

Who Holds the Reins: Genetics or Economics?

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July 29th, 2009



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USDA Higher Education Challenge
Grant # 2007-38411-18146

Pop Quiz!



Total cost = 3.19 for 15oz
Each 1oz serving costs \$0.21

120 calorie portion = 1oz
120 calories costs \$0.21



Total cost = \$3.25 for 32oz
Each 1oz serving costs \$0.10

120 calorie portion = 24oz
120 calories costs \$2.40

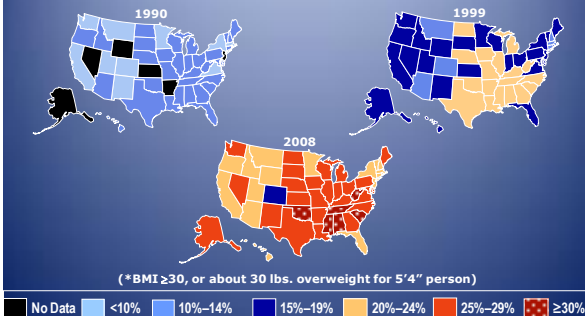


Total cost = \$1.49 for 5.5oz
Each 1oz serving costs \$0.27

120 calorie portion = 1.1 oz
120 calories costs \$0.30

Background Information

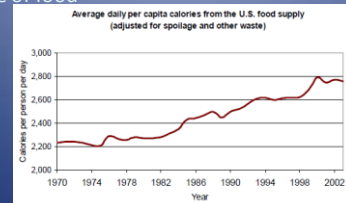
Obesity Trends* Among U.S. Adults



Center of Disease Control and Prevention. (2009). *

Background Information

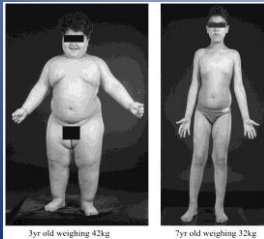
- > Factors contributing to increasing obesity rates:
 - > Fast food restaurants
 - > Low levels of physical activity
 - > Increased per capita calorie intake
 - > Price of food



Golan, E. and Waqiu, H. (2005)

Genetic Factors in Obesity

- In humans and mice, there are some known genetic causes for obesity.



Leptin-deficient person

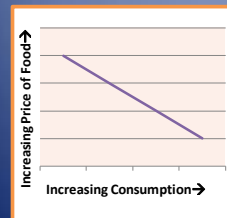


Leptin-deficient mouse

Farooqui, S. and O'Rahilly, S. (2006).

Economics The Law of Demand

- As the price of food increases, it is expected that consumption of high fat food will decrease.



David R. Henderson, "Demand." *The Concise Encyclopedia of Economics*, 2008.

Specific Aims

- To address the relationship between food price and consumption of high fat food.
- To test whether different genotypes of mice react differently to the changing food prices.



Hypotheses

- Female mice, regardless of genotype, will decrease their consumption of high-fat mouse chow as the price of the food increases.
- Price will have less of an impact on genetically obese mice models versus their wild-type counterparts.


Project Overview



Mice	• High fat diet
Genetics	• Obese Mouse Models v. Wild-Type
Behavioral Effects	• Food Consumption vs. Price
Physical Observations	• Body Fat % • Body weight
Physiological Effects	• Serum Parameters

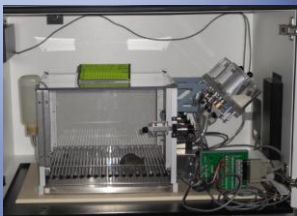

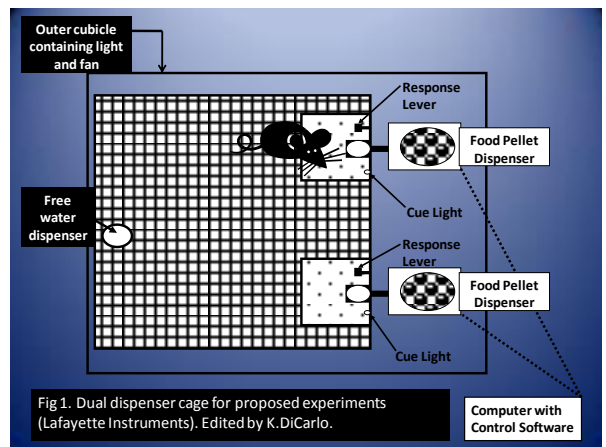
Experimental Design Subjects

- Female mice
- Age 8-10 weeks at start.
- Tub-Mutant-Obese Mouse Model
 - known to have adult onset obesity
- Wild-type counterparts
 - control
- Any mouse that loses >20% initial body weight will be removed from the study.



Experimental Design Apparatus

- Operant chamber with dual lever dispensers
- Computer controlled
- Only one dispenser will operate at a time
- Lever presses simulate "price" of food
- Operates from 5pm-5am each night

Experimental Design Price Schedule

Price = Lever Presses

Price Schedule	Price (No. of Presses)	No. Of Days	No. of Days in dataset.
	Shaping	5-7 days	0
1	10	7	5
2	23	7	5
3	32	7	5
4	40	7	5

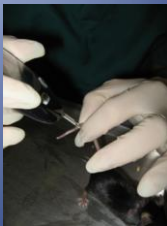
Total experimental time is ~ 5 weeks.

Experimental Design Measurements

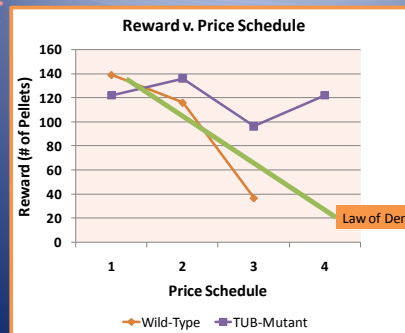
Starting Measurements	Daily Measurements	Ending Measurements
<ul style="list-style-type: none"> Identify genotype Body weight 	<ul style="list-style-type: none"> Lever presses Body weight Vaginal swabs to monitor female estrous cycle. 	<ul style="list-style-type: none"> Body weight Body composition-MRI Glucose tolerance

Results

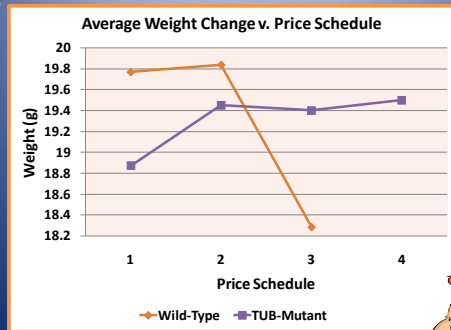
- Subjects thus far:
 - G960-Wild-Type
 - Removed during 3rd price schedule
 - G969-Tub-Mutant
 - Completed study Friday 7-24
 - H010-Wild-Type
 - Removed during shaping phase
 - H011-Wild-Type
 - Started 7-22-09
 - H015-Tub-Mutant
 - Started 7-22-09



Results



Results



Discussion

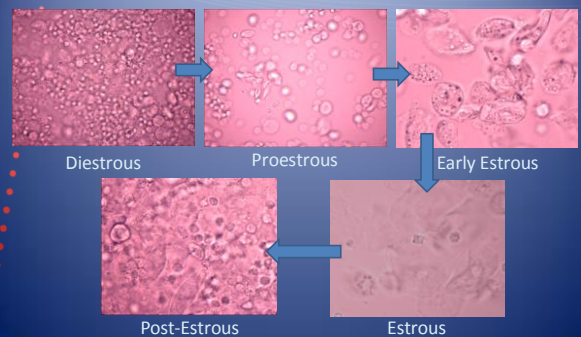
- The results varied between the two mice of different genotypes:
 - The average consumption of the mice differed across the 4 price schedules.
 - Wild-Type: negative correlation
 - Tub-Mutant: no direct correlation

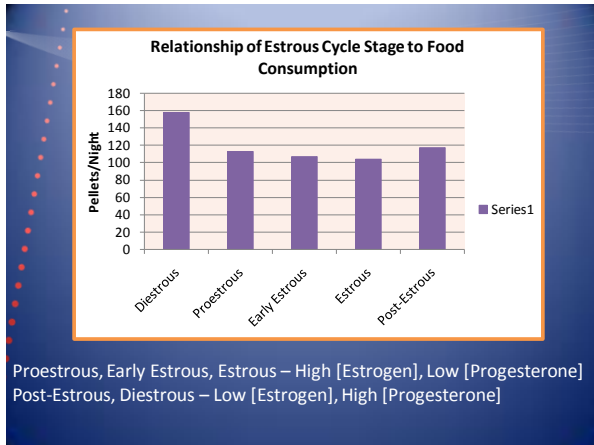
Discussion

- Weight change varied among the subjects.
 - Wild-Type: lost 4.8g total.
 - Tub-Mutant: remained constant or gained weight.
- What effect does the female mouse estrous cycle have on food consumption patterns?

Discussion

The Female Mouse Estrous Cycle





Conclusion

- Differences in reaction to the price of food do exist across genotypes.
- The Tub-Mutant mouse was not influenced by price in their consumption of HF food.
- The Tub-Mutant mouse was willing to work harder to get HF food, regardless of price.

How does this apply to YOU?

- States in the US are already implementing food taxes to try and change consumption patterns.

- Food taxes are currently a hot-topic in Washington D.C.
- But...How would the effectiveness of taxes on high fat foods be different among people of different genotypes?

<http://www.forbes.com/2009/07/27/fat-tax-healthcare-business-washington-obama.html>

Future Direction

- Goal is to obtain data from more mice:
 - n= 4 mice total of each genotype
 - Tub-Mutant
 - Wild-Type
 - N2 Knock-Out
 - Research will continue in the fall
 - May change price structure
- Study might eventually be repeated using a low-fat diet

Price Schedule	Price (No. of Presses)
	Shaping
1	10
2	23
3	32
4	40
5	32
6	23
7	10

Special thanks to:

Dr. George Davis
Dr. Deborah Good
Christina McIntyre
Mary Marchant

Jacy Jacob
USDA Summer Scholars
Program
Good Lab Members



Questions?