Parental monitoring may protect impulsive children from overeating

Bennett, C & Blissett, J

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Carmel Bennett, Ph.D. & Jackie Blissett, Ph.D.

School of Psychology, University of Birmingham, UK.

Keywords: Impulsivity, parental monitoring, eating behaviour, weight

All correspondence to Carmel Bennett

School of Psychology, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK

Email cxb791@bham.ac.uk

Abstract

Background: Research has highlighted links between impulsivity and weight in children and adults. Nevertheless, little is known about the nature of this link in very young children or about the underlying mechanism by which impulsivity leads to greater adiposity. Objective: The present study aimed to explore relationships between impulsivity, weight and eating behaviour in a sample of 95 2-4-year-olds. Method: Parent-child dyads visited the laboratory and **consumed a meal** after which parents completed measures **of** child impulsivity, eating behaviour and parental feeding, while children completed impulsivity tasks measuring the impulsivity facets delay of gratification (Snack Delay task), motor impulsivity (Line Walking task) and inhibitory control (Tower task). Results: Pearson's correlations showed that females with greater motor impulsivity were heavier. Additionally, monitoring moderated the relationship between impulsivity and food approach behaviour, indicating that monitoring may protect more impulsive children from displaying problematic eating behaviours. Conclusions: The motor impulsivity facet appears particularly relevant to child weight; parents can modulate the impact of impulsivity on child eating behaviour through their feeding style.

Keywords: Impulsivity, BMI z-scores, eating behaviour, parental monitoring

Introduction

Childhood obesity is a worldwide major health concern. In addition to lifestyle factors (1), concepts like impulsivity have received increasing attention to identify the mechanisms underlying overeating and poor food choices (2, 3). Impulsivity is a complex concept consisting of underlying facets (e.g. inhibitory control, motor impulsivity, delay of gratification, sensitivity to reward and the tendency to react fast, without planning or foresight) (4). Impulsive behaviours of varying degrees are common and impulsivity is considered to be a relatively stable personality trait, affected by situational demands, varying across the life-span (5).

Impulsivity plays an important role in weight regulation. Overweight children are more impulsive than their healthy weight peers (3). Early inhibitory control abilities appear to predict later weight and overweight risk (6) and the ability to delay gratification has been linked with obesity risk in 4-year-olds (7). Unfortunately, previous studies relied on limited impulsivity assessments; it is unclear whether other impulsivity facets are relevant to weight gain in young children. Nevertheless, these findings suggest that differences in self-regulation and inhibitory control may predate the development of obesity. Furthermore, research has highlighted gender differences in the impact of impulsivity on weight, with more impulsive female 3-12-year-olds being more susceptible to weight gain than males (8). Some studies have failed to identify links between impulsivity and weight in children, which may be attributable to the measures used to assess impulsivity (9). A meta-analysis showed that behavioural, rather than self-report measures of impulsivity and measurements of the decision-making and disinhibition facets rather than of inattention and overall impulsivity, yielded greater effect sizes in studies linking impulsivity and weight in paediatric populations (10). These findings underline the importance of carefully selecting impulsivity measures.

Overall, there is little information on the impulsivity facets that may be particularly relevant to weight in very young populations.

In addition, research suggests that impulsivity can influence eating behaviours (6). High sensitivity to reward may predispose children to prefer highly palatable foods and may encourage their consumption in the absence of hunger (11). Impulsive individuals make poorer food choices, have higher intake rates and a tendency to overeat (12). Furthermore, food variety and impulsivity have been found to interact, leading to overeating in children (13).

In young children the expression of impulsive eating behaviours is influenced by caregivers who are responsible for food environments and mealtime interactions (14). A number of controlling feeding practices (e.g. restriction, pressure to eat) are commonly used to affect eating behaviours and weight, but they do not always yield the desired outcomes (14, 15, 16). The controlling parental feeding practice monitoring, however, has been linked with positive weight and eating outcomes for children, including reduced calorie intake and improved food choices (17, 18). Monitoring is less intrusive than pressure and restriction and involves keeping track of the child's intake of foods high in fat, sugar and salt (19). In addition, research has shown that parental monitoring may also have a protective effect on emotional eating in impulsive 10-13-year-olds (20). Parental monitoring significantly moderated the link between self-reported impulsivity and eating behaviour. Impulsivity was positively linked with emotional eating when parents used low and average levels of monitoring but this relationship was not significant if parents used high levels of monitoring (20). Whether such effects can be observed in younger children and whether moderating effects may vary for different impulsivity facets has not yet been explored.

Aims and hypotheses

This study aimed to explore the relationships between impulsivity, measured through behavioural and parent-report measures, child weight, eating behaviour, intake and parental monitoring in 2-4-year-olds. It was hypothesized that more impulsive children would be heavier, would consume more mealtime calories and would be rated higher in food approach behaviour and lower in food avoidance behaviour than less impulsive children. Finally, it was hypothesized that parental monitoring would be positively associated with impulsivity, reflecting parental concerns about child weight and eating behaviour and efforts to control child intake. The moderating effects of monitoring on the relationship between impulsivity, eating behaviour and mealtime intake were explored. Gender-specific analyses were carried out to explore differences in the abovementioned links.

Method

Participants

Ninety-five parents and their 2-4-year-old children participated in this study and were recruited through the Infant and Child laboratory (ICL) database, from nurseries and toddler groups in and around Birmingham, UK. Exclusion criteria included the presence of food allergies, disorders affecting eating, current/recent major illness, intellectual disabilities, impulsivity-related and anxiety disorders (no dyads were excluded based on these criteria). The sample's demographic characteristics can be seen in Table 1.

Measures and procedure

Demographic information. Questionnaires were completed by mothers, assessing child gender, child and maternal age, ethnicity, annual household income and level of education. Attending fathers (*n*=2) took the questionnaire home for mothers to complete. Mothers and children were measured and weighed wearing light indoor clothing, without shoes. Where fathers attended mothers self-reported height and weight. Maternal BMIs and child BMI z-scores adjusting for age and gender were calculated using the British Growth Reference (1996). Preliminary analyses (not shown) indicated that mothers who completed the questionnaire at home vs. at the ICL and self-reported their height and weight vs. being measured at the ICL did not differ. Data from these mother-child dyads were therefore included.

Child Eating Behaviour. The Children's Eating Behaviour Questionnaire (CEBQ; 21) assesses parent-perceived child eating behaviour. The 35-item questionnaire measures Food Approach behaviour through four subscales (Enjoyment of Food, Desire to Drink, Food Responsiveness, Emotional Overeating) and Food Avoidance behaviour through four subscales (Emotional Undereating, Satiety Responsiveness, Slowness in Eating and Food Fussiness). Items are phrased as statements, using a 5-point Likert scale ranging from 1 (*Never*) to 5 (*Always*). In line with previous research, links between impulsivity and Food Approach/Avoidance behaviour were explored; these were generated by calculating the mean of the relevant subscale scores (22). The CEBQ has been validated for use with children as young as two years and has been linked with intake and BMI (23). The Cronbach's alphas were .81 for the Food Approach subscale and .85 for the Food Avoidance subscale.

Mealtime. Parents and children received a standardised meal. Children did not eat in the hour prior to arrival. Meals consisted of a whole ham or cheese sandwich (half for children; filling dependent on preference; ~240kcal or 250kcal respectively), 10g ready salted potato crisps (~53kcal, Walkers Snack Food Ltd.), two chocolate-chip cookies (~114kcal, Burtons Foods Ltd.), five milk-chocolate buttons (~35kcal, Cadbury Plc.) and five green grapes (~18kcal). The meal contained a fruit novel to the child (part of another study); a whole dried date without the stone (~23kcal), a tinned lychee without the stone (~21kcal), or a quarter of a fresh fig (~12kcal). All foods were weighed before and after mealtimes and overall calorie intake was calculated. Water was available.

Parental Feeding Practices. The Monitoring subscale (four items, e.g. How much do you keep track of the sweets [candy, ice cream, cake, pies, pastries] that your child eats?) of the Comprehensive Feeding Practices Questionnaire (CFPQ; 19) was selected to measure parental monitoring. Items are phrased as questions, using a 5-point Likert scale ranging from 1 (*Never*) to 5 (*Always*). The reliability and validity of the scale, for use in children as young as two years, have been demonstrated (19). The Cronbach's alpha for Monitoring was .85.

Parent-reported child impulsivity. The Impulsivity subscale (e.g. When offered a choice of activities, how often did your child decide what to do very quickly and go after it?) of the Early Childhood Behaviour Questionnaire (ECBQ; 24) was selected to measure impulsivity. Items are written in question form using a 7-point Likert scale ranging from 1 (*Never*) to 7 (*Always*), including a *Does not apply* response option. The reliability and validity of the questionnaire for use with children aged 1.5 to 3 years have been demonstrated (24). The subscale's Cronbach's alpha was .77

Behavioural child impulsivity tasks. The procedures and data coding for the three behavioural tasks were adapted from past research (25).

Snack Delay task. This task assesses the ability to delay gratification by waiting to retrieve a palatable snack (chocolate buttons) placed on the table within the child's reach. Children were asked to delay snack retrieval until a bell was rung over three trials with progressively longer waiting intervals (10, 20 and 30 seconds). Task coding reflected the child's ability to delay snack retrieval. Higher scores reflected lower impulsivity.

Tower task. This task measures inhibitory control. During two trials children were asked to build a tower with the researcher, while taking turns. Data coding reflected the child's ability to take turns and to refrain from pushing the tower over/removing blocks carefully. Higher scores indicated better inhibitory control.

Line Walking task. This task assesses motor impulsivity. Children walked along a 1.8m long line without instruction (one trial) and while being told to walk as slowly as possible (two trials). The walking time during the two slow trials was recorded and averaged. Higher scores indicated lower levels of motor impulsivity.

Parents and children attended the ICL at the University of Birmingham. The researcher presented dyads with their meals, exited the room and observed the mealtime from the observation room. At the end of the mealtime, food was removed and parents completed questionnaires whilst children completed the behavioural tasks with the researcher in a corner of the room. Before debriefing, mothers and children were measured and weighed. Parents were reimbursed for their travel expenses and children received a toy. The Ethical Review Committee of the University of Birmingham approved this study.

Statistical analysis

SPSS version 20 was used to analyse the data. The criterion alpha for significance was .01, accounting for multiple testing. Histograms indicated that the majority of data were normally distributed. Descriptive statistics for impulsivity were calculated and gender differences were explored using independent samples *t*-tests. The impact of covariates on outcome variables was assessed. Pearson's correlations, controlling for covariates where appropriate, were carried out to examine hypothesized relationships for the sample overall and by gender. Finally, moderation analyses were carried out using the PROCESS tool (26).

Results

Descriptive statistics

Demographic characteristics. Table 1 shows the sample's demographic characteristics. *T*-tests indicated that there were no significant differences in age, BMI z-score, food approach/avoidance, intake or parental monitoring by child gender (analyses not shown). Children consumed between 58.39 and 422.73 calories during mealtimes (*M*=205.83, *SD*=90.18). 72.6% of children had a healthy weight (BMI z-score >2nd but <85th percentile), 15.8% of children were overweight (BMI z-score >85th but <95th percentile), 7.4% of children were obese (BMI z-score >95th percentile), while 2.1% of children were underweight (BMI z-score <2nd percentile). Results did not differ when underweight children were excluded from the analyses. Children's CEBQ food approach scores ranged from 0 to 4 (*M*=2.75, *SD*=.56), while their CEBQ food avoidance scores ranged from 0 to 4.43 (*M*=2.93, *SD*=.6). Parental monitoring ranged from 1 to 5 (*M*=4.22, *SD*=.7).

Child impulsivity. T-tests indicated that there were no gender differences in parent-reported impulsivity and impulsivity task performance scores (analyses not shown). See supplemental information for impulsivity ratings/scores.

(Table 1 about here)

Covariates

Preliminary analyses (not shown) indicated that child age, but no other confound, was positively associated with mealtime intake (*r*(95)=.3, *p*=.003). Analyses evaluating links between mealtime intake and impulsivity controlled for child age.

Impulsivity and child weight

Pearson's correlations assessed whether higher impulsivity levels were associated with higher BMI z-scores. Parent-reported impulsivity, Snack Delay and Tower task performance were not associated with BMI z-score. In line with the hypotheses there was a negative association between Line Walking task performance and BMI z-score for females; females with lower motor impulsivity had lower BMI z-scores (see Table 2).

Impulsivity and child eating behaviour

Pearson's correlations were carried out to assess whether higher impulsivity levels were linked with greater mealtime calorie intake, higher levels of food approach and lower levels of food avoidance behaviour. There were no relationships between impulsivity and eating behaviours or intake (Table 2).

Impulsivity and parental monitoring

Pearson's correlations were carried out to assess whether greater impulsivity levels were linked with greater levels of parental monitoring. There was no linear association between impulsivity and monitoring (see Table 2).

(Table 2 about here)

Moderating effects of parental monitoring on associations between impulsivity, eating behaviour and mealtime intake

Preliminary analyses indicated that there were no linear associations between monitoring, parent-reported eating behaviour and intake. Monitoring did not moderate the relationships between impulsivity measures and food avoidance behaviour or intake. Additionally, monitoring did not moderate the relationships between Snack Delay or Tower task performance and food approach behaviour. Parental monitoring did moderate the relationship between parent-reported impulsivity and food approach behaviour in females. The relationship was significant if monitoring was low (1 *SD* below mean: b=.34, t=1.6, p=.01), but not if parents reported using average (mean: b=.08, t=.88, p=.38) or high amounts of monitoring (1 *SD* above mean: b=-.19, *t*=-1.43, *p*=.16). Females high in parent-reported impulsivity were rated higher in food approach behaviour, if parents used low levels of monitoring (see Figure 1a).

Monitoring moderated the relationship between Line Walking task performance and food approach behaviour in the sample overall, and specifically in males. In males the relationship was significant if monitoring was low (1 *SD* below mean: b=.04, *t*=3.39, *p*=.002), but not if parents reported using average (mean: b=-.01, *t*=-.25, *p*=.8) or high amounts of monitoring (1 *SD* above mean: b=-.05, *t*=-1.34, *p*=.19). Males high in motor impulsivity were rated higher in food approach behaviour, if parents used low levels of monitoring (see Figure 1b).

(Figure 1 about here)

Discussion

The current study explored links between impulsivity, weight, eating behaviour and parental monitoring in 2-4-year-olds. Overall, few associations emerged. Associations between impulsivity and weight emerged for females and associations between impulsivity and eating behaviour emerged only when the moderating effects of monitoring were considered.

It was hypothesized that more impulsive children would be heavier than less impulsive children. The hypothesis was partly confirmed; females with higher motor impulsivity levels, measured through the Line Walking task, had higher BMI z-scores. Females' performance on the task and its association with weight may indicate an early tendency to act on impulse, which may become problematic in later life when children have independent access to foods. Interestingly, impulsivity and BMI z-score were not linked in males. Similar gender differences regarding the impact of impulsivity on weight have previously been reported in 3-12-year-olds (8). The current study thus extends previous findings to a younger, narrower age group. Earlier maturation in females is unlikely to explain the current findings. Impulsivity levels did not differ by gender and neither did the range of scores on the impulsivity measures, making it unlikely that the results are due to range restriction in males. The lack of associations between weight and delay of gratification measured by the Snack Delay task is surprising. Previous studies using delay of gratification tasks did find relationships, especially when using edible rewards (27). As child liking of the reward was not formally measured, its impact on associations cannot be ruled out. Supplementary analyses showed that task performance was not linked with mealtime intake, making it unlikely that performance was influenced by mealtime intake and associated hunger/satiety.

To address the possibility that gender differences in impulsivity-weight links were due to underlying differences in eating behaviour, links between impulsivity and eating behaviour were explored. Contrary to the hypotheses there were no associations. Research in adults has suggested that impulsivity is associated with emotional overeating in response to negative mood and through this to increases in BMI (28). Additionally, research has indicated that more impulsive children may have more difficulties resisting palatable foods, making them more prone to eating in the absence of hunger (29). Current findings suggest that, for 2-4-year-olds, pathways between impulsivity and eating behaviour may not be established yet or may only exist under conditions not tested in this study (e.g. negative mood, caregiver absence).

Associations between impulsivity and eating behaviour may have been affected by the influence of parental controlling mealtime behaviours (14). In the current study impulsivity and monitoring were not associated. Despite this, monitoring moderated the relationship between impulsivity and food approach behaviour, as previously shown in 10-

13-year-olds (20). The relationship was only observed when parents used low rather than average/high levels of monitoring. Interestingly, this effect was found when impulsivity was measured through parent-report in females, but through the Line Walking task in males. In both instances the association between impulsivity and food approach behaviour was positive if parents used low levels of monitoring. These findings indicate that children high in trait-like impulsivity (females) and motor impulsivity (males), whose parents monitor their intake less, may be more prone to display food approach behaviours associated with weight gain. This is an interesting novel finding, which may provide a basis for feeding recommendations for parents of children with elevated impulsivity levels.

Impulsivity is a multifaceted concept and the parent-report and performance measures used in the current study were selected to assess a variety of facets (6). The results highlight that links between impulsivity, weight and eating/feeding outcomes may vary depending on the facet under exploration and the task chosen to measure that facet. This underlines the importance of using a thorough, multi-method approach when measuring impulsivity to ensure confidence in the presence/absence of observed links.

This study has several limitations. The sample sizes for gender analyses were small and a replication of the findings in larger subsamples is desirable. Impulsivity task compliance was an issue for the Tower task. Although this task was age-appropriate some children failed to grasp the concept of turn-taking (25). Importantly, there were no age/gender differences between completers and non-completers for any of the behavioural tasks (analyses not shown). Dyads remained in the same room while children completed the impulsivity tasks and it cannot be ruled out that this may have influenced task performance.

This study highlights the relevance of the motor impulsivity facet in relation to weight and eating behaviour in 2-4-year-olds; stable impulsivity traits as explored through parent-report measures and links with problematic eating behaviour are also indicated. The observed differences in associations by child gender, stress the value of carrying out gender analyses.

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CB and JB conceived and carried out experiments and analysed data. Both authors were involved in writing the paper and had final approval of the submitted and published versions. The authors declare no conflicts of interest.

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Table 1

Demographic characteristics of the sample overall (N = 95)

Variables	Parent Characteristics	Child Characteristics
Gender	93 female, 2 male	41 females, 54 males
Age, mean (*SD*)	35.42 (4.92) years	29.49 (5.43) months
Age range	26 – 54	22-46
BMI, mean (*SD*)*	25.6 (5.62)	.34 (1.18)
BMI range *	18.1 – 45.86	-5.24-3.61
Educational level	7.4% Professional/Doctorate (*n*=7)	
	28.4% Post-Graduate Qualification (*n*=27)	
	35.8% University graduate (*n*=34)	
	17.9% A-Levels (*n*=17)	
	1.1% Some secondary education (*n*=1)	
	2.1% Other (*n*=2)	
Family annual income	15.8% > £75000 (*n*=15)	
	10.5% £60-75000 (*n*=10)	
	22.1% £45-60000 (*n*=21)	
	27.4% £30-45000 (*n*=26)	
	21.1% £15-30000 (*n*=20)	
	3.2% < £15000 (*n*=3)	
Parental ethnicity	80% White British (*n*=76)	
	1.1% Black British (*n*=1)	
	10.5% Asian/Asian British (*n*=10)	
	2.1% Mixed (*n*=2)	
	6.3% Other (*n*=6)	

* For children BMIs (mean and *SD*) are adjusted for their age and gender (BMI z-scores)

Table 2

Correlations between impulsivity task performance and child BMI z-score, food approach and avoidance behaviour and parental monitoring for the sample overall (N=95) and for the female subsample (n=41) and the male subsample (n=54) separately as well as between impulsivity task performance and mealtime intake for the sample overall (N=92) and for the female subsample (n=38) and the male subsample (n=51) separately

		ECBQ Impulsivity	Snack Delay	Line Walking	Tower
Child BMI z-score	Overall	.01	.14	.09	-.02
	Females	.01	-.01	-.45*	.07
	Males	.01	.31	.33	-.15
Food Approach	Overall	.15	-.01	.06	.13
	Female	.13	-.05	-.24	.11
	Male	.18	.06	.14	.18
Food Avoidance	Overall	-.1	-.12	.24	.03
	Female	-.11	-.27	.22	-.07
	Male	-.09	-.01	.27	.14
Mealtime Intake +	Overall	.02	-.22	-.05	.01
	Female	.16	-.02	.13	-.01
	Male	-.06	-.34	-.12	.08
Monitoring	Overall	-.13	.13	.004	.08
	Female	-.03	.14	.11	.1
	Male	-.2	.11	-.03	.06

+ Controlling for child age; **p*=.01

Table S1 (supplemental information)

Children's scores on the parent-report measure of impulsivity and on the impulsivity tasks. Scores are presented for the sample overall and separately for females (n=41) and males (n=54)

		Mean (*SD*)	Min	Max	*N*
ECBQ Impulsivity	Overall	5 (0.83)	2.8	6.8	95
	Females	5.03 (0.82)	3	6.8	41
	Males	4.98 (0.84)	2.8	6.7	51
Snack Delay task	Overall	3.11 (1.2)	0	4	74
	Females	3.22 (1.29)	0	4	34
	Males	3.02 (1.12)	0	4	40
Line Walking task	Overall	5.68 (3.75)	1.41	25.11	69
	Females	5.27 (2.25)	2	11.44	31
	Males	6.01 (4.64)	1.41	25.11	38
Tower task	Overall	17.02 (2.81)	9	24.09	62
	Females	17.01 (3.27)	9	24.09	29
	Males	16.95 (2.37)	12.92	20.71	33

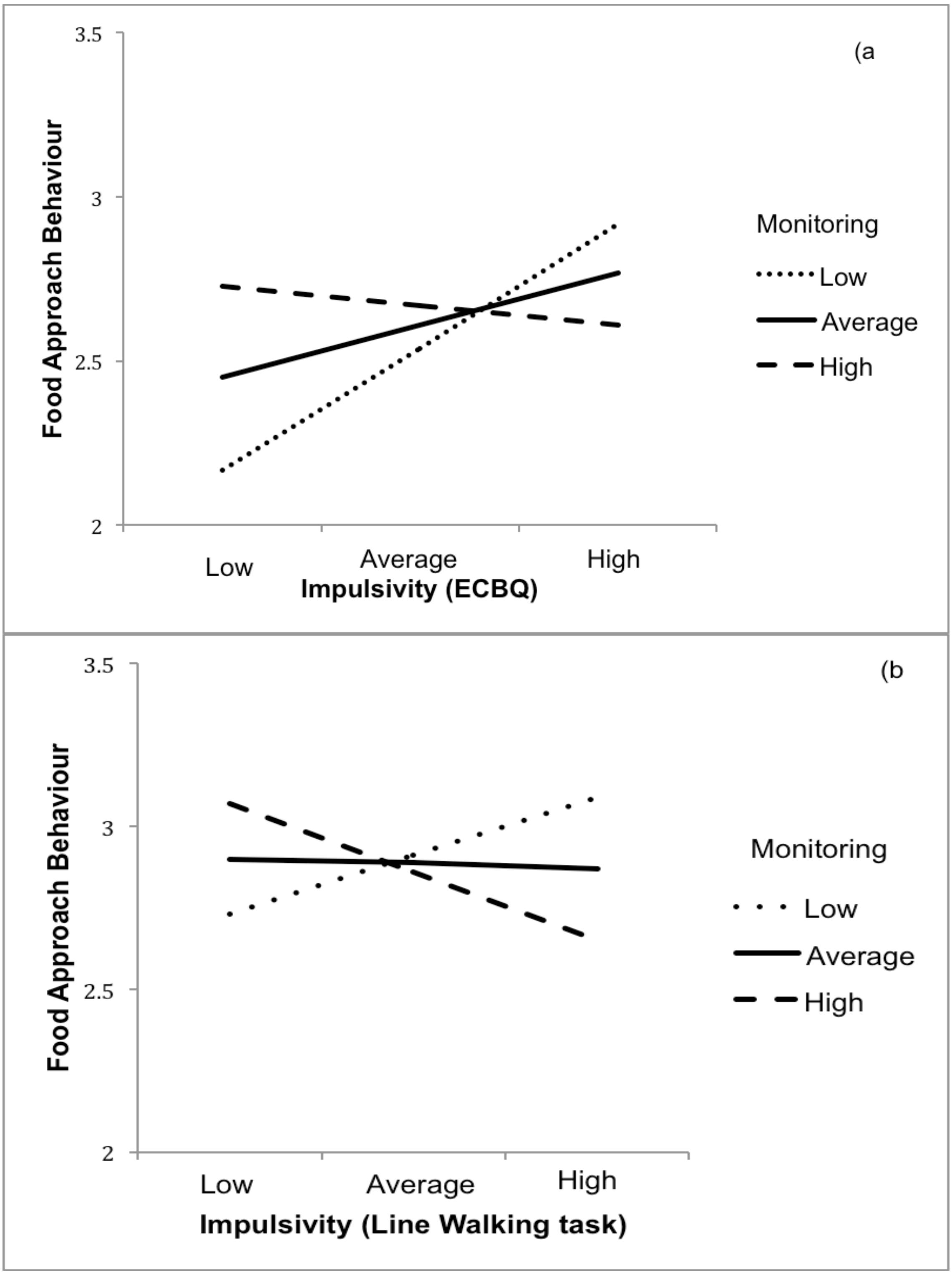

Figure 1. Plots of the moderating effects of monitoring on the relationship between parent-reported impulsivity and food approach behaviour in females (a) and on the relationship between Line Walking task performance and food approach behaviour in males (b).