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Effects of repeated food exposure on increasing vegetable consumption in preschool children with autism spectrum disorder

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ABSTRACT

Food selectivity is common among children with autism spectrum disorder (ASD), and repeated exposure to food is considered a key component of treating this problem. This study investigated the effects of a preventive program using repeated exposure of vegetables on vegetable consumption, both in an experimental setting and during mealtime among preschoolers with ASD showing no severe food selectivity. A total of 27 preschoolers with ASD were assigned to either a 6-month-long exposure program (n = 13, mean age = 4.42 years) or a control group (n = 14, mean age = 4.04 years). The training program was developed to facilitate visual and tactile contact with various vegetables and consisted of 24 activities, which were repeated four times using different vegetables. The training was conducted four times a week at the children's early intervention agency by their therapists. Changes in vegetable consumption in the experimental setting as well as nutritional intake during regular mealtime were compared between the exposure and control groups, before and after the exposure program. Significant group differences were found in vegetable consumption, but not in nutritional intake during regular mealtime. The limitations and direction for future research are further discussed.

1. Introduction

The majority of children with autism spectrum disorder (ASD) exhibit feeding problems ranging from food selectivity with a limited food repertoire to severe food refusal (Bandini et al., 2010; Beighley, Matson, Rieske, & Adams, 2013; Matson & Fodstad, 2009). Food selectivity is common among typically developing preschool children (Bryant-Waugh, Markham, Kreipe, & Walsh, 2010), showing a prevalence rate of 25–40%. Yet, it is more frequently observed among children with ASD, reaching as high as 90% (Cornish, 1998; Kodak & Piazza, 2008; Nadon, Feldman, Dunn, & Gisel, 2011; Twachtman-Reilly, Amaral, & Zebrowski, 2008). Food selectivity in children with ASD is manifested through extreme preferences for a certain texture, taste, color, smell, or specific features in appearance (Cermak, Curtin, & Bandini, 2010; Nadon et al., 2011; Schreck & Williams, 2006). Some children with ASDs often exhibit a severe form of food selectivity, resulting in a failure to meet their caloric needs (Ma, Thompson, & Weston, 2016; Williams, Field, & Seiverling, 2010).

Techniques that utilize the principles of applied behavior analysis (ABA) are well-supported treatment for children with severe feeding problems (Kerwin, 1999; Ledford & Gast, 2006; Matson & Fodstad, 2009; Sharp, Jaquess, Morton, & Herzinger, 2010; Volkert & Vaz, 2010). Typical ABA intervention includes multiple treatment components, such as escape extinction (EE; e.g., Piazza, Patel, Gulotta, Sevin, & Layer, 2003; Piazza et al., 2002), differential reinforcement (DRA) for food acceptance or swallowing (e.g., Ahearn,

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2002; Anderson & McMillan, 2001; Kahng, Boscoe, & Byrne, 2003), simultaneous or sequential presentation of food (e.g., Najdowski, Wallace, Doney, & Ghezzi, 2003; Piazza et al., 2002), and stimulus fading (e.g., Freeman & Piazza, 1998; Patel, Piazza, Kelley, Ochsner, & Santana, 2001).

Children with feeding problems not only refuse to consume food but also actively protest against feeding by engaging in crying, throwing food and utensils, expulsion, and vomiting. These problems are considered as negatively reinforced behaviors (Piazza, Fisher et al., 2003; Sharp et al., 2010) since children can avoid the aversive stimuli (e.g., foods) by engaging in such problem behaviors. Hence, the treatment for feeding problems predominantly involves escape extinction (EE), which prevents the child from escaping from feeding situations, in the form of non-removal of the spoon (NRS; e.g., Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Piazza, Fisher et al., 2003) and physical guidance (PG; e.g., Freeman & Piazza, 1998; Piazza et al., 2002). In addition, teaching alternative behaviors via gradual exposure to new food and providing positive reinforcement upon consumption are also included as major treatment components, which are necessary for treating problem behaviors (Cooper, Heron, & Heward, 2006). For gradual exposure, task analyses are performed to develop a hierarchy of foods to be introduced, and they are introduced one by one from the bottom of the hierarchy until the child no longer refuses to eat food and shows no refusal behaviors.

However, whether exposure is effective to prevent feeding problems in young children with ASD, who are at a higher risk than typically developing peers, has not been sufficiently explored (Ledford & Gast, 2006; Marshall, Ware, Ziviani, Hill, & Dodrill, 2015; Sharp et al., 2013). Considering both ethical and economic aspects, providing early intervention or implementing preventive measures for children with ASD, who exhibit selective eating behaviors, is just as important as it is to eliminate other problem behaviors. Thus, investigation on an appropriate prevention method for food selectivity in children with ASD is urgently called for. For typically developing children, the effects of repeated exposure to taste as an intervention for a milder form of food selectivity are well documented (Birch & Fisher, 1998; Birch & Marlin, 1982; Birch, 1987; Birch, McPhee, Shoba, Pirok, & Steinberg, 1987; Dovey, Staples, Gibson, & Halford, 2008; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Pliner, 1982). Taste exposure, however, often involves coercive feeding, which may associate with unpleasant feelings toward the food, sometimes even leads to increased food selectivity (Batsell, Brown, Ansfield, & Paschall, 2002; Tuorila & Mustonen, 2010; Heath, Houston-Price, & Kennedy, 2011). The downsides, as described, may appear even more severely in children with ASD, who are characterized to be more resistant to change and are at the risk of developing problem behaviors compared to typically developing children.

Recently, exposure through other senses, such as visual, olfactory, or tactile mediums has been suggested for typically developing children (Heath et al., 2011). In fact, a number of studies have reported the effectiveness of showing pictures of fruits and vegetables on enhancing children's willingness to taste them (de Droog, Buijzen, & Valkenburg, 2014; Heath et al., 2011; Heath, Houston-Price, & Kennedy, 2014), suggesting the possibility of visual exposure as a sole intervention for increasing consumption. Lee and Chung (2015) examined the extent to which longitudinal exposure of vegetables affects the consumption of preschool-aged typically developing children. They included both visual and tactile exposure, without any kind of taste exposure for six months. The program consisted of various play activities, which were carried out by the kindergarten teachers. The results showed significantly increased vegetable consumption and improved nutritional intake, indicating the effectiveness of visual and tactile exposure on food consumption.

The purpose of the study was to investigate the effects of repeated exposure on vegetable consumption in the population of children with ASD. Specifically, the effects of the modified version of the exposure program employed in the study by Lee and Chung (2015) were evaluated on increasing the vegetable consumption in the experimental setting and improving nutritional intake in the general meal setting.

2. Method

2.1. Participants

Participants were recruited via five ABA early intervention agencies for children with ASD located in the metropolitan area of Seoul, Korea. Parents of 42 children (34 boys and 8 girls) gave their informed consent on behalf of the children. Among the recruited children, a total of 35 children (27 boys and 8 girls) met the following inclusion criteria: 1) aged between two and five and a half years, 2) confirmed ASD diagnosis via parental report, 3) reported no extreme food restrictions or medical conditions impeding any kind of food consumption, and 4) received no additional feeding-related interventions. Among these 35 children, 8 children (3 boys and 5 girls) were excluded from this study, since they dropped out of their ABA early intervention program during the study period. As a result, a total of 27 children (24 boys and 3 girls) were included in this study (See Table 1). The four agencies were assigned to either the experimental or control group, and the 5th agency was assigned to the control group in order to match the number of

Table 1
Demographic characteristics of the exposure and control groups.

	Exposure group (n = 13)	Control group (n = 14)
Age (years) ± *SD*	4.42 ± 0.50	4.04 ± 1.02
Age range (months)	45 ~ 63	30 ~ 65
Gender	11 boys (84.6%)	13 boys (92.9%)
BMI (kg/m^2) ± *SD*	15.35 ± 0.99	16.08 ± 1.41