Body mass shapes social decision-making in obesity

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Background

Fairness perception fundamentally shapes **human social interactions**, as demonstrated through experiments like the Ultimatum Game[1,2]. This fairness sensitivity likely has **evolutionary roots in our survival strategy**—sharing became essential when resources were scarce. These ancestral pressures likely shaped our modern social decision-making architecture, where **physiological and emotional states serve as information channels** between body and brain[3,4,5].

Evidence suggests **bodily signals**, particularly **those related to energy metabolism, unconsciously influence decisions, with mood potentially mediating past experiences**[6]. However, it is unknown how these body-brain communication pathways adapt as a function of body-weight loss.

Research Questions

RQ1: Does social decision-making change after a 10-week weight loss intervention (WLI)?

RQ2: Does weight loss, i.e., a change in BMI, predict the change in social decision-making in obese individuals after a 10-week WLI?

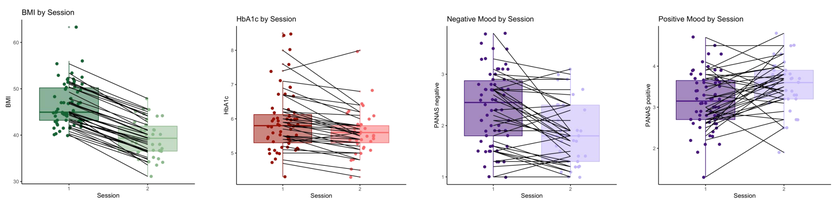
RQ3a/RQ3b: Which factors (bodily signals, such as HbA1c or emotional ones such as positive or negative mood) drive the effect of BMI on social-decision making in obese individuals before vs. after a 10-week WLI?

Methods

Sample

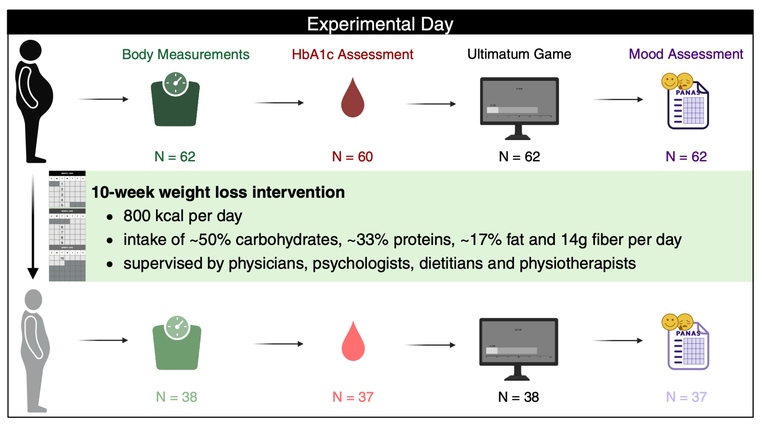
	N	Females	Age	BMI	HbA1c[a]	neg. mood (PANAS)[a]	pos. mood (PANAS)[a]
Before WL	62	66.1%	44.8 (14.6)	46.5 (4.65)	5.88 (0.86)	2.36 (0.73)	3.16 (0.67)
After WL	38	65.8%	48.1 (14.7)	39.4 (3.93)	5.62 (0.66)	1.86 (0.61)	3.54 (0.61)

Note. [a]N = 37 after WL; WL = weight loss; standard deviations are given in brackets.

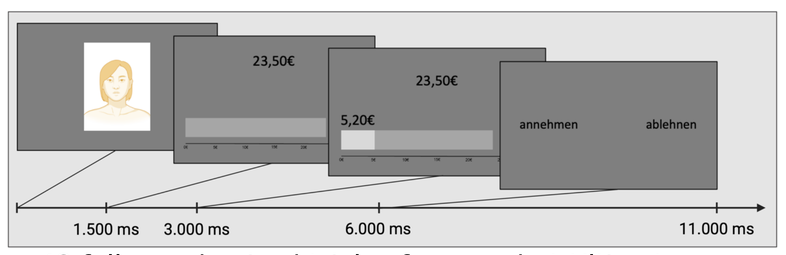


- After the WLI BMI, HbA1c and negative mood was significantly reduced, positive mood was improved.

Procedure



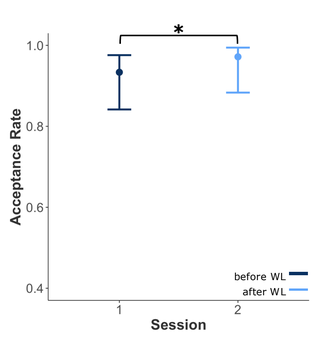
Ultimatum Game



- 48 fully randomized trials of a one-shot Ultimatum Game in the role of the responder
- Offers have three levels of fairness (fair, medium fair, unfair) and three levels of offer magnitude (high, medium, low). These two factors are orthogonal.

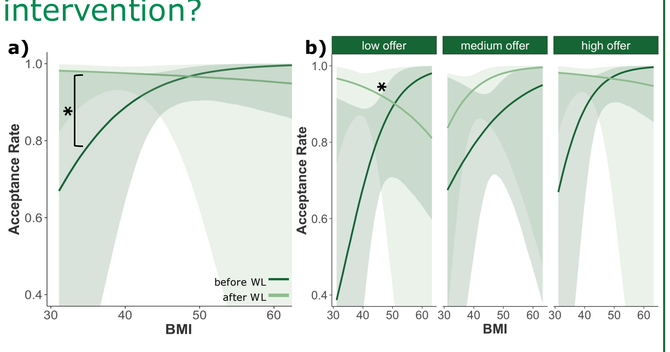
Results

RQ1: Does sDM change after a 10-week WLI?



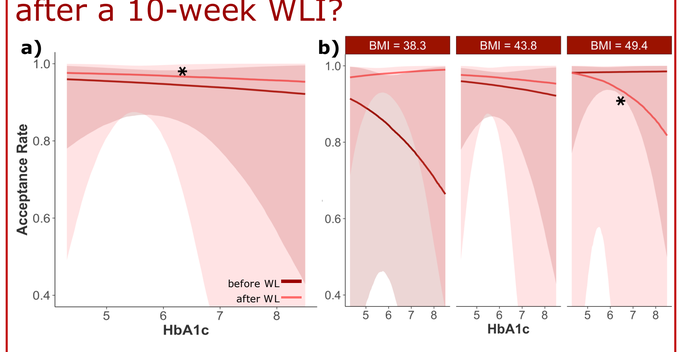
- sDM changed after a 10-week WLI
- after WL, participants accepted more offers, showing decreased fairness sensitivity & more rational economic decion-making

RQ2: Does WL predict the change in sDM in obese individuals after a 10-week WL intervention?



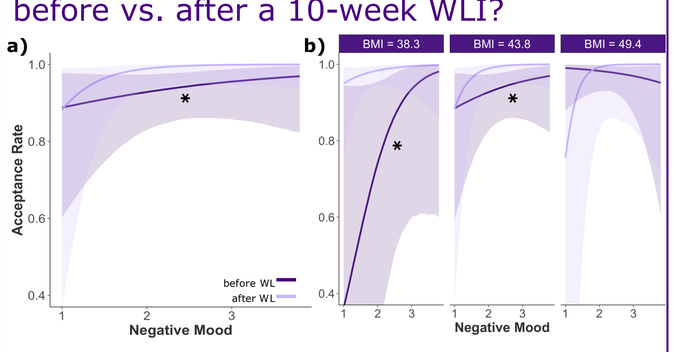
- BMI impacts the acceptance behavior of offers differently before and after WLI **(a)**
- In particular, individuals who achieved a lower BMI after the intervention were more likely to accept small offers compared to those who maintained a higher BMI **(b)**. They became less sensitive to fairness violations by accepting more offers.

RQ3a: Do bodily signals drive the effect of BMI on sDM in obese individuals before vs. after a 10-week WLI?



- After WL, but not before, HbA1c levels predict acceptance behavior of offers. Lower blood glucose levels after WL decrease the sensitivity to fairness **(a)**
- This effect was most prominent in those individuals with the largest weight status after the WL **(b)**.

RQ3b: Do emotional states drive the effect of BMI on sDM in obese individuals before vs. after a 10-week WLI?



- Higher negative mood before WL was associated with decreased sensitivity to fairness **(a)**
- This effect was most prominent in those individuals with lower and intermediate weight status before the WL **(b)**.

Conclusions

- **Weight loss decreases fairness sensitivity**: After a 10-week weight loss intervention, individuals became more economically rational, accepting more offers regardless of potential fairness violations **(RQ1)**.
- Degree of weight loss predicts behavioral change: Greater BMI reduction was associated with increased acceptance of small, unfair offers—indicating reduced fairness sensitivity **(RQ2)**.
- **Different regulatory mechanisms operate before and after weight loss**: Before weight loss, negative mood predicts acceptance behavior, particularly in individuals with lower BMI **(RQ3b)**. After weight loss, HbA1c levels become the primary predictor of acceptance behavior, especially in those with higher remaining BMI **(RQ3a)**. Positive mood did not affect sDM in obese individuals.

→ Our work suggests that the **body-brain communication pathways dynamically adapt to changing metabolic states**, switching between emotional regulatory mechanisms that ultimately shape our social interactions and economic decisions. Understanding these metabolic and psychological mechanisms **could improve weight-loss interventions** by accounting for their dynamic influence on social behavior during weight change.

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