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Strategies to increase preschoolers' vegetable liking and consumption: The role of reward sensitivity

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ABSTRACT

The present study investigated the effectiveness of different strategies to increase the willingness to taste, liking and consumption of a disliked vegetable in preschool children, and the moderating role of reward sensitivity. Kindergarten classes (n = 8; preschool children: n = 154, 46,8% boys, age: $M = 5.08$, $SD = 0.61$) were assigned to one of four different conditions (i.e. Repeated Neutral Exposure, Repeated Exposure + social reward, Repeated Exposure + token reward and control condition). The results demonstrated that children's liking and consumption of the disliked vegetable significantly increased in the three active strategies (i.e. consumption and liking increases ranged from 10.1 to 20.6 g, and 34.1 to 51.8% respectively) compared to the control condition (i.e. consumption and liking increases ranged from 0.3 to 1.7 g, and 1.9 to 4.7% respectively). No significant differences were found between the three active strategies for all dependent variables. Little evidence was found for the moderating role of the individual characteristic reward sensitivity.

1. Introduction

In young children, healthy eating habits are essential to achieving healthy growth and development (Conners, 1989; Pipes, 1989). Despite the necessity to eat healthily and the numerous efforts of health promotion interventions, the consumption of vegetables in preschool children is far below the minimum food-based dietary guidelines (Huybrechts et al., 2008). The regular consumption of vegetables is determined by a wide range of personal and family-related factors (Blissett & Fogel, 2013; Mitchell, Farrow, Haycraft, & Meyer, 2013; Rasmussen et al., 2006; Zeinstra, Koelen, Kok, van der Laan, & de Graaf, 2010). Of these, preferences or the liking of food, is repeatedly identified as a strong and important determinant of consumption (Baxter & Thompson, 2002; Cullen et al., 2003; Domel et al., 1996; Gibson, Wardle, & Watts, 1998). Therefore, the present study focused on strategies to improve liking of vegetables in preschool children.

Repeated Exposure, in which children are repetitively exposed to the taste of food items, is the most basic learning strategy for establishing liking. Multiple studies proved Repeated Neutral Exposure (i.e. Repeated Exposure through neutral instructions) to be effective in increasing liking and consumption of an initially disliked vegetable (Anzman-Frasca, Savage, Marini, Fisher, & Birch, 2012; Caton et al., 2013; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Wardle, Herrera, Cooke, & Gibson, 2003; Wardle et al., 2003; Wild, Graaf, & Jager, 2015). However, since willingness to taste is needed to obtain exposure, and thus, a prerequisite to establish liking (Birch, Mcphee, Shoba, Pirok, & Steinberg, 1987), a major pitfall of Repeated Neutral Exposure is the absence of a motivational component to encourage tasting. Such motivation is advisable, given the high prevalence of food neophobia (i.e. the rejection of novel or unknown foods) (Birch & Fisher, 1998) and picky/fussy eating (i.e. the rejection of familiar foods) (Galloway, Lee, & Birch, 2003) in preschool children (Dovey, Staples, Gibson, & Halford, 2008).

Previous research evaluated various motivational strategies to enhance children's tasting behavior, such as modelling (Addessi, Galloway, Visalberghi, & Birch, 2005; Hendy, 2002; Zeinstra, Kooijman, & Kremer, 2017), teaching (Blissett, Bennett, Fogel, Harris, & Higgs, 2016), role-playing (Blissett, Bennett, Donohoe, Rogers, & Higgs, 2012) or rewarding (Cooke et al., 2011). The current study focused on rewards. Following the principle of operant conditioning (Skinner, 1938), offering a reward for eating certain foods should motivate the child to eat them again. However, recent research demonstrates that the effects of rewards within the food domain are less straightforward. The success of reward-based strategies additionally depends upon other

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factors such as the rewarded behavior and the type of reward (for review see Cooke, Chambers, Anez, & Wardle, 2011). Research shows that it is important not to reward *how much* children eat, as this "clean up your plate" – strategy undermines their internal regulation system and increases the preference for larger portions (Colapinto, Fitzgerald, Taper, & Veugelers, 2007), which may in, turn, lead to overweight and obesity (for review see Fisher & Kral, 2008). Therefore, the current study provided rewards for *tasting,* which does not affect the internal regulation system. Instead, it enables children to benefit from repeated taste exposures (Cooke et al., 2011). The type of reward also determines whether rewards have positive or negative effects. The current study provided non-food tangible (i.e. stickers) and non-tangible (i.e. praise) rewards, as the repeated use of these rewards were previously found to cause short- and long-term increases in children's liking and consumption of disliked food items (Cooke et al., 2011; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004).

Besides their proper use, the success of these strategies might also depend on child characteristics. Indeed, previous research highlighted the influence of individual characteristics on the effectiveness of strategies to improve vegetable acceptance (Blissett et al., 2016; Vandeweghe, Verbeken, Moens, Vervoort, & Braet, 2016), suggesting that individually tailored strategies may be more helpful in nudging children towards healthy eating habits. While previous research points to the important role of an individual's reward sensitivity as a biological predisposition that guides human learning and behavior (Beaver et al., 2006), little is known about its specific role in learning to like and consume vegetables. Therefore, the child's trait reward sensitivity in relation to the success of the strategies was investigated as well. It was recently found that the effectiveness of strategies to enhance children's *willingness to taste* disliked food items depended on individual differences in reward sensitivity (Vandeweghe et al., 2016). According to the Reinforcement Sensitivity Theory, reward sensitivity reflects the extent to which positive, rewarding environmental stimuli (e.g. games, palatable foods) activate the Behavioral Activation System (Gray, 1981, 1987a, b; Gray & McNaughton, 2003). The activation of this neuropsychological brain system initiates approach behavior in order to obtain the rewarding goal (e.g. playing the game, eating the food) (Depue & Collins, 1999; Gray, 1981, 1987a; Kane, Loxton, Staiger, & Dawe, 2004). In line with this theory, it was found that, compared to providing neutral instructions, children high in reward sensitivity were more willing to taste a disliked vegetable when they were rewarded for tasting with a token. An unexpected result emerged as well: compared to giving neutral instructions, children lower in reward sensitivity were more likely to taste after hesitation when verbally encouraged (Vandeweghe et al., 2016). These differential sensitivities underscore the importance of taking into account individual characteristics when applying strategies to improve liking and consumption of vegetables. As this study was conducted in an experimental laboratory setting, the external validity of the findings might be challenged. Therefore, it is important to replicate and extend these results in a more ecologically valid study.

The present study aimed to further investigate the effectiveness of different strategies (i.e. Repeated Neutral Exposure (RNE), Repeated Exposure (RE) + token reward and RE + social reward) in preschool children in an ecologically valid context. The effectiveness of the strategies was determined by the *willingness to taste* and *liking after having tasted the vegetable* during the intervention period (i.e. when the strategy is applied), and *change in liking and consumption* after versus before the intervention period compared to a control condition in which no strategy was provided.

Based on previous research, it was hypothesized that children in the three intervention conditions (i.e. RNE, RE + token reward, RE + social reward) would show increased liking and consumption of an initially disliked vegetable after the intervention period compared to children in the control condition. Because of the motivational component in the reward conditions, we additionally expected a stronger increase in the four outcome measures (i.e. liking and consumption after the intervention as well as the willingness to taste and liking during the intervention) in both RE + reward conditions compared to the RNE condition.

Second, the study investigated whether the effectiveness of the different conditions depends on reward sensitivity. With respect to RE + token reward condition, it was expected that, based on theory (Gray, 1981, 1987a) and previous research (Vandeweghe et al., 2016), children high in reward sensitivity, compared to children low in reward sensitivity, would show a stronger increase in liking and consumption after the intervention, and a higher willingness to taste and higher odds of obtaining liking during the intervention. With respect to RE + social reward, opposite hypotheses were formulated based on theoretical conceptualizations on the one hand (Gray, 1981, 1987a) and previous findings on the other (Vandeweghe et al., 2016). In line with the theoretical conceptualization of reward sensitivity, children high in reward sensitivity, compared to children low in reward sensitivity, are expected to show a stronger increase in liking and consumption after the intervention and a higher willingness to taste and higher odds of obtaining liking during the intervention in the RE + social reward condition. However, in line with a previous study showing that verbal encouragement, which announces a social reward, is most effective in low reward-sensitive children (Vandeweghe et al., 2016), opposite effects are expected. More specifically, it is hypothesized that children in the RE + social reward condition with low compared to high reward sensitivity, would show a stronger increase in liking and consumption after the intervention, and a higher willingness to taste and higher odds of obtaining liking during the intervention.

2. Method

2.1. Participants

The study was conducted in two Flemish nursery schools in Deinze (77 children; 50,6% boys; age: $M = 5.18$; $SD = 0.60$) and in Bevere (77 children; 42,9% boys; age: $M = 5.01$; $SD = 0.60$). No one was allergic to the target vegetable. In total, the dataset comprised 154 children (46,8% boys; age: $M = 5.08$; $SD = 0.61$).

2.2. Material

2.2.1. Behavioral inhibition system/Behavioral activation system (BIS/BAS) scales

In order to assess reward sensitivity (RS), mothers completed the BAS scale of the BIS/BAS scales (Carver & White, 1994) adapted for parent report (Vervoort et al., 2015), which was based on an age-downward adaptation of the original scales (Muris, Meesters, de Kanter, & Timmerman, 2005). The BIS/BAS-scales parent version is found to be a useful and valid index of a child's RS (Vervoort et al., 2015). The BAS scale consists of 13 items on 4-point Likert Scale from 1 (not true) to 4 (very true) and can be further subdivided in 3 subscales. The Reward Responsiveness subscale (5 items) includes statements as "It would excite my child to win a contest". The Fun Seeking subscale (4 items) includes statements as "My child craves excitement and new sensation". The Drive subscale (4 items) includes statements as "When my child wants something, he or she usually goes all out to get it". In the current study, RS refers to the sum of the 13 BAS items (Cronbach's $\alpha = 0.87$).

2.2.2. Vegetable liking list

The Vegetable Liking List (VLL) was used to investigate which vegetable was most disliked and should be served during the intervention. The VLL assesses children's liking of 10 vegetables in steamed or boiled form (i.e. fennel, chicory, zucchini, mushrooms, peas, leek, Brussels sprouts, beetroot, spinach, and cauliflower). The choice of items in this self-developed questionnaire was based on the least liked vegetables in a previous study (Vandeweghe et al., 2016). The mother indicated the