A Psychogenetic Analysis of Appetite and Overeating

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Homeostatic Hunger

- Physiologic signals
- Following relatively prolonged food deprivation
- Regulated, in part, by blood glucose levels.
Hedonic Hunger

• Desire occurs in the absence of deprivation
• Triggered by the palatability, novelty, and attractiveness of food
Brain Reward/Pleasure Pathways
Behavioural Differences in Overeating

Passive Overeating

Compulsive Overeating
Binge Eating Disorder (BED)

1. Eating, in a discrete period of time, an amount of food that is definitely larger than most people would eat during a similar period of time.

2. A feeling that one cannot stop eating or control how much they are eating.

3. The binge-eating episodes are associated with at least three of the following:
   
   3.1 Eating rapidly
   3.2 Feeling uncomfortably full
   3.3 Eating without feeling hungry
   3.4 Eating alone because of embarrassment
   3.5 Feeling disgusted with oneself, depressed, or guilty after overeating

4. The binge-eating occurs at least twice per week for 6 months.

5. The binge eating is not associated with the regular use of inappropriate compensatory behaviors such as purging, fasting, or excessive exercise.
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<td><strong>Hyper-palatable Food as Drugs</strong></td>
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<tr>
<td>1. Activate dopamine and opioid neural circuitry</td>
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<td>2. Trigger artificially high levels of reward</td>
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<td>3. Alter neurobiological systems</td>
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<td>4. Cause neuro-adaptations that foster tolerance</td>
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<td>5. Elicit cue-triggered cravings</td>
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<td>6. Consumed in spite of negative consequences</td>
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<td>7. Resistant to efforts to cut down or stop</td>
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<td>8. Cause high public health costs</td>
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<td>9. Prone to binge consumption</td>
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<td>10. Exposure <em>in utero</em> can cause negative health consequences</td>
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Mediated by variation in dopamine availability in neural circuitry extending from the brainstem to regions including the nucleus accumbens, amygdala, and prefrontal cortex.
Reward Sensitivity
Obese Adults
N = 269
Age 25-50 years

BED
N = 92

Non-BED
N = 177
Hedonically-Driven Eating

‘The Power of Food’

Mean PFS Total Score

p < 0.0001
BED > Non-BED

**Food Cravings**
\[ p < 0.0001 \]

**Symptoms of Food Addiction**
\[ p < 0.0001 \]

**Addictive Personality**
\[ p = 0.002 \]
Multilocus Genetic Profiling

• Individual loci account for a small proportion of phenotypic variance.
• Gene x gene analyses require relatively large samples for statistical power.
• **Multilocus genetic profiling** reflects the *cumulative* effect of multiple polymorphic loci - of known functionality - on a specific signaling mechanism.
Neural Target:
Responsiveness of the Ventral Striatum (VS)

- VS regulates reward-related and appetitive behaviours.
- Increased dopamine signaling would imply increased VS reactivity.
- Increased VS reactivity would reflect greater ‘reward sensitivity’.
Genetic Coding Scheme for Striatal Dopamine Signaling

- **ANKK1** Taq1A: A1+ = low
- **DAT1** VNTR: 9-repeat = high
- **DRD2** -141Ins/Del: DelC+ = low
- **DRD2** C957T: T/T = high
- **DRD2** rs12364283: C+ = high

High = 1; Low = 0

Nikolova et al (2010)
*Neuropsychopharmacology*
- Heightened DA signaling.

- Higher Reward Sensitivity.

- More appetitive and hedonic response to food.

- **Reward Surfeit Syndrome**

\[ p = 0.019 \]
Conclusions

BED is a subtype of obesity with a distinctive psychobiological profile characterized by:

- A heightened sensitivity to food reward
- Clinical symptoms of an addiction disorder
- Some personality traits similar to those found in drug-dependent individuals