STRESS REACTIVITY AND BODY MASS INDEX

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ABSTRACT

Purpose: Reactivity to psychological stress may promote greater adiposity. The ability to rapidly reduce reactivity to repeated exposures of the same stressor may be protective against adiposity. The purpose is to determine the association between individual differences in habituation to stress and body mass index (BMI). **Methods:** Participants (n=30, ages 18-29) completed 2 lab visits. On the stress day, subjects rested for 10 min followed by seven 2 min mental subtractions and one 2 min speech (counterbalanced order). Each stressor was followed by a 2 min rest. Subjects read magazines and matched cards for equal time on the control visit. Blood pressure (BP) and heart rate (HR) were measured throughout the session. **Results:** Greater initial HR reactivity predicted greater BMI. Faster habituation, measured by the slope of reduced HR reactivity, predicted greater BMI. Initial HR reactivity was strongly correlated with HR reactivity to the later novel stressor. **Conclusion:** Acute reactivity to a variety of novel stressors may be more important than the ability to reduce reactivity to a repeated stressor for altering adiposity.

BACKGROUND

- Habituation is nonassociative learning where responses decrease with a continued stimulus.
- Habituation to stress is measured by changes in HR and BP reactivities across trials.
- Greater initial stress reactivity is associated with increased total and central adiposity.
- It is not known whether initial reactivity to a stressor or continued reactivity to the same stressor, is most important for predicting BMI.

PURPOSE

Aim 1: To identify whether some individuals have the trait of being more stress reactive by determining their stress reactivity across different stressors and testing the association between their initial stress reactivity and reactivity to a novel stressor.
Aim 2: To determine the association of initial physiological stress reactivity with BMI.
Aim 3: To determine the association of the rate of stress reactivity habituation with BMI.
Aim 4: To determine the association of the initial stress reactivity and stress habituation.

METHODS

- Participants completed 2 laboratory visits. On both visits, participants completed surveys, were fit with laboratory equipment (BP cuff, electrodes, HR monitor), and completed a 10 min baseline rest. Blood pressure and heart rate measurements were recorded during all tasks. Perceived stress was measured after each task and rest.
- Stress day: Participants performed eight 2 min stress tasks, with each task followed by a 2 min rest period. The first five or six trials were mental arithmetic (serial subtraction) tasks. The sixth or seventh trial was the dishabituation speech task . The final trial was mental arithmetic. The dishabituation trial was counterbalanced between subjects.
- Control day: Participants performed a card matching task for 16 min and rested for 16 min. The card matching task was designed to be non-stressful.
- **Data Analysis:** ANOVA was used to test for sex differences in physical characteristics. Mixed-effects linear regression models were used to determine slope of habituation for heart rate, systolic blood pressure, diastolic blood pressure and perceived stress. Multivariate linear regression was used to predict BMI from initial HR reactivity and from stress habituation, controlling for sex and usual stress.

RESULTS

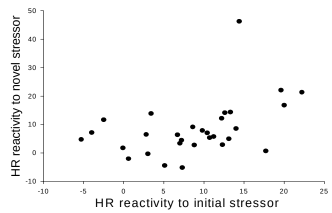
Table 1: Participant characteristics

	Males (N=11)	Females (N=19)
Age (years)	22.7 ± 1.7	22.7 ± 3.3
Height (cm)*	172.8 ± 7.0	161.4 ± 5.8
Weight (lbs)	162.8 ± 1.8	131.7 ± 16.7
BMI	24.8 ± 2.9	23.0 ± 2.9
Perceived Stress*	22.8 ± 5.7	28.7 ± 7.3
HR habituation slope	-0.23 ± 0.24	-0.31 ± 0.3

*Males and females are significantly different, $p < 0.05$

Aim 1: Initial HR reactivity and novel speech stressor reactivity are correlated (ρ=0.43, *p* <0.02).

Figure 2. Plot of the correlation between HR reactivity for the initial serial subtraction stressor on Trial 1 and the novel speech stressor on Trial 6 or 7

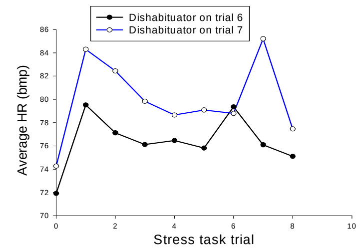


Aim 2: When controlling for gender and usual stress, greater initial HR reactivity predicted greater BMI (β = 0.15 , *p* < 0.05)

Independent Variable	Coefficient	Coefficient SE	Stand. Coefficient	*p*
Intercept	25.6	2.1		0.00
Gender	-1.5	1.1	-0.24	0.20
Usual Stress	-0.09	0.08	-0.22	0.24
Initial HR reactivity	0.15	0.07	0.36	0.04

R=0.53
R^2=0.28

Figure 1. Habituation of heart rate reactivity across stressor trials



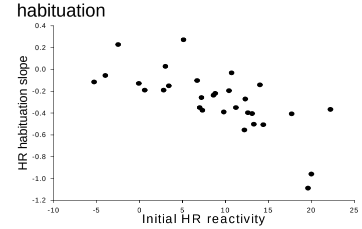
Aim 3: When controlling for gender and usual stress, a slower rate of habituation (less negative heart rate slope) predicted greater BMI (β = -5.44, *p* < 0.004).

Independent Variable	Coefficient	Coefficient SE	Stand. Coefficient	*p*
Intercept	25.3	1.9		0.00
Gender	-1.8	1.0	-0.29	0.09
Usual Stress	-0.07	0.07	-0.18	0.29
HR slope	-5.4	1.7	-.50	0.003

R=0.53
R^2=0.28

Aim 4: Initial stress reactivity and HR habituation slope are correlated ρ = -0.70, *p* <0.001). This correlation inhibits further modeling of the interaction between initial stress reactivity and stress habituation.

Figure 3. Plot of the correlation between HR reactivity to the initial serial subtraction stressor and HR slope of habituation



CONCLUSION

- Individuals who are more reactive to initial stress have a greater BMI.
- Individuals with lower BMI habituate faster to stress compared to those with higher BMI.
- Individuals' HR reactivity to an initial stressor is strongly correlated with their HR reactivity to a novel stressor.
- Acute or novel stress may be more important than reactivity to repeated stress when predicting BMI.
- Efforts to prevent weight gain may benefit from focusing on coping methods for acute or novel stressors.

ACKNOWLEDGMENTS

Supported by IFR funds to Dr. Roemmich.