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Research report

Bits and pieces. Food texture influences food acceptance in young children ☆

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ABSTRACT

Background: Picky or fussy eating is common in early childhood and associated with a decreased preference for a variety of foods. The aim of the current study was to experimentally test which sensory food feature is associated with food acceptance, which, in turn is an indication for fussy eating, in young children (between 32 and 48 months). In a repeated-measures-design, three sensory features were manipulated separately (i.e., colour, texture and taste) while keeping the other two features constant. The baseline measurement consisted of a well-liked yoghurt, which was presented before each manipulation variant. The number of spoons that children (N = 32) consumed from each variant were registered as behavioural indication for food acceptance. Another aim was to evaluate how the behavioural measurement of food acceptance would be related to parental reports of their child's fussy eating behaviour and parental feeding styles. In addition, this study explored if children's body-mass index (BMI) was related to the behavioural measurement of food acceptance and parental reports of fussy eating behaviour. *Results:* The manipulation of food texture caused a significant decrease in intake. Colour and taste manipulations of the yoghurt did not affect children's intake. Parental reports of children's fussy eating behaviour and parental feeding styles were not related to the behavioural observation of food acceptance. The behavioural measurement of food acceptance and parental accounts of fussy eating were not related to children's BMI. *Conclusion:* Food texture but not taste or colour alternations affected food acceptance, at least when consuming variations of a well-liked yoghurt. This knowledge is important for further research on picky-eating interventions. Parental reports of fussy eating did not concur with the behavioural observation of food acceptance. Further research is warranted to test whether these findings generalize to other food types.

Introduction

"I can't eat broccoli – it is disgusting" (Schneider, 2011). Almost all parents of young children can tell numerous stories about the fussy eating behaviour of their children and their own creativity in trying to trick their child into eating more fruits and vegetables. Although considerable research has been devoted to study picky or fussy eating behaviour in children, there is an equivocality in definitions (and assessment methods) of fussy and picky eating behaviour. Most commonly, pickiness or fussiness refers to children's unwillingness to try new foods (neophobia) together with an avoidance of certain foods (e.g. vegetables) (Dovey, Staples, Gibson, & Halford, 2008). If pickiness is significantly interfering with physical and emotional development or functioning, a clinical diagnosis of avoidant/restrictive food intake disorder (ARFID) can be considered (Eddy et al., 2014; Fisher et al., 2014). Research reported that 13–22% of children between 3 and 11 years (Mascola, Bryson, & Agras, 2010) and up to 50% of children between the age of 4 and 24 months are perceived as picky eaters by their parents (Carruth, Ziegler, Gordon, & Barr, 2004). Longitudinal data from a recent study further indicated that picky eating was relatively stable over a period of nine study years (Mascola et al., 2010). Results further specified that picky eating declined after two years for about half of all picky-eaters, whereas 40% of picky-eaters continued to display food fussiness for more than two years (Mascola et al., 2010). Thus, even though picky or fussy eating behaviour seems relatively common in (young) childhood, there seem to be considerable variations in the persistence and severity of picky eating behaviour.

A particular concern regarding picky eating behaviour is a possible malnutrition and decreased variety in dietary intake because

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picky eaters have a decreased preference to eat fruits and vegetables (e.g., Cooke, Wardle, & Gibson, 2003; Dovey et al., 2008; Galloway, Lee, & Birch, 2003; Russell & Worsley, 2008). Picky eating can indeed be related to dietary inadequacy, even though it is unclear whether this concerns malnutrition of certain nutrients (Dubois, Farmer, Girard, & Peterson, 2007; Falciglia, Couch, Gribble, Pabst, & Frank, 2000; Galloway, Fiorito, Lee, & Birch, 2005, but see Carruth et al., 2004 for conflicting findings), or also the risk of underweight (e.g., Ekstein, Laniado, & Glick, 2010; Tharner et al., 2014; Wright, Parkinson, Shipton, & Drewett, 2007, but see Carruth et al., 2004 and Galloway et al., 2005 for conflicting findings). Thus, research is contradictory if picky eating is related to malnutrition and underweight.

Another concern that has been raised by some researchers (e.g., van der Horst, 2012; Wardle, Carnell, & Cooke, 2005) is that how parents react on their children's (picky) eating behaviour could have a negative influence on further picky eating behaviour and on psychological determinants of eating behaviour later in life. Indeed, picky eating has been related to family conflict (Marchi & Cohen, 1990; Mascola et al., 2010), behavioural problems of the picky-eating child (Jacobi, Schmitz, & Agras, 2008), tantrums and parents fighting with each other about the right strategy to deal with their child's picky eating (Marchi & Cohen, 1990; Mascola et al., 2010).

It has been speculated that picky eating could be related to the development of eating disorders or obesity, depending on how parents deal with their children's picky eating (e.g., Kuhl, Clifford, & Stark, 2012; Marchi & Cohen, 1990; van der Horst, 2012). Picky-eaters whose parents mainly concentrate on providing the child with the food they like to eat might unwittingly foster overeating tendencies by giving into their child's demands of sweet or fatty food (Carruth et al., 2004; Dovey et al., 2008; Galloway et al., 2005). Accordingly, picky eating has been found to be associated with overweight or obesity in some studies (Carruth et al., 2004; Finistrella et al., 2012). In contrast, parents who use parental pressure or control to bring their children to eat vegetables and fruits might increase their child's risk of eating-related behavioural problems and negative associations with eating (van der Horst, 2012) that could later lead to a susceptibility for eating disorders. Research showed that picky eating in childhood has been associated with anorexia nervosa-like eating behaviour in adolescence and eating disorders in adulthood (Marchi & Cohen, 1990; Wildes, Zucker, & Marcus, 2012). Thus, research is contradictory about whether picky eating is associated with a risk to overeat and higher BMI or with a risk to undereat and having a lower BMI than children who are non-picky eaters, and empirical evidence for both claims is very sparse at the moment.

A possible explanation for the divergence of results could be that the assessment of picky eating "is still in its infancy" (Dovey et al., 2008, p. 187) and studies differ considerably in their definition and assessment of picky eating (ranging from the use of different, validated questionnaires to asking the simple question "do you consider your child a picky eater?") (Cooke et al., 2003). In general, the measure of picky eating is based on parental reports and behavioural data of picky eating is often not obtained. Considering the family conflict around picky eating (Mascola et al., 2010) and the influence of parental feeding behaviour on subsequent child eating behaviour, parental reports of picky eating might be confounded and the temporal relation of occurrence of picky eating and parental feeding behaviour is not clear (e.g., Cooke et al., 2003). For example, van der Horst (2012) suggested that parental pressure to eat could be both: a reaction to picky eating but also a precursor of picky eating. Parents could use pressure to eat to deal with their child's picky eating but pressure to eat could also place a very negative affect on eating for the child that in turn leads to more pickiness in eating (Cooke et al., 2003). Moreover, parental concern about their child's vegetable and fruit intake could lead to higher parental reports of their child being a picky eater (Cooke et al., 2003). Children's food acceptance when trying novel food could be a good predictor of their fussiness in intake and liking of different food types. Thus, a less subjective measure that objectively evaluates which sensory food features influence food acceptance could be a useful extension to parental reports of eating behaviour, also because parental reports do not inform on which type of food or which food features are more likely to be rejected. This knowledge can have important implications for effective intervention that help parents to react appropriately to their children's picky eating behaviour.

Currently, relatively little is known about specific sensory features (i.e., colour, taste, and texture) of food that are affecting picky eating and research findings are mixed. For example, research by Smith, Roux, Naidoo, and Venter (2005) showed that tactile sensitivity was associated with a higher aversion of food textures in young children aged 3 to 10 years and qualitative interviews with parents indicated that parents believe that texture and appearance could influence picky eating in children (Russell & Worsley, 2013). Similarly, another study in adults using disgust-ratings of food reported that food texture is an important factor for food disgust (Martins & Pliner, 2006). Yet, note that research by Dovey et al. (2012) showed differences between adults and children in which sensory features affected the willingness to try novel foods: for adults a tactile component ("appealing to touch") determined whether they would try a new fruit and correlated highly (negatively) with food neophobia ratings; in 5 to 10 year old children, however, visual aspects, but not tactile, influenced the willingness to try the novel fruit and were also significantly related to food neophobia ratings. Moreover, Coulthard and Blissett (2009) showed that taste and smell sensitivity was associated with fruit and vegetable consumption and food neophobia in children and noted that also tactile sensitivity was associated with lower fruit and vegetable consumptions and higher food neophobia ratings, yet this relation disappeared after accounting for maternal fruit and vegetable consumption. Altogether, these results suggest that different sensory features of food might impact food acceptance, as indication of "pickiness", when it comes to vegetable and fruit consumption.

To sum up, picky eating is highly prevalent in childhood and possibly associated with decreases in the diversity of nutritional intake. Yet, it is unclear which specific food features contribute to the acceptance (or the dislike) of certain foods. Moreover, an objective, behavioural assessment of food acceptance, which could, in turn inform on fussiness is still missing.

The first aim of the current study was to experimentally test which specific sensory food feature (colour, texture or taste) is associated with food acceptance of variations of a normally well-liked food. Another aim was to test if the behavioural assessment of food acceptance is related to parental perceptions of child's fussy eating behaviour and parental feeding styles. In addition, we also wanted to explore if individual differences in children's willingness to try (variations of familiar) food (i.e., behavioural assessment of food acceptance and parental reports of food fussiness) was related to differences in weight-status of children because previous research disagrees on the association of picky eating and weight status in children.

Method

Participants

Participants were recruited via three local day care centres for young children. Parents of children between 30 and 48 months received a letter informing them about the purpose of this study and asking for informed consent. The specific age range of 2.5 to 4 years was chosen because several studies indicated consistently that in this early age picky eating is most prevalent (e.g., Carruth et al., 2004; Mascola et al., 2010). Children were eligible if their parents

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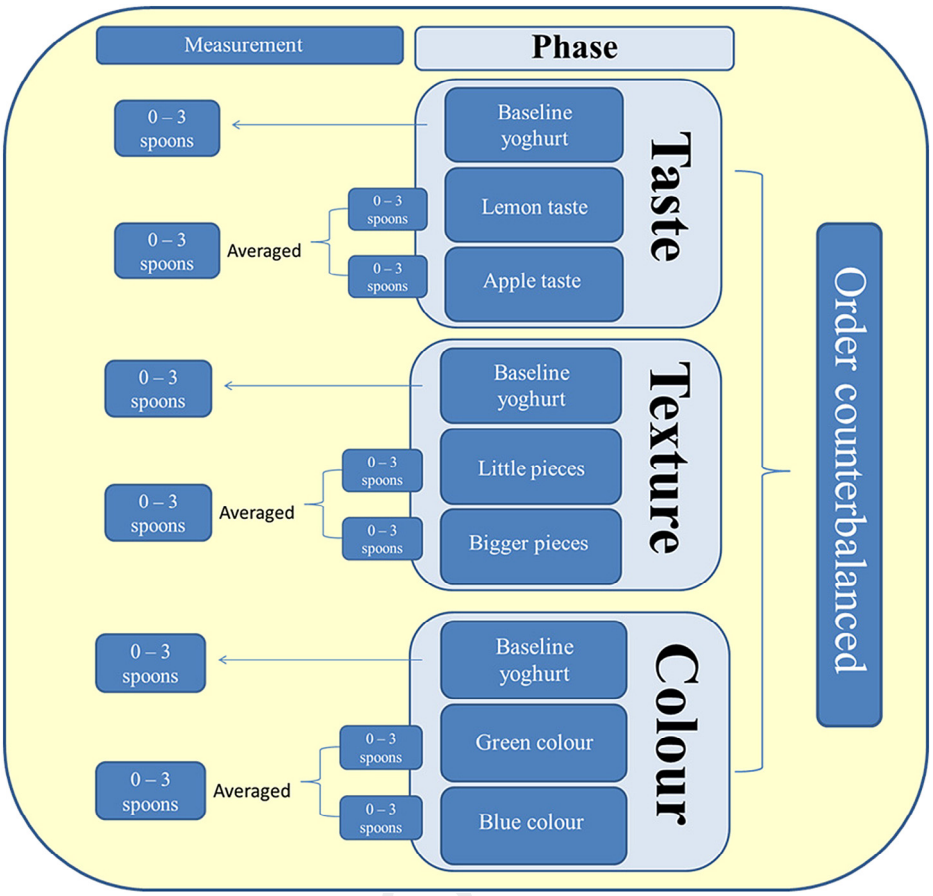

Fig. 1. Graphical display of the behavioural test procedure.

reported no food-allergies and if they liked smooth (i.e. without pieces) strawberry-raspberry yoghurt (brand: Melkunie, The Netherlands). 140 parents were contacted and received the information material. Only children whose parents endorsed that they liked smooth strawberry-raspberry yoghurt were tested. Parents of 38 children responded by signing informed consent and filling out the respective questionnaires; however, five of these children were not tested due to illness or refusal to participate ($n = 1$). Additionally, one boy was tested but excluded from analysis because he refused to taste the baseline yoghurt in all testing phases. Thus, analyses were based on data of 32 participating children (20 girls, 12 boys) with a mean age of 39.69 ($SD = 4.73$) months old (i.e. around 3 years). Children were mostly healthy weight (mean body mass index (BMI) adjusted for gender and age was 97.25%, $SD = 10.33\%$).[1] One child was slightly overweight (adjusted BMI of 121%).[2]

Behavioural test for food acceptance

To test the influence of sensory food properties on willingness to eat this food, a behavioural test was conducted. Intake (in spoons) of a well-liked and well-known (as eligibility criterion for participating children) baseline yoghurt (smooth strawberry-raspberry yoghurt produced by Melkunie) was contrasted with manipulated variants in a within group two (measurement: baseline yoghurt versus manipulated yoghurts) by three (sensory phase: colour, texture, and taste) repeated measures design; see Fig. 1 for a graphical display of the behavioural test. Only one feature was manipulated per test phase, while the other features were kept constant. The order of testing of different sensory phases was counterbalanced across children to control for any possible effects of testing order. Each measurement started with the presentation of the baseline yoghurt, followed by the presentation of the two variants. Children were not pressured to taste if they did not want to. Children were presented with 30 gram samples of the baseline yoghurt and the two manipulated variants per testing phase. The number of spoons (small coffee spoon) children took from each variant was registered by the experimenter (ranging from 0 to 3 spoons intake per variant in each testing phase).[3]

To manipulate taste, smooth natural plain low-fat yogurt without any taste was flavoured with lemon and apple taste. Per yoghurt (300 gram package) 25 drops of apple-flavour (brand: SteviJA, Drachten, The Netherlands) was added for the apple variant and 20 drops of lemon-flavour (brand: SteviJA, Drachten, The Netherlands) and 5 grams of sugar (brand: Douwe Egberts) were added for the lemon variant. Additionally, the variants were coloured with one drop of tasteless red food colouring to achieve the same slightly

[1] Weight data on one child was missing and the BMI analyses are thus based on the remaining 31 children.

[2] Main analyses were repeated without this child, but as results remained the same, all reported analyses are based on the complete sample of 32 children.

[3] To achieve comparability of intake between the baseline variant (which could range from 0 to 3 per testing condition) and the two manipulated versions per testing condition (which could together range from 0 to 6 per testing condition), spoon intake of the two manipulated variants was subsequently averaged per testing phase for the analyses. Thus, the dependent variable of spoon intake could range from 0 to 3 spoons for each measurement (baseline, manipulation) per testing phase.

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pink colour as the baseline strawberry-raspberry yoghurt. Lemon and apple taste are regarded as unusual tastes for yoghurt in the Netherlands. Thus, in this taste condition, yoghurts differed in taste only, whereas the texture and colour were the same.

To manipulate the texture, smaller and bigger raspberry pieces were added to the smooth strawberry-raspberry yoghurt for the two manipulated variants. For the variant with smaller pieces 25 grams of fresh mashed raspberries was added to a 300 gram package of the baseline yoghurt. For the variant with bigger pieces 50 grams of fresh raspberries cut into halves were added. Colour and taste of the yoghurts in this phase were the same in this condition, whereas the texture of the variants differed in lumpiness. To ensure that children did not avoid the pieces when taking a spoonful, the experimenter gave children the spoon of yoghurt with pieces in this condition.

To manipulate colour, tasteless blue and green food colouring was added to the respective two variants of the baseline yoghurt. For the green variant, two drops of blue tasteless food colour were added to a 300 gram package of the baseline yoghurt. For the green variant, six drops of green tasteless food colour were added to a 300 gram package of the baseline yoghurt. Green and blue yoghurt are regarded as unusual colours for yoghurt in the Netherlands. In this condition, texture and taste were kept constant, whereas the colour differed between the yoghurt variants.

Parental reports of picky eating in children and their own feeding style

The *Parental Feeding Style Questionnaire* (PFSQ; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002) informs on the feeding style of parents and consists of four aspects: emotional feeding (using food to deal with stress/negative emotions), instrumental feeding (using food as reward), prompting/encouragement to eat (praise if child eats what parent wants), and control over eating (feeling in control over child's intake). Parents self-report their feeding style on 27 questions on a Likert scale ranging from 1 (I never display this feeding style) to 5 (I always display this feeding style). This questionnaire has been used in previous research to determine differences in parental feeding behaviour between obese and healthy-weight mothers and has reportedly adequate reliability (Wardle et al., 2002). Therefore, a Dutch version of the PFSQ was included in the current study to determine if picky eating, as observed in the behavioural test, is associated with specific parental feeding behaviour.

The Dutch version of the *Child Eating Behavior Questionnaire* (CEBQ; Sleddens, Kremers, & Thijs, 2008; Wardle, Guthrie, Sanderson, & Rapoport, 2001) was used to evaluate parental views of the child's (problematic) eating behaviour in eight areas: *food enjoyment, desire to drink* and *responsiveness to food cues*, as indicators of external eating and interest in food; *satiety responsiveness* as indicator of sensitivity to signals of hunger and satiety; *fussiness* and *slowness in eating*, as indicators for difficulties with and avoidance of food intake; and *emotional undereating* and *emotional overeating*, as indicators of mood-dependent problematic eating behaviour. This questionnaire comprises in total 35 questions and parents have to indicate their perception of their child's eating behaviour on a Likert scale ranging from 1 (my child never displays this eating behaviour) to 5 (my child always displays this eating behaviour). Recently, some subscales of this questionnaire have been validated as measure of obesogenic eating behaviour in young children (Carnell & Wardle, 2007) and in Dutch children (Sleddens et al., 2008). In this study the fussiness subscale of CEBQ was applied to test if parental perceptions of "*fussiness*" are mirrored in the behavioural measure of food acceptance and correspond with children's BMI. Note that the "*fussiness*" subscale includes items referring to the rejection of both novel *and* familiar foods and might thus also partly capture neophobia.

Body mass index (BMI)

Children's weight was measured and parental reports of their height were used to calculate a measure of children's body mass index (BMI). This measure was adjusted for age and gender by calculating the measured weight divided by the national (Dutch) norm weight (Van Winckel & Van Mil, 2001), adjusted for gender and age, ×100 (for a similar classification see e.g., Braet & Crombez, 2003; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012; Soetens & Braet, 2007). According to this percentage score a BMI percentage between 90% and 120% of the ideal weight is regarded as a healthy BMI range for a child. A percentage of 120–140% of the ideal weight is classified as overweight, a percentage of 140–160% is classified as moderate obesity, and a percentage of 160% is regarded as serious obesity.

Procedure

The local ethical committee approved the study. Parents received the study information and parental assessments of their child's fussy eating behaviour (by means of the *CEBQ*) and parental feeding style (by means of the *PFSQ*), parental reports of the child's height (to calculate BMI) and informed consent were collected prior to the participation of children. All children were tested individually in a separate testing room at their respective day-care facility. To control for the influence of hunger on testing, all children were tested between 9.30 a.m. and 10.30 a.m., presuming that their hunger should be more or less similar at that time, after breakfast. After having picked up the child and making her or him feel at ease, the experimenter seated the child at a table and started the behavioural test. After the completion of the behavioural test, weight of children was measured. Children were then thanked for their participation and received a small gift (stickers and stamps). All participating day-care centres also received a gift for their cooperation.

Results

Which sensory feature of food affects eating behaviour in children?

A within-subjects 2 (measurement: baseline yoghurt, manipulated yoghurt) × 3 (sensory phase: taste, texture, colour) repeated-measures analysis of variance (ANOVA) was conducted to test if alterations of sensory features of the baseline yoghurt affected intake (as measured by the number of spoons consumed) in children. The two significant main effects of measurement, $F(1, 31) = 15.89$, $p < .001$, and sensory phase, $F(2, 62) = 12.22$, $p < .001$, were qualified by a significant interaction of sensory phase × measurement, $F(2, 62) = 3.78$, $p = .028$.

To further test this interaction, main effects were analysed by two separate within-subject repeated measures ANOVA, one for the effects of sensory phase in the baseline measurement and one for the effects of sensory phase in the manipulation measurement. As expected, results showed that there were no differences during the baseline measurement in baseline-yoghurt intake across the sensory phases, $F(2, 62) = 0.91$, $p = .41$. Interestingly, results indicated that intake differed significantly across sensory phases during the manipulation measurement, $F(1.61, 49.96)$[4] $= 13.37$, $p < .001$. Further pairwise comparisons specified that the texture manipulation led to a significant decrease in intake when compared to the taste manipulation ($p < .001$), and the colour manipulation ($p < .01$). Intake in the colour and the taste phase did not differ significantly ($p = .22$), see Fig. 2. These results show that specifically alterations in food

[4] Greenhouse-Geisser corrections are reported, because the assumption of sphericity was violated.

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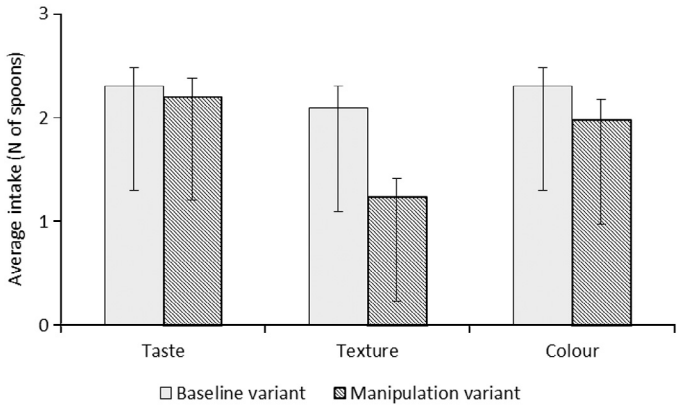

Fig. 2. Average intake (in spoons) of the baseline and of the manipulation measurements, respectively, for the taste, the texture and the colour testing phase.

texture (smaller and bigger pieces instead of smooth texture) affected the yoghurt consumption, and thus food acceptance, in children and could thus be indicative for fussiness.

Do parental reports of children's fussy eating behaviour (according to the CEBQ) relate to the behavioural measure of food acceptance?

Correlation analyses were conducted to test if the parental account of their child's fussy eating behaviour (based on the fussiness subscale of the CEBQ) was related to the behavioural measurement of food acceptance (i.e., average spoon intake of the manipulation variants per testing phase). If parental reports of fussy eating were in line with the behavioural observation of food acceptance, a significant correlation of average spoon intake in the texture condition and the CEBQ subscale "food fussiness" would be expected. However, parental reports of children's fussy eating behaviour did not correlate with spoon intake in the texture condition, $r(32) = .01$, $p = .59$, intake in the taste condition, $r(32) = -.17$, $p = .36$, or intake in the colour condition, $r(32) = -.03$, $p = .87$. Thus, parental reports of picky eating did not correspond with the behavioural observation of food acceptance.

Do parental reports of their feeding styles relate to the behavioural measure of food acceptance?

Correlation analyses were conducted to test if parental feeding style (as measured by the four subscales of the PFSQ) related to the behavioural measurement of children's food acceptance (i.e., average spoon intake of the manipulation variants per testing phase). None of the parental feeding style subscales (emotional feeding, instrumental feeding, prompting to eat, control over eating) correlated with the behavioural measure of food acceptance, all $rs(32) < -.30$, $p > .10$, indicating that parental feeding styles were not related to behavioural observations of food acceptance in children.

Is fussy eating behaviour and food acceptance related to children's BMI?

To test if fussy eating and food acceptance was related to children's BMI (adjusted for age and gender), correlation analyses were conducted for the children's adjusted BMI and parental reports of their children's fussy eating behaviour (based on the food fussiness subscale of the CEBQ), and the behavioural measurement of children's food acceptance (i.e., average spoon intake of the manipulation variants per testing phase). Mean adjusted BMI was 97.25% (SD = 10.33%, range = 80.00–121.00%). No significant correlations emerged with the behavioural measurement of food acceptance, all $rs < .23$, $ps > .21$ or with the food fussiness subscale of the CEBQ, $r(32) = -.31$, $p = .09$. Thus, children's BMI was not related to parental or behavioural measures of food acceptance.

Discussion

The main aim of this study was to test which specific sensory food feature affects food acceptance in young children, which, in turn, could be indicative for fussy eating, by means of a behavioural test. Our results showed that spoon intake was significantly affected by changes in the texture of an otherwise well-liked yoghurt. Conversely, intake was not affected by alterations in colour or taste. Thus, variations in texture, especially a lumpy texture, can affect children's food acceptance. It is to be noted that texture was manipulated independently of other sensory features in the texture testing phase; that is, the taste and colour were held constant.

Our results, that children preferred a smooth texture over a lumpy texture with pieces, dovetails the observation that sensory sensitive children are more likely to be more selective in their eating (Farrow & Coulthard, 2012). In this respect, our results correspond also well with the observation that the textural properties of food emerged as one important factor for adults that influenced perceived disgustingness when viewing depicted food scenarios (Martins & Pliner, 2006) and determined the willingness to try a novel food (Dovey et al., 2012). Moreover, our result is also in line with parental reports that texture affects food preferences in children (Russell & Worsley, 2013). Thus, if our behaviour measure of food acceptance is seen as indication for picky eating behaviour, our results support the notion that picky eating is related to tactile sensitivity in children (Smith et al., 2005). However, it is to be noted that there might be another explanation for the observation that children ate less in the texture manipulation phase, even though unlikely: during the texture phase, the experimenter gave children the spoon with yoghurt, whereas in other conditions children took the spoon themselves. This difference in the experimenter's behaviour might have influenced spoon intake. Yet, it is also to be noted that children in this age group are still very much used to getting spoon-fed. Future research should thus replicate these findings while controlling for the method of spoon-feeding. Moreover, we did not assess or control for possible problems with oral motor functioning in the participating children. Even though possibly unlikely, as all children were healthy and recruited from a regular day-care centre, we cannot rule out that children found it (physically) more difficult to eat texture variants, instead of not liking to eat yoghurt with lumps. Future research should therefore consider this alternative explanation for a reduction in intake when providing children with different textures and accordingly include a measure for oral motor functioning. Moreover, we want to stress that the manipulation of the texture variant was aimed to be as ecologically valid as possible by adding raspberry pieces, instead of for example changing the texture in a less natural way (e.g., by adding an artificial thickening agent which might have created an "unnatural" consistency). Yet, since no formal test was conducted to determine if adding raspberry pieces to the raspberry yoghurt might have affected the taste of these variants slightly, our results should be considered under this limitation.

The finding that food texture affected food acceptance can have implications for parental practice and further research: Research-wise this knowledge is important because our results suggest that individual differences in tactile sensitivity (and thus sensitivity to food textures) could affect the risk of picky eating behaviour. Moreover, our results imply that gradual exposure to changes in texture could possibly help to overcome picky eating behaviour. Previous studies focussed on exposure to different tastes to increase vegetable consumption and found that exposure to different tastes

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can make novel food more acceptable to children (Anez, Remington, Wardle, & Cooke, 2013; Fildes, van Jaarsveld, Wardle, & Cooke, 2013; Wardle, Herrera, Cooke, & Gibson, 2003). Extending these exposure techniques by exposing children to different textures in a picky eating context could be a valuable addition to this procedure.

Interestingly, taste variations did not affect food intake of children in this behavioural study. This finding is at odds with a previous result reporting that children's vegetable and fruit consumption was related to the smell and taste (Coulthard & Blissett, 2009). A possible explanation for this divergence could be that the previous study relied on maternal self-report of children's eating behaviour and neophobia, whereas the current study used a behavioural test with food acceptance, as indicator for fussiness. In addition, it is to be noted that the behavioural test was limited to tasting yoghurt and fruit flavours. Relevant in this respect is that picky eating might be associated to a greater extent with vegetable consumption than fruit consumption, possibly because fruits are generally more accepted by children (Dovey et al., 2008; Jacobi, Agras, Bryson, & Hammer, 2003). Thus, it is possible that in our study using fruity flavours, food acceptance, indicating fussiness, was mostly associated with the texture of food, but this could be different for a behavioural test using vegetables. Future research has to determine whether our current finding that taste did not influence food intake extends to vegetable (or other) tastes.

Previous research indicated that breastfeeding was associated with reduced risk of picky eating. For example, Shim, Kim, and Mathai (2011) suggested that children learn novel tastes through breastfeeding and their picky eating might then be less susceptible to taste alterations through their previous exposure to a variety of tastes by breast milk. Accordingly, an alternative explanation for the observation that taste did not influence picky eating in this study could be that Dutch children are commonly breastfed (Bulk-Bunschoten, van Bodegom, Reerink, Pasker-de Jong, & de Groot, 2001). However, it is to be noted that the empirical evidence for a causal relation of breastfeeding and picky eating is still lacking and previous findings are equivocal (see e.g., Galloway et al., 2003; Russell & Worsley, 2008).

Variations in colour of the well-liked yoghurt did not affect food intake. This finding is in contrast to the results of Dovey et al. (2012) showing that children relied on visual aspects to decide if they want to try a novel fruit. A possible explanation for our result could be that the children found the colour alterations exciting, as reported anecdotally by the experimenter. This observation would fit with previous research indicating that children ate more of attractive looking foods (fruits) than plain looking foods (Jansen, Mulkens, & Jansen, 2010). This finding is important for parents of picky eaters, as it indicates that by making foods attractive or interestingly looking children's' liking or acceptance of these foods might increase. Future research has to determine whether other visual aspects of food could still affect picky eating, for example when using more natural or less attractive colours.

Another aim of this research was to test if the behavioural observation of food acceptance was related to parental reports of food fussiness or parental feeding styles. Correlation analyses indicate that this was not the case. An explanation of this lack of correspondence between parental reports of their child's fussy eating behaviour and the behavioural observation of food acceptance could be that parental reports of picky eating might be biased. For example, it is possible that parents might not be very accurate in estimating how much their child's eating behaviour (and pickiness) deviates from "normal" eating behaviour in children. Another explanation is that parental reports of picky eating are confounded by their own responses to their child's eating behaviour. For example, van der Horst (2012) suggested that parental reactions to their child's eating behaviour could contribute to problematic eating, such as picky eating. Thus, parental perceptions of their child's eating behaviour might be confounded by their own concerns or their parental eating and feeding behaviours and be less accurate about the "pure", that is, behavioural observation of their children's eating behaviour (when not eating with parents). The finding that parental reports of picky eating in children do not necessarily correspond with texture problems in selective eating behaviour is in line with results from another study that failed to find a correlation between parental reports of picky eating and reports of their child having texture problems when eating (Seiverling, Hendy, & Williams, 2011). Moreover it is to be noted that the CEBQ "fussiness" scale measures a combination of both: pickiness and food-neophobic eating behaviour, and it is thus not further possible to distinguish the (possible) influence of parental perception of picky eating versus neo-phobia with regard to our behavioural observation of food acceptance. Future research should further investigate the correspondence of objective behavioural observation of food acceptance and subjective, parental self-reports of picky eating experimentally in order to disentangle the effects of parental reports and objective measures of problematic (picky) eating behaviour in children. In this respect it could be fruitful to include a questionnaire about food frequency. Including such a questionnaire could help to further understand the eating behaviour differences between picky eaters and food neophobic children.

Finally, this study also tested whether the behavioural test of food acceptance and parental reports of their child's fussy eating behaviour correlated with the child's BMI. This is important, because one major concern of picky and fussy eating is that picky eaters under-eat and have a less optimal weight and growth development due to missing important nutrition (e.g., Dovey et al., 2008; Galloway et al., 2005). No correlation of the behavioural measure of food acceptance and parental accounts of picky eating and BMI was found, corresponding with previous studies that showed that picky eating (when measured by parental reports) was not related to underweight in children (e.g., Carruth et al., 2004).

Our results should be viewed under some limitations of our study: The range of BMI in the current sample was considerably small and mostly within a healthy weight range and this could have affected the strength of correlation between children's adjusted BMI and measures of picky eating behaviour and food acceptance. It is thus possible that stronger correlations only emerge within samples with a more diverse BMI range. It is further to be noted that the assessment of BMI was based on parental reports of height while weight was measured by one single measurement with a weight scale at the kindergarten. Thus, BMI data should be considered under this limitation. In addition, it could be argued that our behavioural measure of food acceptance could be an indicator for both: picky eating and neophobia. As there is no good definition and (self-report) measure of picky eating and neophobia, it is thus possible that some children rejected variation of the yoghurt because these variations were novel to them, whereas others rejected variants of the yoghurt because they are picky. We would like to stress that we did not strive to measure picky eating behaviour per se. The aim of this research was to test which (sensory) food feature might impact (dis) liking of certain food features and affect the willingness to try variations from an otherwise well-liked food. Thus, a major strength of the current study was that we applied an objective, experimental and unbiased behavioural test to determine which specific sensory food feature has an influence on children's food acceptance within a paediatric sample.

Together, the current results stimulate further research on a behavioural objective measure for food acceptance and food fussiness (including picky eating and neophobic eating behaviour) in children, and emphasize the influence of food texture on food acceptance in mainly healthy weight young children.

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Conclusions

Food acceptance was affected by the texture of food, but not by colour or taste of the offered yoghurts, in young children. This result emphasizes the importance of tactile sensitivity in the context of fussy or picky eating behaviour. In this respect our findings might provide practical implications and a scope for further research on picky-eating interventions: gradually exposing picky eaters to different food textures could possibly attenuate picky eating behaviour. Moreover, our data suggests that parental accounts of fussy eating might not correspond well with a behavioural observation of children's eating behaviour. This is important to note for future research, because for a better understanding of the risks and precursors of picky eating it is necessary to further examine the best method for a valid assessment of picky eating in children.

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