The Effect of High Reward Sensitivity on Impaired Appetitive Learning in Individuals with Obesity

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Introduction

Food Cue Exposure and Food Intake [1]

- Strong correlation between future weight & habitual overeating, susceptibility to overeat in response to every day food cues.

Food Cue-reactivity through Classical Conditioning

- Classical conditioning: Repeated pairing between unconditional stimulus (food intake) & neutral stimulus (e.g., image of food) → conditioned appetitive response ↑.

High Reward Sensitivity & Activation of Appetitive Conditioning in Obese People [2]

- High reward sensitivity can strengthen CS-US appetitive association currently undergoing.
- Obese people did not acquire differential US expectancies to a CS+ paired with prospective food rewards vs. a CS-.
- High reward sensitivity in many obese people → Impaired acquisition and extinction of conditioned responses to food-predicting cues.

Aim of This Study

- To test whether high reward sensitivity is related to impaired associative learning in individuals with obesity.

Method

Participants

- 120 female a) BMI ≥ 25, b) high & low reward sensitivity (BAS).

Table 1. Demographic and clinical characteristics in each group

Measure	Group				Test Statistics (F)
	Obese High Reward Sensitivity (N = 33)	Obese Low Reward Sensitivity (N = 26)	Normal-weight High Reward Sensitivity (N = 28)	Normal-weight Low Reward Sensitivity (N = 32)	
Age (yrs)	35.33 (13.76)	36.76 (13.79)	34.00 (11.88)	37.96 (13.76)	.041
BMI	28.03 (3.64)	28.00 (3.27)	20.73 (1.94)	20.75 (1.79)	.088
BAS	17.21 (1.67)	11.84 (3.04)	16.11 (2.20)	11.75 (2.32)	1.193

Modified discrimination and reversal learning paradigm [3]

- Conditioned stimuli (CS):** blue & purple square /
- Unconditioned stimuli (US):** 10 or 15 M&Ms → To identify the relationship two colored squares & reward using 1-9 (**Figure 1**).

Figure 1. The diagram of learning paradigm

Learning indices

- ACQ:** how well one could discriminate the CS+ from the CS-.
- ΔA & ΔB:** how well one could update and extinction the value.

Procedure

Figure 2. Procedure of the study

Results

Data Analysis

- 2 (**Obese:** Obese, normal-weighted) x 2 (**Reward sensitivity:** high, low) ANOVA / **Dependent variable:** ACQ, ΔA, ΔB (scores)

Acquisition

- Significant interaction group & reward sensitivity level [$F(1, 116) = 3.98, p < .05, \eta_p^2 = .033$].
→ Obese with high reward sensitivity showed lower acquisition learning than normal-weight with high reward sensitivity.
- No significant main effect of group and reward sensitivity (*n.s.*).

Extinction

- Significant interaction group & reward sensitivity level [$F(1, 68) = 3.00, p < .05, \eta_p^2 = .043$].
→ Obese with high reward sensitivity showed impaired extinction performance than normal-weight with high reward sensitivity.
- No significant main effect of group and reward sensitivity (*n.s.*).

Updating

- No significant interaction group & reward sensitivity level and main effect of group and reward sensitivity level (*n.s.*).

Figure 3. Acquisition and extinction scores across groups
(* $p < .05$, *** $p < .001$)

Discussion

Discussion & Implication

- Examined whether obese and healthy weight individuals differ in the acquisition, updating, and extinction of appetitive learning to food cues according to the reward sensitivity level.
→ Obese with high reward sensitivity individuals had deficit in discriminative appetitive learning and extinction.
→ Implicated that recognizing individual difference in appetitive learning with reward sensitivity would be necessary.

Suggestion for Future Research

- Need to investigate more complex paradigms not limited to classical conditioning.

References

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