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# Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance

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ABSTRACT

The texture of food can be a reason why children reject it: It matters if food is crispy, slimy, smooth or has pips and bits in it. In general, mere exposure is the best method to increase acceptance of food: becoming more familiar with a food by repeated exposure increases liking for it. However, exposure to texture can be difficult, as children can be reluctant to try tasting it. In the current study, it is tested if acceptance of a food with a specific texture is improved after exposure to the feel of it, with hands only. Sixty-six children (between 3 and 10 years old) were randomly assigned to either the exposure or control condition. In the exposure condition, children played with an colourless and odourless jelly with their hands and in the control group, children played a board game. Afterwards, children were asked to taste 3 desserts (in balanced order): smooth strawberry yoghurt, strawberry yoghurt with pieces and strawberry jelly. Results showed that the children in the exposure condition ate specifically more of the jelly dessert - the texture of which they had been pre-exposed to - compared to the children in control condition. No group differences were found for the other two desserts. The results imply that feeling the texture of a food with hands increases the acceptance of food with the same texture. Playing with food with hands seems therefore be a first step in getting familiar with food and might help to increase variety of food intake.


Sufficient intake of fruit and vegetables is important for a healthy diet. In young children, this is not always easy to achieve: children become more selective in eating around 2 years old, they start rejecting foods they previously liked and avoid new foods (Dovey, Staples, Gibson, & Halford, 2008; Jacobi, Agras, Bryson, & Hammer, 2003). Although most children grow out of this gradually (Nicklaus, 2009), variety between children is large and around 13–22% of children between 2 and 12 years can be considered picky or fussy eaters (Jacobi, Schmitz, & Agras, 2008; Mascola, Bryson, & Agras., 2010). This means that they reject a large proportion foods, both familiar and novel, which results in a diet which is characterised by a low variety of foods. A specific subset of picky eating is food neophobia, which refers to the rejection of novel or unknown foods (Dovey et al., 2008). Picky eating is related to insufficient intake of fruit and vegetables, a higher incidence of underweight and even malnutrition (Antoniou et al., 2015; Ekstein, Laniado, & Glick, 2010; Jacobi et al., 2003). Moreover, children who eat a less varied diet at a young age, tend to have less varied diets later in life, especially when considering intake of fruit and vegetables (Nicklaus, Boggio, Chabanet, & Issachou, 2005; Skinner, Carruth, Bounds, & Ziegler, 2002). A varied diet at childhood might therefore help to establishing a healthy, nutritional diet at adulthood.

The decision of children to reject foods is not only based on taste, but also on how the food smells, looks or feels (Coulthard, Palfreyman, & Morizet, 2016; Monnery-Patris et al., 2015). Werthmann et al. (2015) asked children to taste several types yoghurts and varied the color, taste or structure of the yoghurts successively, while keeping the other two features constant. Variations in taste and color did not affect food acceptance, however, chances in food texture led to reduced food intake. They concluded that food texture is an important feature, influencing food acceptance in children. It seems that specifically food that has pieces in it, is tough, feels slimy or slippery is often rejected by children (Szczesniak, 2002), and food that looks mushy or slimy is more easily considered disgusting (Martins & Pliner, 2006). Children who enjoy tactile stimulation or tactile play less, are found to be pickier

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in eating (Nederkoorn, Jansen, & Havermans, 2015) and score higher on food neophobia (Coulthard & Sahota, 2016; Coulthard & Thakker, 2015; Smith, Roux, Naidoo, & Venter, 2005). This suggest that children who are more sensitive to tactile stimulation in general might rejects foods more easily because they don't like the texture or mouth feel.

A common strategy to improve liking of foods is mere exposure. Frequent exposure to a stimulus makes it more familiar and enhances the attitude towards this stimulus (Zajonc, 1968). When children taste an unknown food several times, this increases the liking and acceptance of the food (i.e. Cooke, 2007; Hetherington et al., 2015; Maier-Nöth, Schaal, Leathwood, & Issanchou, 2016). Repeated exposure can also help to increase the liking of a familiar but previously disliked food (Wardle et al., 2003), showing that mere exposure can not only help to overcome food neophobic reactions, but also picky eating in general. If children dislike a food because of the texture, it seems logical that the children should be exposed to the texture, by having them eat the food with the specific texture, or at least tolerate it in their mouth. However, this is not always easy to achieve: children might be reluctant to try the food. Caregivers often report that their toddlers refuse to eat foods, spit it out and push or throw foods away (Lewinsohn et al., 2005). Parental pressure to taste or eat food can even have counterproductive effects and cause children to eat less (Galloway, Fiorito, Francis & Birch, 2005; Jansen et al., 2017). One solution is to gradually increase texture in food (Shore, Babbitt, Williams, Coe, & Snyder, 1998). Another solution could be to exposure children to other sensory properties of food, without tasting. Dazeley and Houston-Price (2015) showed that if toddlers see, smell, touch or hear unusual fruits and vegetables during play activities, they touch and taste more of these foods during a taste test afterwards. It has also been shown that exposure to a variety of sensory aspects, including taste, increases the willingness to eat fruits and vegetables (Hoppu, Prinz, Ojansivu, Laaksonen, & Sandell, 2015; Witt & Dunn, 2012). Coulthard and Sealy (2017) looked more specifically at the role of exposure to the texture of food on acceptance of food. They showed that if children play with fruits and vegetables with their hands, they are more likely to eat them, compared to exposure to the sight of the same foods or playing a non-food sensory game. An explanation for this finding is that the children familiarized themselves with the foods, which is supported by the finding that the largest effects were found for less familiar foods, like pomegranate (Coulthard & Sealy, 2017).

It has not been tested yet however, if exposure to an isolated tactile aspect in non-food transfers to greater acceptance of that aspect in food. For instance, if playing with non-food jelly would increase consumption of a jelly pudding. This would show that the familiarity to the holistic concept of a food is not necessary to increase food acceptance, but that the increased familiarity of a single feature of food also helps to enhance consumption of food. Acceptance of this specific texture could than generalize to different foods with the same texture.

In the present study it was tested if tactile exposure to a non-food texture, by feeling it with the hands, could increase acceptance of food with the same texture. Half of the children were pre-exposed to the texture of odor- and colorless jelly, the other half not. Next, the children were asked to taste from three strawberry desserts, which either had a comparable jelly texture or a texture that differed in viscosity and consistency. We expected that the children in the exposure condition would become habituated to the jelly texture and therefore taste more of the strawberry jelly than children in the control condition. For the other two desserts, no pre-exposure took place and therefore no differences between groups were expected.

## 1. Method

### 1.1. Participants

The parents of the children of two preschools and one elementary school were informed about the current study and asked if their child could participate. An exclusion criterion was food allergy for strawberry yoghurt or jelly. Sixty-eight children participated. Two children refused to taste any food and were excluded from analyses. The remaining sample consisted of 36 boys and 30 girls, with a mean age of 5.8 (SD = 1.8, ranging from 3 to 10 years). The mean BMI z-score, based on a Dutch healthy weight norm population (TNO, 2016), was 0.51 (SD = 1.27), meaning the children weighed significantly more than the healthy weight norm group. The sample included 9 children with overweight, 4 children with obesity and 4 children with underweight. The child characteristics per condition are reported in Table 1.

### 1.2. Design

The study had a cross-sectional, mixed experimental design. The between-subject factor was the condition (tactile exposure or control), to which each child was randomly assigned. The within-subject factor was the texture of three foods, which differed in viscosity and consistency. One texture (jelly) matched the texture of the tactile exposure material, the other two (smooth yoghurt and yoghurt with pieces) differed. The desserts were presented in balanced order. The dependent measure was the number of spoonfuls (between 0 and 3) the child tastes of each dessert.

## 2. Materials

### 2.1. Exposure

Children were manually exposed to the tactile stimuli during individual sessions. Children were asked to play with a large bowl (ø 18 cm) filled with a colourless and odourless jelly (made of gelatin and water) in a semi-structured way. In the beginning, the children were free to play with the gelatin mass, as long as they used their whole hands in interaction with the jelly. After a few minutes the children were motivated to feel the texture by tasks like scooping the jelly with their hands into another bowl, finding hidden coins in the bowl and sculpting figures from the jelly (see Fig. 1). When children were shy or reluctant to touch the jelly during the free play, these tasks were initiated from the start. This way, the experimenter made sure that all the children touched the jelly for 10 min, in a playful way.

In the control group, children played an age-appropriate board game (Memory) with the experimenter, for 10 min.

### 2.2. Taste test

Children were asked to eat from three types of strawberry dessert, in balanced order: 1) Yoghurt with pieces: a pink colored strawberry yoghurt (low-fat) that contained small pieces of strawberry (brand: Albert Heijn, The Netherlands), 2) Smooth yoghurt: the same yoghurt, filtered to remove the pieces of strawberry, resulting in a smooth strawberry yoghurt and 3) Jelly: a red colored strawberry jelly pudding (brand: Dr. Oetker, The Netherlands). The desserts were presented in equal clear plastic bowls (ø 8 cm). The children were asked to taste a spoonful of the food and if they tried it, the experimenter asked if they would like another spoon. The children handled the spoons themselves, the experimenters supervised if the spoons were properly filled and helped the younger children when needed. The number of spoons