Reward Sensitivity and weight status in adolescents: cross-sectional and longitudinal associations

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INTRODUCTION

Understanding eating behaviour in individuals is not possible without studying individual reward circuits. Reward Sensitivity (RS) is a psychological concept reflecting sensitivity of the neurological Behavioral Approach System (BAS) (Gray, 1987). Cross-sectional studies in adults (Davis & Fox, 2008) support a dynamic vulnerability model for obesity, showing a curvilinear relationship between RS and BMI: RS and BMI are positively correlated in normal weight and overweight individuals, while they are negatively correlated in obese individuals.

We replicate and extend these findings by describing **cross-sectional** (Study 1**) and longitudinal associations** (Study 2) **between RS and bodyweight in adolescents**.

METHOD

Participants. *Study 1.* 438 Flemish adolescents aged 10-15 years (age: M=12.07, SD=1.51; adjusted BMI: M=109%, SD=27; underweight: 11%, average weight: 67%, overweight: 9%, obese: 13%; 53% girls). *Study 2.* 2022 Dutch adolescents participating in Trails study aged 12-15 years at baseline (age: M=13.05, SD=0.60; adjusted BMI: M=102%, SD=17; underweight: 11%, average weight: 77%, overweight: 8%, obese: 4%; 53% girls).

Measures. *RS* is indexed by the BAS-subscale of the Dutch child version of Carver and White (1994) BIS/BAS-scales (Muris et al., 2005; α=.76). BMI is calculated and adjusted for age using CDC-grow charts

$$adj\ BMI = \left(\frac{BMI}{50th\ perc\ for\ age\ and\ gender}\right) x100$$

underweight: adjBMI< 85%, overweight: adjBMI ≥ 120%, obesity: adjBMI ≥ 140% obese (Van Winckel & Van Mil, 2001).

DATA-ANALYSES

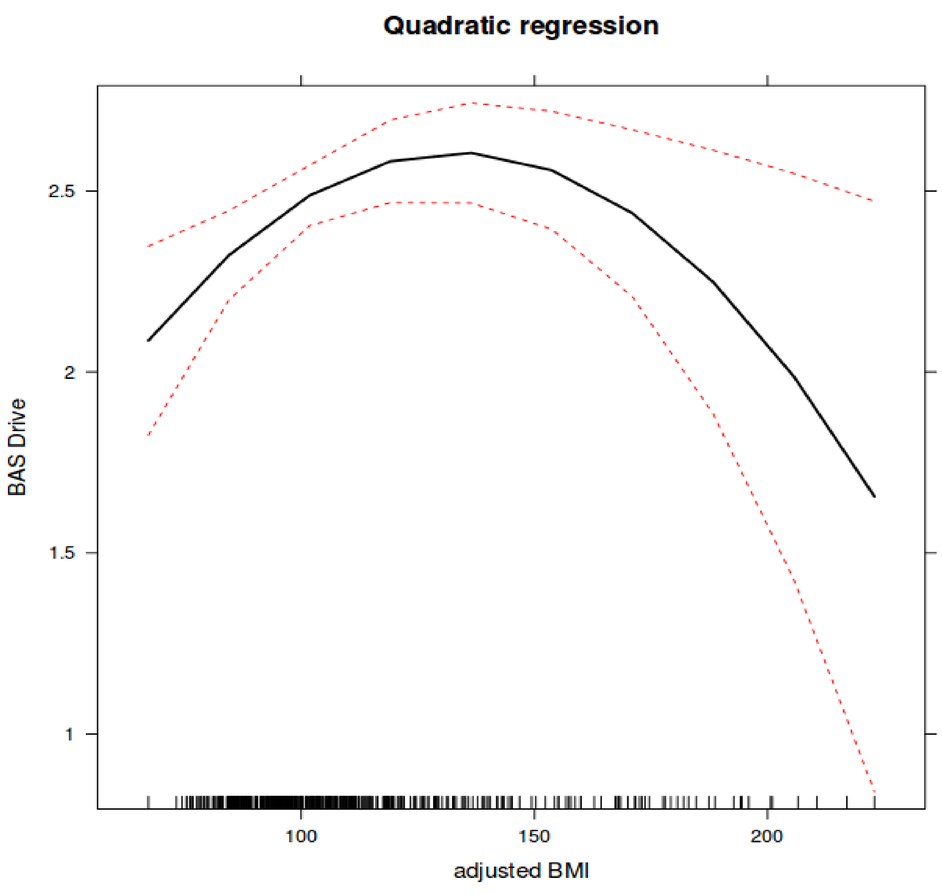
Study 1. The predicted cross-sectional curvilinear association between Reward Sensitivity and Weight was tested by fitting a quadratic regression model of BAS-scores on adjBMI. (for this analysis we used the scores of the BAS Drive subscale).

Study 2. An unconditional multilevel growth model with first-order and second-order polynomials (random slopes, random intercepts, AR(1)heterogeneous for both polynomials) was used to investigate the growth trajectories of adjusted BMI over time. To test for the potential moderating effect of BAS, BAS-scores were added as fixed predictors of adjBMI in a conditional growth model.

RESULTS

Study 1: cross-sectional associations

The quadratic component of adjBMI significantly predicts RS: $F(1,428)=6.53$, $p=.01$, $R^2=0.03$, $\beta=-2.32$.

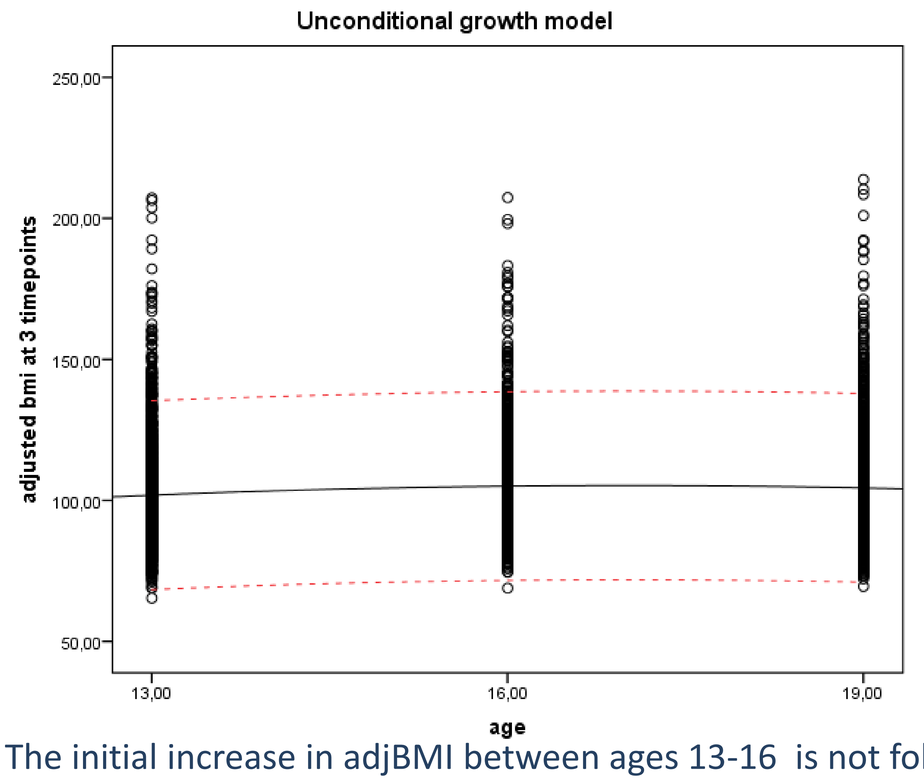


There is a positive relationship between adjBMI and RS until adjBMI=133%. Above this point, there is a negative relationship between adjBMI and RS.

Study 2: growth and longitudinal associations

Both the linear, $F(1,1581.64)=119.47$, $p<.001$, $-2LL=40095.21$, and the quadratic model, $F(1,1484.36)=134.24$, $p<.001$, $-2LL=39963.87$, significantly described the changes in BMI over time. However, the quadratic trend best describes the data, $\chi^2(2)=131.36$, $p<.001$.

Adding BAS total scores as an extra predictor to the quadratic model, resulted in a non-significant model, $F(1,1579.10)=.03$, $p=.87$.



The initial increase in adjBMI between ages 13-16 is not followed by further increase between aged 16-19. RS did not moderate the growth trajectory.

CONCLUSION AND DISCUSSION

The cross-sectional results from *Study 1* shows the predicted curvilinear relationship between RS and BMI, and thus supports the dynamic vulnerability model for obesity. However, *Study* 2 did not provide evidence for the predicted moderation of weight gain by RS. At the moment, we have no testable explication for the lack of evidence for our longitudinal predictions. However, it might be the case that associations between RS and weight status mediated by a third variable (e.g. food consumption). Additionally , it might be possible that the association is moderated by yet another variable (e.g. physical activity, effortful control). Although there is support for the idea that RS is implicated in obesity, the exact nature of the association remains unclear.