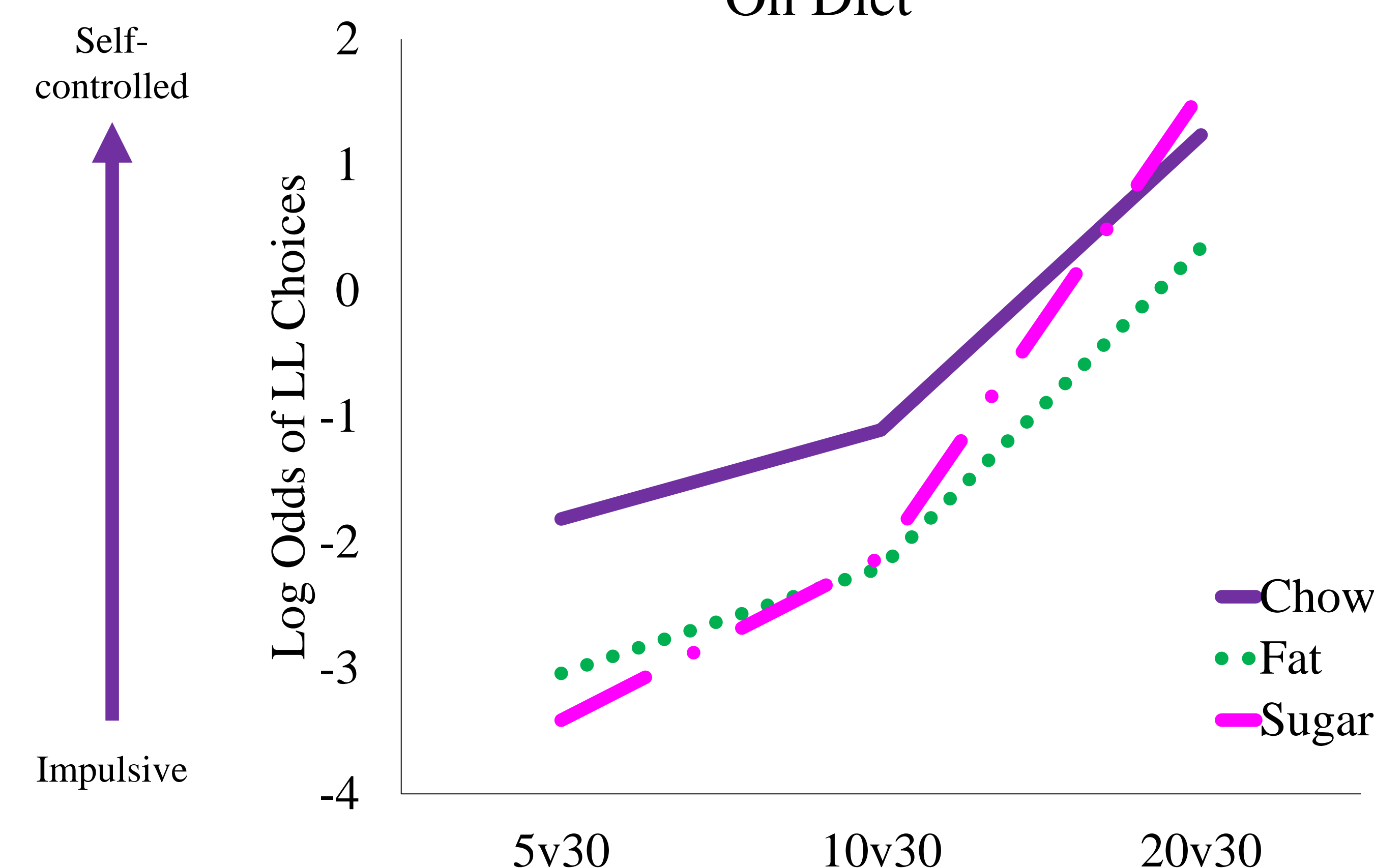
Log Odds of LL choices

- LL=number of larger-later choices
- SS=number of smaller-sooner choices

$$\log \frac{LL + .5}{SS + .5}$$

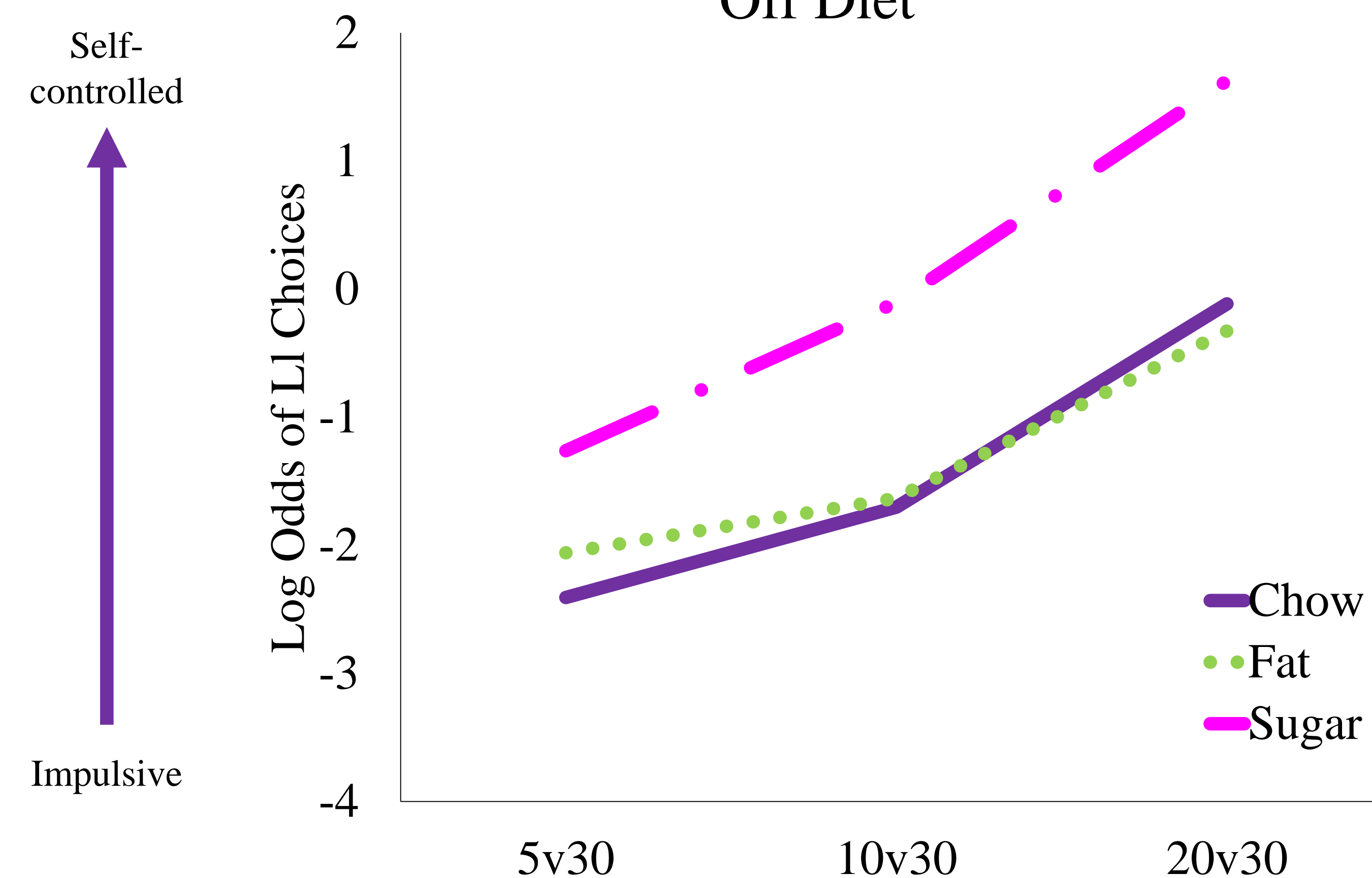
>0: Self-controlled
<0: Impulsive

On Diet



As SS delay increased, all groups made fewer impulsive choices. High-fat and high-sugar diets led to more impulsive choices when the SS delay was 5 and 10 s.

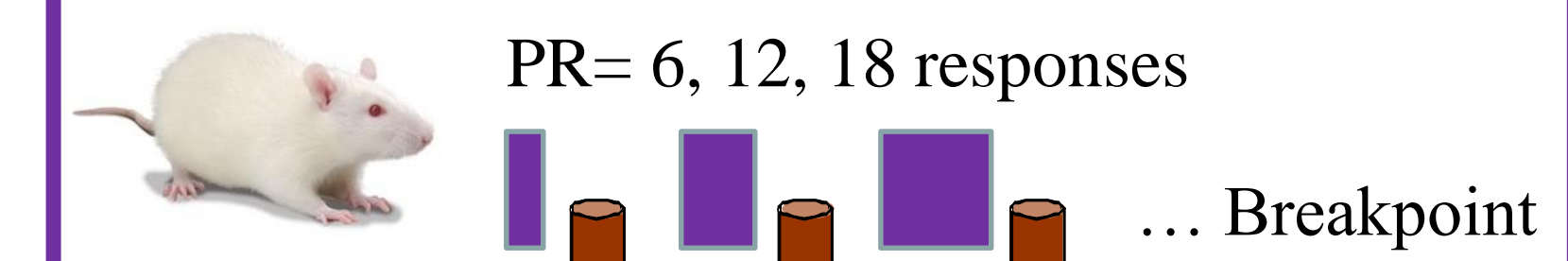
Off Diet



As SS delay increased, rats in all groups made fewer impulsive choices. High-sugar diet led to more self-controlled choices for all delays.

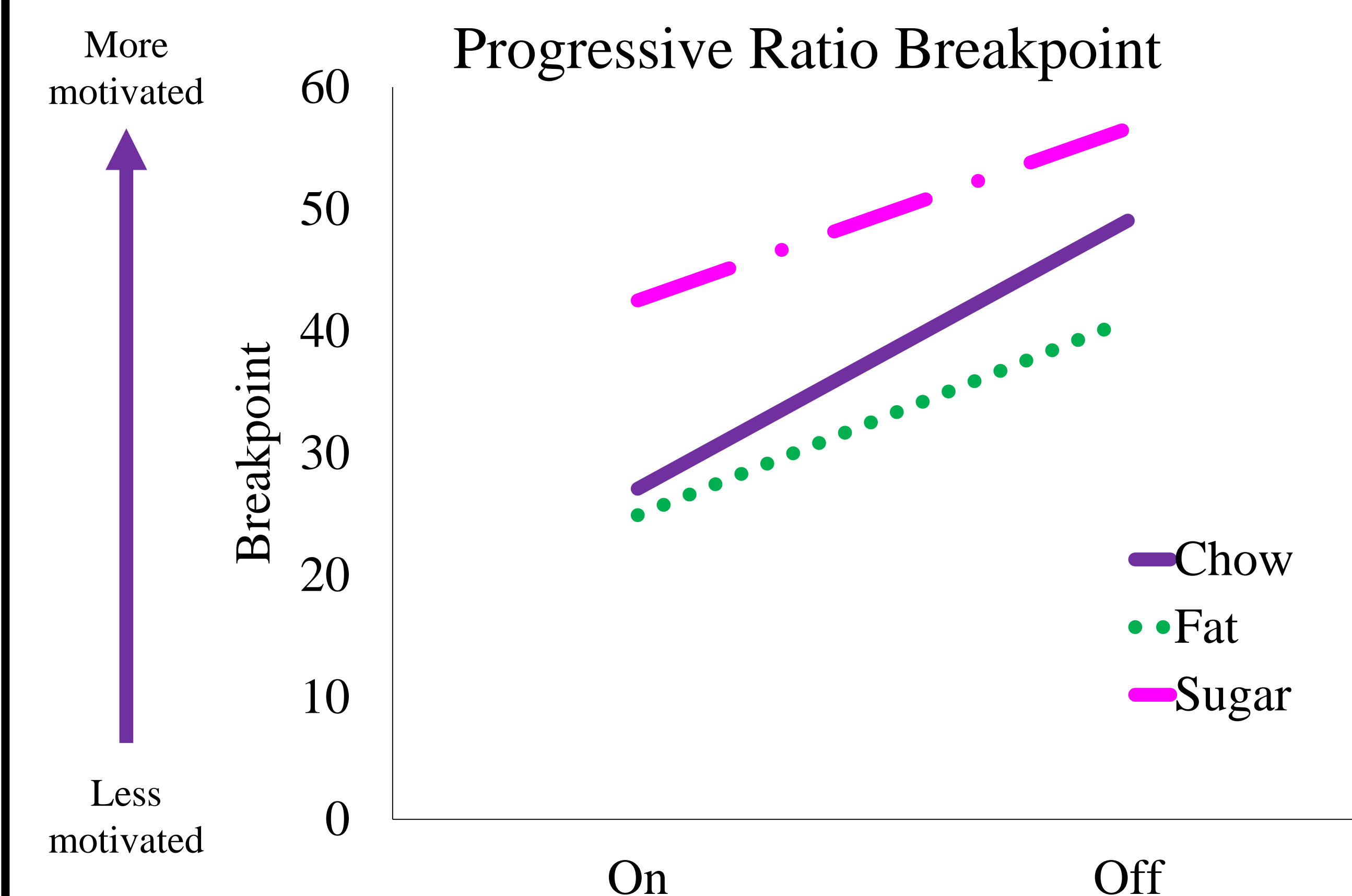
Motivation

Progressive Ratio Task



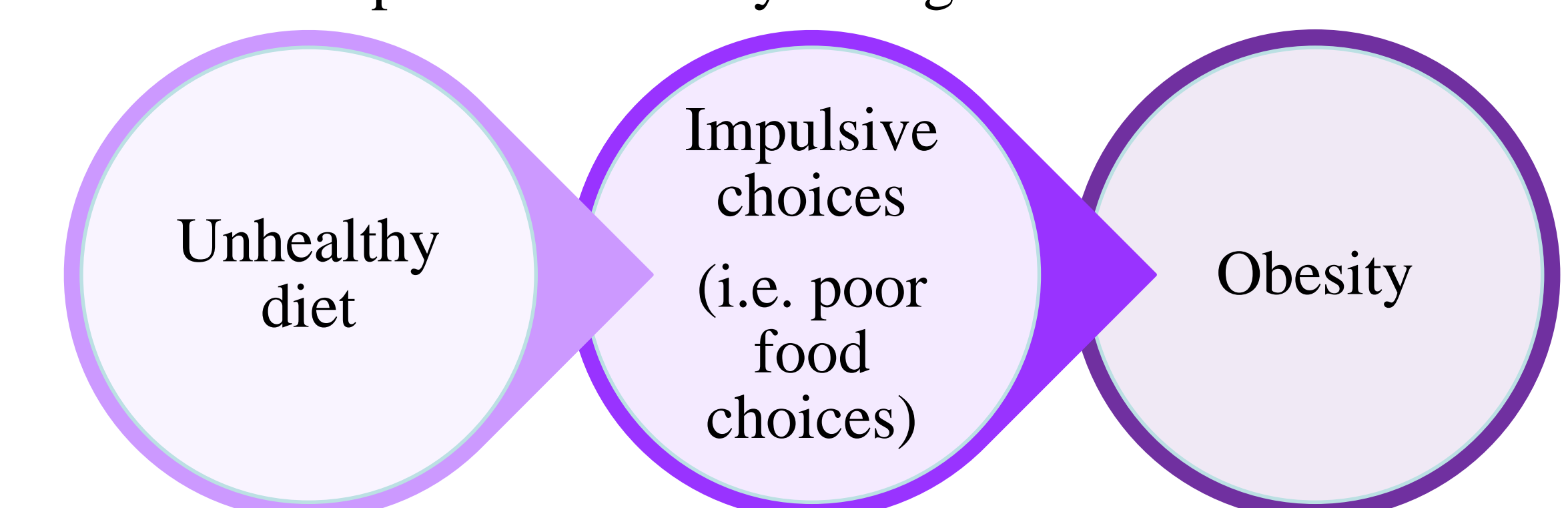
All groups were more motivated to work for food when off the diet. Rats on the high-sugar diet were more motivated to work for food overall.

Progressive Ratio Breakpoint



Discussion

- High-fat and high-sugar diets lead to more impulsive choices while on the unhealthy diet
- Behavioral patterns change when taken off the unhealthy diet, such that the high-sugar diet resulted in more self-controlled choices
- Diet may be the root cause of the relationship between impulsivity and obesity, suggesting a strong need for early behavioral interventions to promote healthy eating



References

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2. Narayanaswami, V., Thompson, A. C., Cassis, L. A., Bardo, M. T., & Dwoskin, L. P. (2013). Diet-induced obesity: dopamine transporter function, impulsivity and motivation. *Int J Obes (Lond)*, 37(8), 1095-1103.
3. Peterson, J. R., Hill, C. C., & Kirkpatrick, K. (2015). Measurement of impulsive choice in rats: Same- and alternate-form test-retest reliability and temporal tracking. *Journal of the Experimental Analysis of Behavior*, 103(1), 166-179.

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