Effects of dietary manipulations on body weight, locomotor activity, and impulsive choice in rats

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Impulsive choice underlies…

- Maladaptive behaviors:
  - Substance abuse (Bickel & Marsh, 2001)
  - Gambling (Alessi & Petry, 2003)
- Diseases
  - ADHD (Solanto et al, 2001)
  - Obesity

Obesity & Impulsive Choice

- Higher body fat percentage is associated with more impulsive choice behavior (Rasmussen, Lawyer, & Reilly, 2010)
- 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
  - (3) another related factor, such as diet, causing both

Diet-induced Models of Obesity

- Studies typically include either high-fat or high-fat/high-sugar diets
- Impulsive choice behavior decreased for rats on high-fat diet (Narayanaswami et al., 2013)
  - Used adjusting procedure (Peterson, Hill, & Kirkpatrick, 2015)
  - Had ab libitum access to food →differences in energy budget
  - Tested when rats were off of the diet

Current Study:

How do high-fat and high-sugar diets affect body weight, locomotor activity, and impulsive choice behavior?

Method

24 male Sprague Dawley rats

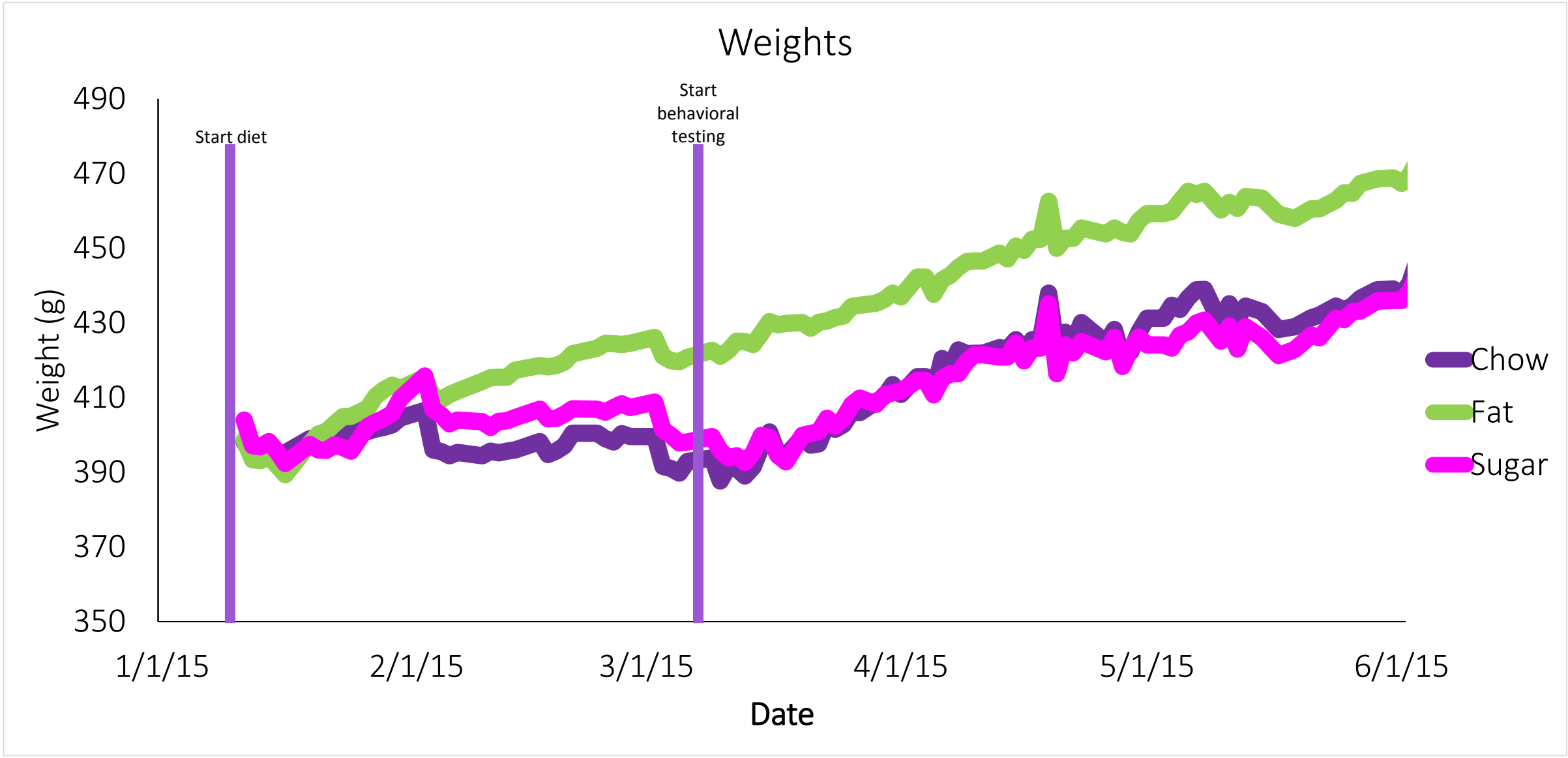
Pre-locomotor test → Diet manipulation

101 .75 calories

Control
25 g of chow

High-fat
15 g of chow
4.38 g of lard

High-sugar
15 g of chow
10.33 g of sucrose


Weights
Start diet
Start behavioral testing
490
470
450
430
410
390
370
350
Weight (g)
1/1/15
2/1/15
3/1/15
4/1/15
5/1/15
6/1/15
Date
Chow
Fat
Sugar

Method

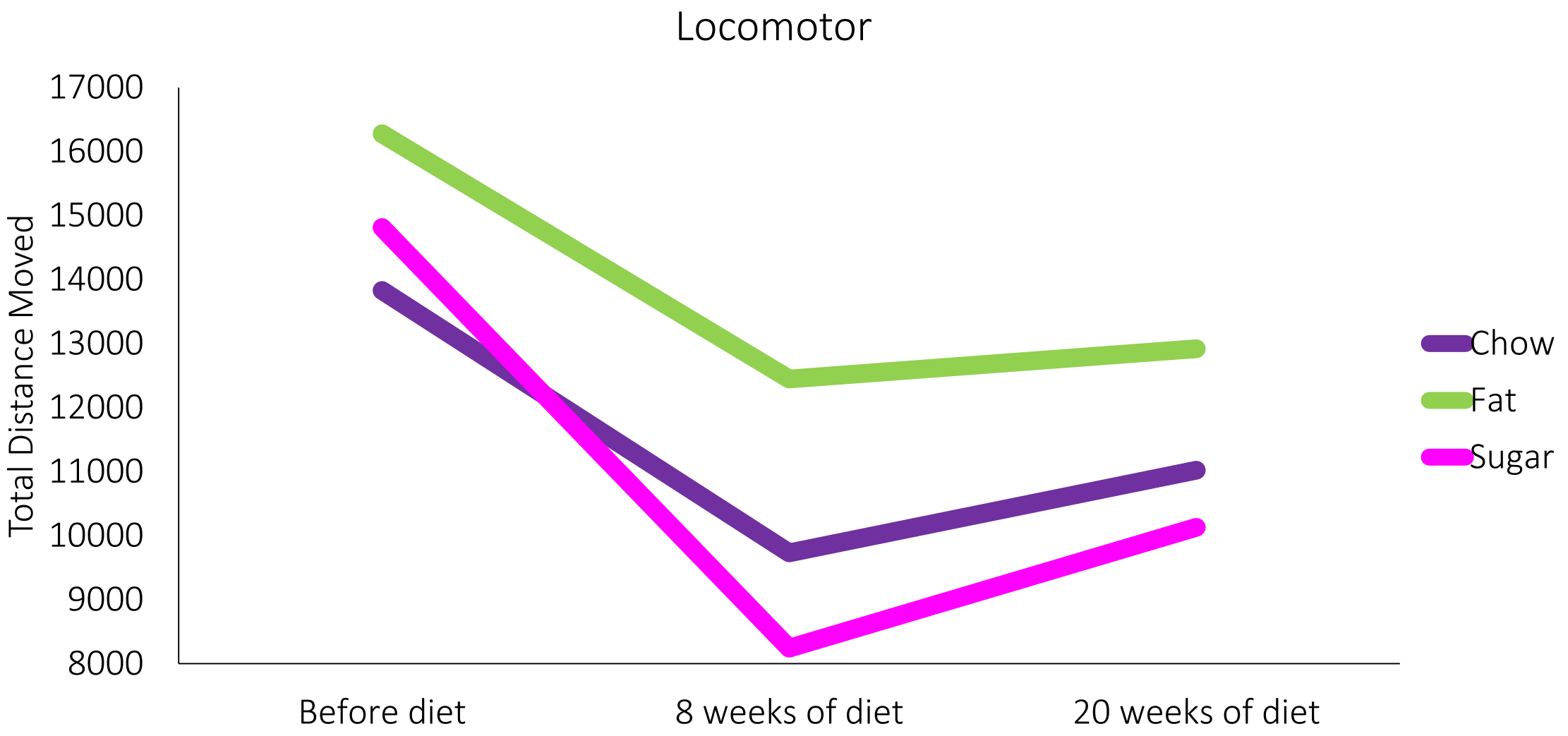
24 male Sprague Dawley rats

Pre-locomotor test → Diet manipulation → Post-locomotor test

Control
25 g of chow

High-fat
15 g of chow
4.38 g of lard

High-sugar
15 g of chow
10.33 g of sucrose


Locomotor
Total Distance Moved
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
Before diet
8 weeks of diet
20 weeks of diet
Chow
Fat
Sugar

Method

24 male Sprague Dawley rats

Pre-locomotor test → Diet manipulation → Post-locomotor test → Impulsive choice task

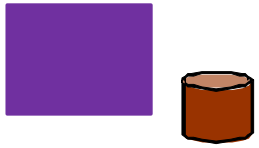
Control
25 g of chow

High-fat
15 g of chow
4.38 g of lard

High-sugar
15 g of chow
10.33 g of sucrose

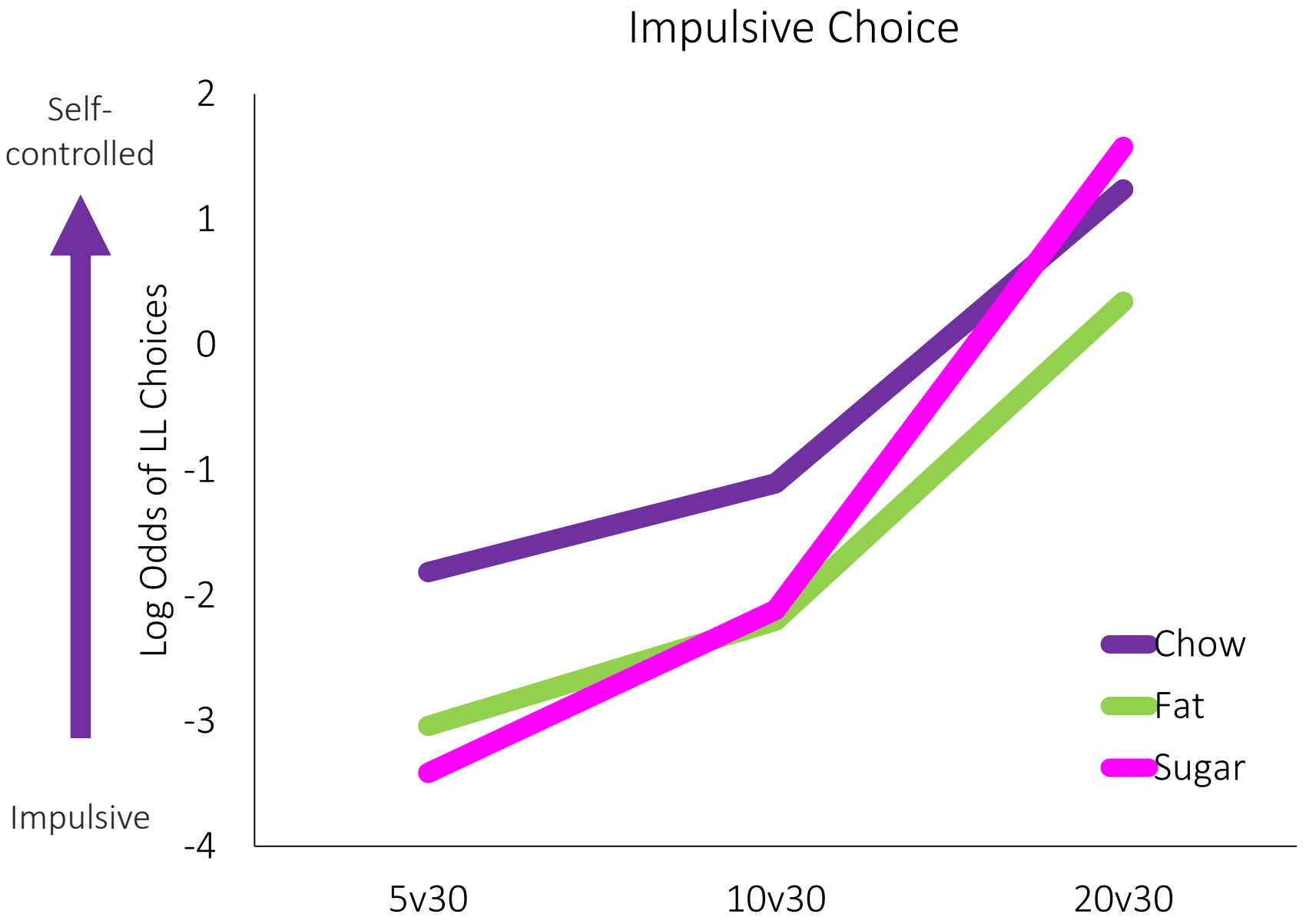
Impulsive Choice Task

SS = 5→10→20 s, 1 p



LL = 30 s, 2 p

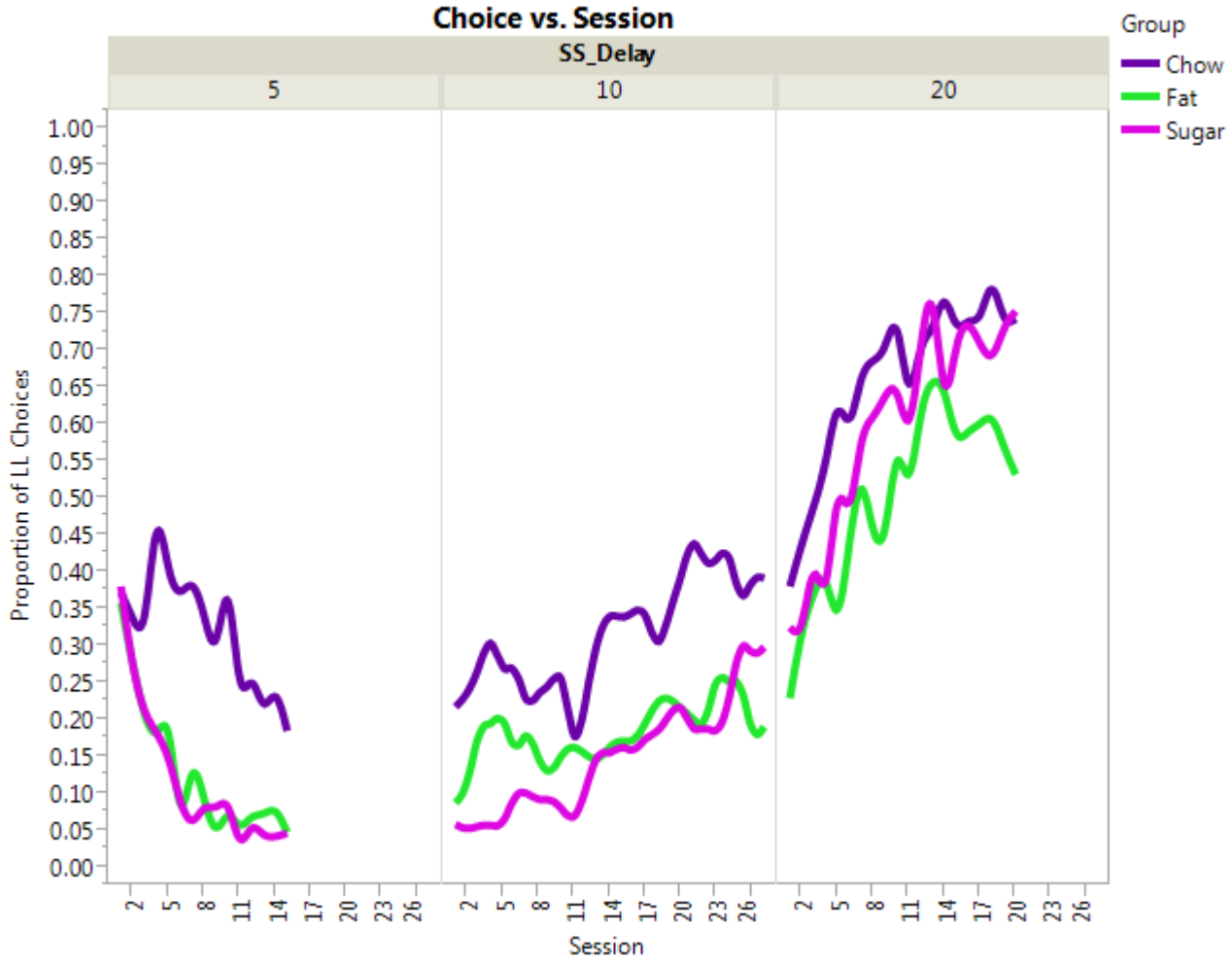
(Green & Estle, 2003)



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

High-fat and high-sugar diets led to more impulsive behavior

Self-controlled



Impulsive

Random effects:

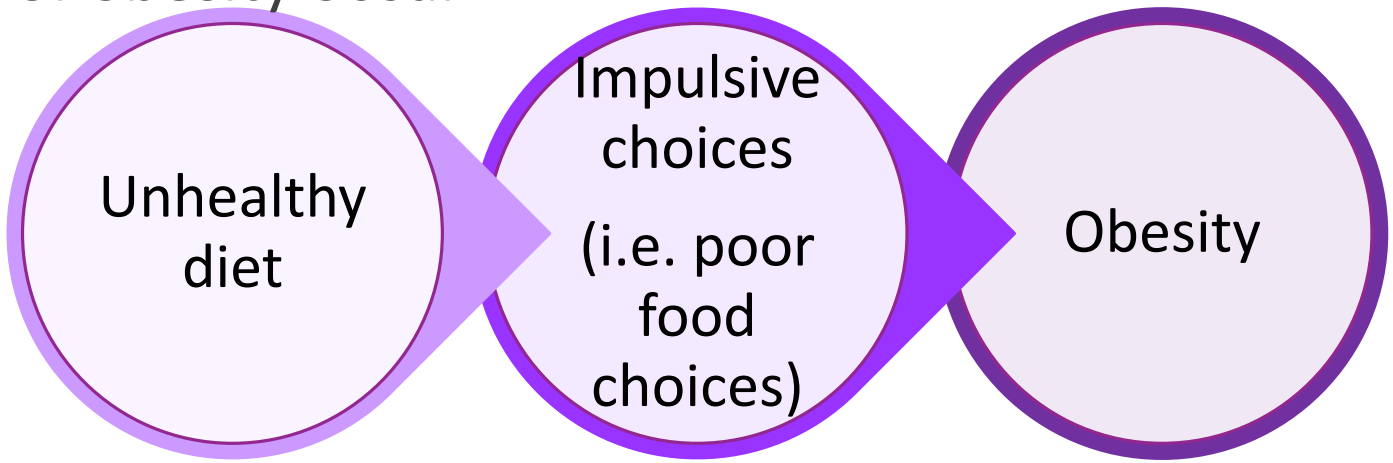
- Intercept
- SS_Delay

Fixed effects:

- Group*SS_Delay*Session

Conclusions

- High-fat and high-sugar diets result in greater impulsive choice behavior
  - Effects on impulsivity are not a result of hyperactivity or weight
- The high-sugar diet appears to be affecting the brain and behavior before physical signs of obesity occur



- See Board Z42 on Tuesday from 8-12 for details on short- and long-term effects of dietary manipulations of impulsive choice and motivation

Questions?

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Random effects