The relative contributions of parent perceived child characteristics to variation in child feeding behavior

Around half of all parents are estimated to experience difficulties feeding their child at some time, with problems ranging from relatively minor dietary challenges to clinical avoidant/restrictive food intake disorders (Carruth, Ziegler, Gordon, & Barr, 2004). Because feeding is regarded by many parents as a fundamental parenting responsibility, perceived problems in this area, even at non-clinical levels, can cause considerable concern (Blissett & Harris, 2002; Greer, Gulotta, Masler, & Laud, 2008; Singer, Song, Hill, & Jaffe, 1990), and have a negative impact on parental self-efficacy, perceptions of parenting, and subsequent parenting behavior (Blissett & Harris, 2002; Craig, Scambler, & Spitz, 2003; Crist et al., 1994; Feldman, Keren, Gross-Rozval, & Tyano, 2004; Fraser, 2004; Greer et al., 2008; Levine et al., 2011; Lindberg, 1994; Powers et al., 2002; Robinson, Droter, & Boutry, 2001; Silverman, 2010; Tarkka, 2003). Concerns around feeding and intake have been associated with the use of maladaptive parent feeding strategies such as coercion, coaxing, bribery, and rewards (Birch, 1999; Burklow, McGrath, & Kaul, 2002; Harris, 1992; Linscheid, 2006; Sanders, Patel, Legrice, & Shepherd, 1993; Wolff, 1994; Woods, Borrero, Laud, & Borrero, 2010), and with deficits in optimal parent problem-solving skills (Martin, Dovey, Coulthard, & Southall, 2013; Robinson et al., 2001); these factors have been importantly linked to the maintenance and exacerbation of child feeding problems (Piazza et al., 2003). These findings suggest that parental perceptions of problematic child behaviors and of their own ability to cope with these behaviors can have a significant impact on subsequent parenting approaches and interactions, and future child feeding problems. Therefore, it is important to try and understand population feeding problems including a profile of key correlates of these problems from the parents’ perspective.

Examination of child feeding literature found that the most common non-medical correlates of problematic child feeding behaviors were child temperamental difficulty (Ammaniti, Lucarelli, Cimino, D'Olimpio, & Chatoor, 2010; Hagekull, Bohlin, & Rydell, 1997; Niegel, Ystrom, Hagtvet, & Vollrath, 2008), general child conduct and adjustment problems (Sanders et al., 1993; Wolke, Rizzo, & Woods, 2002), sensory processing issues (Coulthard & Blissett, 2009; Dovey, Isherwood, Aldridge, & Martin, 2010; Smith, Roux, Naidoo, & Venter, 2005), and food neophobia (Pliner & Hobden, 1992). These correlates have typically been examined separately, with various mechanisms for their individual associations with problematic feeding proposed across the literature.

Difficulties in conduct, self-regulation (e.g., hunger, tiredness, emotions), and temperament have been implicated in the development of problematic feeding via the disruptions they can cause to adaptive parent-child feeding interactions (Ammaniti et al., 2010; Farrow & Blissett, 2006; Hagekull et al., 1997; Hane, Fox, Polak-Toste, Ghera, & Guner, 2006). Poor interactions may have
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a negative impact on the way that parents perceive their child’s behaviors and on their own abilities to manage challenging behaviors (Ammaniti et al., 2010). Furthermore, children learn a great deal about what, when, and how to eat via social interactions, so barriers in this area can significantly hinder appropriate feeding behavior and dietary development (Addessi, Galloway, Visalberghi, & Birch, 2005; Aldridge, Dovey, & Halford, 2009; Birch, 1999). Externalizing behaviors and temperamental difficulties may also be more directly associated with the frequency of observable feeding problems, if the difficulties impinge on feeding and mealtimes (e.g., poor appetite regulation, restlessness at mealtimes, rigidity around new foods and routines, etc.). Regarding sensory processing, food selectivity and refusal behaviors are thought to occur via over-sensitivity or reactivity towards the texture, taste or smell of certain food groups and types (Berlin, Davies, Lobato, & Silverman, 2009; Chatoor & Ganiban, 2003; Coulthard & Blissett, 2009; Dovey, Farrow, Martin, Isherwood, & Halford, 2009; Smith et al., 2005), or via under-responsiveness to sensory stimuli and associated poor oral motor control (Berlin et al., 2009). Sensory processing issues and the degree of sensitivities may therefore underlie the frequency or strength of observed feeding problems. Beyond atypical conditions, developmental food neophobia (the reluctance to eat, or avoidance of new foods during early childhood (Pliner & Hobden, 1992)), has also been associated with child feeding problems. Despite being a normal stage of early development (Dovey, Staples, Gibson, & Halford, 2008), persistence of food neophobia beyond expected timeframes is associated with problematic feeding via poor dietary intake (Carruth & Skinner, 2000; Cooke, 2007; Falciglia, Couch, Gribble, Pabst, & Frank, 2000; Galloway, Lee, & Birch, 2003).

The aforementioned characteristics may represent important risk factors for child feeding problems; however, little is known about how they exist together in association with problematic feeding behaviors. It is important to move beyond the simple associations between characteristic and feeding outcome, towards a combined and controlled model of child feeding problems, which, to the best of our knowledge has not been assessed in any prior study. This is despite the co-occurrence of such factors within individual children and despite widespread knowledge that the role or influence of one factor on an outcome can be attenuated or exacerbated by the presence of another factor (Baron & Kenny, 1986). Therefore, the primary aim of the current study is to determine the relative contributions of parent-report child characteristics within multi-variable models of child feeding behavior. Feeding outcomes will be separated into parent-observed problem frequency (child scale) and parental perceptions and strategies for coping with feeding problems (parent scale). The aim is to assess whether factors associated with parental experiences of feeding challenges differ from those associated with parentally observed problem frequency.

Based on existing research, it is hypothesized that the child variables associated with feeding
problem frequency will differ from those associated with parental feelings and strategies related to child feeding problems. Specifically, we hypothesize that innate or underlying factors such as sensory sensitivities and temperamental difficulties will be associated with observed feeding problems, while more external characteristics such as generalized conduct and social interaction problems will be associated with parent perceptions and strategies for coping with child feeding problems. It is anticipated that child food neophobia will be associated with both feeding outcomes as it can represent an inherent developmental stage and a behavioral feeding challenge to parents.

**Methods**

**Participants and recruitment.** The overarching study of children’s feeding, for which ethical approval was granted, obtained data from 445 parents of children with no past or present clinical feeding disorder. The current study focuses only on mothers of children aged 3-6 years (N=202). Participants were recruited through parent and child social groups and networks. Written information regarding the study purpose, procedure, and contacts was given to all prospective participants by the researcher during visits to parent-child groups or via an online invitation posted on parent forums. The majority of data (97%) were obtained online; recent research suggests that there are few differences between child feeding questionnaires completed on and offline, and online responses may produce marginally higher feeding problem outcome scores (Dovey, Jordan, Aldridge, & Martin, 2013).

Individuals with missing feeding behavior outcome data were excluded (N=41), leaving a final sample of 161. After examination of numerous demographic factors, breastfeeding was found to be the only factor to differentiate between those who did and did not complete the outcome measures. Completers had a higher incidence of breastfeeding (79.2%) than non-completers (62.5%), χ²= 4.90, p=0.027, and breastfed for notably (though not significantly) longer (M=30.80, SD=43.10) than non-completers (M=18.18, SD=24.92) t(199)=1.80, p=0.074, 95% CI: -1.22, 26.47.

**Sample Mothers.** Maternal age ranged from 19 to 46 years (M=32.68, SD=5.62). 75.60% of the sample were married, 16.9% cohabiting, and 7.5% defined themselves as single, separated, or divorced. Finally, 81% of mothers considered their pregnancy planned and 19% unplanned.

**Study Children.** Children were 51.6% female, with a mean age of 53.80 months (SD=11.38, range 36-83). 48.1% of the children were born on time, 45% were post-due date, and 6.9% premature (<37 weeks), with an average birth weight of 3.44kg ± 0.57 (range 1.26-4.63kg). Most children were breastfed at some time with duration ranging from 0 days (20.8%) to 212 weeks (M=30.80, SD=43.10 weeks). The majority of children had at least one sibling (76.4%; range 0-5 siblings); 67.7% were the first born child, 24.8% were second born and the remaining ranged from third to fifth born. Finally, 83.2% of the sample had no known allergies or intolerances.
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Measures and procedure. Following informed consent, participants completed five parent-report psychometric measures assessing child feeding behaviour, food neophobia, temperament, sensory sensitivities, and general behavior/conduct. The measures were completed in the order presented below. Information was also collected regarding parent and child age, child sex, birthweight, breastfeeding duration, presence of food allergies/intolerances, and number of older and younger siblings.

Behavioral Pediatrics Feeding Assessment Scale [BPFAS] (Crist et al., 1994). The BPFAS assesses child feeding behaviors (25 items) e.g., “Spits out food”, “Tantrums at mealtimes”, and parent feelings about and strategies for dealing with child feeding behaviors (10 items) e.g., “I coax my child to get him/her to take a bite”. All items are scored on a five point likert scale and require a yes/no response to indicate if the item is considered a problem or not. Ten items are reverse scored (e.g., “Eats vegetables”) so that high scores indicate greater problem frequency. This BPFAS yields four domain scores: child behaviour frequency (sum of Likert scores; range 25-125); child behaviour problems (count of items rated “yes”; 0-25); parent feelings/strategies frequency (10-50); and parent feelings/strategies problems (0-10). Due to incomplete reporting for problem domains (≈50-66% did not complete them fully), only frequency domains were used in the current study. The BPFAS has demonstrated good psychometric properties; showing sensitivity to feeding behaviors across clinical and non-clinical child samples, sensitivity to change over time and intervention, and excellent test-retest reliability (Crist et al., 1994; Dovey & Martin, 2012; Dovey, Martin, Aldridge, Haycraft, & Meyer, 2011; Haywood & McCann, 2009). Cronbach’s alpha coefficients (α) of 0.88 (child), and 0.82 (parent) were identified in the current study.

Child Food Neophobia Scale [CFNS] (Pliner, 1994). The CFNS was adapted by Pliner (1994) from the adult Food Neophobia Scale (Pliner & Hobden, 1992), to assess food neophobia, the tendency to avoid/reject new and unfamiliar foods, in children. The 6 items of the CFNS are scored on a seven point likert scale, with high scores representing stronger neophobia. The FNS (on which the CFNS is based) demonstrates strong test-retest reliability (p<0.01), and reasonable concurrence with observed food selection behavior (Hobden & Pliner, 1995). In the current study, the CFNS exhibited excellent internal reliability (α=0.95).

Emotionality, Activity and Shyness [EAS] (Buss, 1984). The EAS was developed to examine parental report of child temperament at around 1-9 years. Temperament is assessed via 20 items comprising the subscales emotionality, activity, shyness and sociability. Items are scored on a five point likert scale with high scores indicating greater difficulty (sociability reverse scored). EAS subscales have demonstrated good tests-retest and inter-rater reliability (Boer & Westenberg, 1994), with internal reliability confirmed in the current study (α coefficients ranged from 0.73-0.87).
Strengths and Difficulties Questionnaire [SDQ] (R. Goodman, 1997). The SDQ assesses attributes of psychological adjustment, and was used in the current study to suggest dimensions of child behavior problems. The scale comprises 25 items across five subscales (emotional symptoms, conduct problems, hyperactivity-inattention, peer problems, and pro-social behavior), with high scores reflecting increased behavior/adjustment problems (prosocial reverse scored). Construct validity, test-retest stability, and adequate subscale internal consistency (α ranged from 0.57 - 0.85) have been previously identified (R. Goodman, 1997, 2001); the latter was supported in the current study (α range 0.64 - 0.76).

Infant Toddler Sensory Profile/Sensory Profile [ITSP/SP] (Dunn, 1994, 1999; Dunn & Daniels, 2002). The 38 item SSP for children over 3 years was used in the current study. This scale comprises subscales for a number of sensory domains, though only Tactile and Taste/Smell sensitivity were used in the current study. Items are scored on a five point likert, where low scores indicate sensory processing problems. The Sensory Profile measures are used widely in research and clinical practice to examine sensory processing abilities (Ahn, Miller, Milberger, & McIntosh, 2004; Miller, Coll, & Schoen, 2007); the current study confirmed internal reliability in the total scale (α=0.93), the tactile domain (α=0.71) and the taste/smell domain (α=0.94).

Data Analyses. Up to four missing data items within the BPFAS outcome scale were imputed to permit calculation of total scores (Crist et al., 1994). For all other measures, scale mean scores (calculated if ≥90% items completed) were used in analyses. Across all covariates missing data ranged from 0.04% - 25.5%, so a multiple imputation model comprising all child characteristics, feeding outcomes, and demographic variables, was used to impute five iterations of missing values (Rubin, 1987). Very few differences were observed in variable scores or model outcomes between pooled imputation results and the original data, suggesting that data were missing at random. To maximize the precision of final estimates, results in the current paper are reported from pooled imputation data. Where pooled results are unavailable, the average of values across imputations is given.

Most predictor variables were approximately normally distributed, and mild skew observed in the child and parent frequency scores of the BPFAS did not affect data summaries. Multiple linear regression analyses were used to assess the significance of child variables in combined models of the BPFAS child and parent feeding behavior scores. Collinearity and influence statistics were examined and all fell well within acceptable ranges. Residual statistics were also examined for each model and were found to be normally distributed in each case.

Child feeding literature informed the selection of 12 variables from four main child characteristics (food neophobia, temperament, conduct/adjustment, and sensory sensitivity) for
analysis; however, little theory exists regarding the temporal importance of these variables within a multi-element model of feeding outcomes. Therefore, enter method regression models were used to examine the relative importance of all child characteristics to the child feeding outcomes. All models were adjusted for parent and child demographic factors and only those found to have no material influence on the model were removed to improve model parsimony.

Results

Sample Child Behavior Characteristics.

Multi-element models of child feeding behaviors and problems.

Child feeding problems (BPFAS Child frequency scale). The model of 12 child characteristics explained a substantial and highly significant proportion (Adjusted R²=0.67) of variability in BPFAS child feeding problem frequency score, F(16,160)=21.27, p<0.001. This model was adjusted for parent and child age, child sex, and number of older siblings. Child food neophobia, and behavioral problems associated with conduct and hyperactivity were significant predictors in the model; the data also suggested an inverse relationship between feeding problems and prosocial behavior (result italicized in table 1), though this association was not significant at 5%. Beta coefficients, 95% confidence intervals, and p-values for all covariates are given in table 1. Although no account is taken for any shared variance observed in the full model, notably, a model containing only the significant predictors and prosocial behavior accounted for 64% of the variability in the BPFAS child frequency score.

Parent feeding problems (BPFAS Parent frequency scale). The model of 12 child characteristics again explained a considerable proportion (Adjusted R²=0.52) of variability in BPFAS parent feeding problem frequency score, F(16,160)=10.84, p<0.001. This model was adjusted for parent and child age, child sex, breastfeeding duration, birthweight, and number of younger siblings. In this model, child food neophobia, and problems associated with hyperactivity and decreased prosocial behaviors were significant predictors in the model; the confidence interval also suggested a potential inverse relationship between sociability and feeding problems, but this finding was not significant at 5% (result italicized in table 1). Beta coefficients, confidence intervals and p-values for all covariates are given in table 1. A model containing only the significant predictors and sociability was found to explain 50% of the variability in BPFAS parent frequency scores.

Discussion

The current study examined the relative associations between several child characteristics
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and problematic child feeding behavior. It also examined whether or not there were differences in the profiles of correlates of child feeding problems when assessed via parentally-observed behaviors (BPFAS Child) and parentally-reported feelings and strategies for coping with child feeding problems (BPFAS Parent). Notably, the current study found that models comprising only a small number of significant child characteristics, could explain over half of all variability in BPFAS parent frequency scores and a remarkable two thirds of the variability in BPFAS child frequency scores. Follow-up analyses suggested that the vast majority of the variance accounted for in each model could be attributed to these significant predictors. While the cross-sectional nature of the current study precludes inferences around cause and effect between child characteristics and feeding, the strength of the results suggests that the models uncovered in this study represent key profiles of characteristics to focus on in the reduction or prevention of population-level child feeding problems. Given that the characteristics were maternally reported, such methods of reduction/prevention would likely need to focus on both the child’s behaviors and the parent’s perceptions of those behaviors. Our hypotheses that the models of child and parent outcomes would differ, and that different child characteristics would prevail for each outcome, was partially supported by the data. The specific pattern of predictors and the total model explanatory values differed slightly between the models of child and parent feeding outcomes, and certain characteristics were found to play a greater role in BPFAS child scores, while others were more highly associated with BPFAS parent scores.

The current study found that child food neophobia and behavioral hyperactivity were strongly and positively associated with both domains of problematic child feeding behavior (observed behaviour and parental perceptions and management). Accounting for the relative scales of measurement, the strength of these predictors was similar and noteworthy for each outcome scale. A single unit increase in food neophobia was associated with a 16.7% (minimum 11.8%) increase in BPFAS Child scores, and a 17.1% (min 10.6%) increase in BPFAS parent scores. Similarly, a unit increase in hyperactivity was associated with a 26.6% (min 13.1%) increase in child scores, and a more variable 29.5% (min 2.6%) increase in parent scores. The frequency of observed problematic feeding behaviors (BPFAS child) was also positively associated with behavioral conduct problems, which coupled with hyperactivity reflect a profile of externalizing behaviors (A. Goodman, Lamping, & Ploubidis, 2010; Liu, 2004). Rather than conduct problems, the parental problem scale (BPFAS parent) was significantly negatively associated with prosocial child behavior, and distinctly but non-significantly negatively associated with sociability. Prosocial deficits were marked, but not significant, in relation to the frequency of observed child feeding problems. Aside from social domains, no other facets of temperamental difficulty were associated
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with problematic feeding behavior. The absence of emotional symptoms (either behavioral or temperamental) alongside social deficits in models of problematic feeding behavior, suggests that it is social interaction deficits specifically that correlate with feeding issues, rather than signifying broader internalizing behavior profiles. The additional absence of sensory sensitivities from the predictive models also suggests that psychophysiological factors do not routinely underpin population feeding problems.

These key findings suggest that population level child feeding problems are predominantly active and interactive issues for the parent and child, co-occurring or perhaps falling within other externalizing-type behavior profiles; rather than underlying emotional, temperamental, or physiological issues. The findings also suggest that parents may observe a range of problems with their child’s feeding and general interaction with their environment (Liu, 2004), but the presence of child social problems may be the distinguishing marker for the perception of problematic feeding behaviors as a challenge to parenting. This ties-in with a body of research, which advocates the importance of socialization, throughout feeding/eating development, as a means for teaching and learning about what, where, when, and how to eat (e.g., (Addessi et al., 2005; Birch, 1998, 1999; Nestle et al., 1998)). Difficulties in this area can therefore hinder natural learning techniques and impact on the parent’s ability to manage or overcome feeding problems. It was identified earlier in the paper that parental perception of feeding problems can have significant negative impact on the parent’s subsequent actions, feeding strategies, and parental self-efficacy. As such, the current results suggest that deficits to social interactions may represent a key risk factor to this negative association and potential downward spiral of feeding behavior. Advice, support, and interventions for poor feeding, based around improvement of socialization and interaction may therefore be beneficial to the parent and child in the general population, though more research would be needed to test this supposition. The absence of sensory and temperament or regulatory factors in the models of child feeding may also have important implications for the differentiation of clinical and non-clinical feeding problems, though further research would again be required to test this assertion.

A limitation to the current study was that ethnicity and socioeconomic data was incomplete and thus not reported. However, estimates available from the overarching child feeding study suggest that a predominantly white British sample was obtained, but a reasonably broad spectrum of socioeconomic backgrounds was represented via paid, voluntary, or full-time parenting roles, though very few individuals were identified as unemployed. In future research, more detailed information should be collected on these factors to control for their potential influence on child feeding outcomes.

The strength and nature of the current study findings are noteworthy. The study gives a clear
profile of child characteristics that explain a huge amount of the variability in poorer feeding behaviors in the population. Two thirds of the variability in problematic feeding behaviors was explained by associated negative external behaviors and food neophobia in the child. Parental perceptions of child feeding problems as challenging were not associated with child conduct problems, but were instead significantly associated with child social deficits. This key correlate amplifies the importance of social interaction within feeding development and behavior, and may indicate a crucial focus for parental support in overcoming feeding problems.

References

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