Providing choice increases children's vegetable intake

Paloma Rohlfs Domínguez [a,b,c,*], Fernando Gámiz [d,e,f], Marta Gil [g], Hayarelis Moreno [g,h],

Raúl Márquez Zamora [i], Milagros Gallo [d,e,f], Isabel de Brugada [g]

a University of Granada, Department of Experimental Psychology and Physiology of Behavior, Campus de Cartuja s/n, 18071 Granada, Spain
b University of Huelva, Department of Clinical, Experimental and Social Psychology, Avenida Tres de Marzo, 21007 Huelva, Spain
c University of Extremadura, Department of Psychology and Anthropology, Avenida de la Universidad, s/n, 10071 Cáceres, Spain
d University of Granada, Department of Psychobiology, Spain
e Institute of Neuroscience ''Federico Olóriz'', Spain
f Centro de Investigaciones Biomédicas (CIBM), Avenida del Conocimiento, s/n. P.T. de la Salud, 18016 Armilla, Spain
g University of Granada, Department of Experimental Psychology, Campus de Cartuja s/n, 18071 Granada, Spain
h Simon Bolívar University, Caracas, Venezuela
i University of Sevilla, Department of Experimental Psychology, Calle Camilo José Cela, s/n, 41018 Sevilla, Spain

ABSTRACT

One hundred and fifty children between 4 and 6 years old were studied to examine the effect of providing them with a choice of vegetables on their vegetable consumption. Offering vegetable choice was expected to increase the children's vegetable intake due to increased personal autonomy. The option for the children to choose the vegetables to ingest was varied across three different conditions. Within the discrete choice condition (DCC), children could choose the target vegetable at the beginning of the meal; within the continued discrete choice plus variety condition (CDCP), children were exposed to a variety of vegetables (zucchini and green beans), so that they could choose the target vegetable whenever they made a bite during the whole meal. Within the no-choice condition (NCC), children were alternately exposed to only one kind of vegetable, so that no choice possibility was provided. The choice conditions (CDCP and DCC) were associated with higher vegetable intake, in comparison to the no-choice control condition (NCC). No significant differences were found between the DCC and the CDCP regarding participants' total vegetable intake. These results demonstrate the enhancing effect of providing choice to increase vegetable intake in young children. A higher degree of personal control and consequent level of intrinsic motivation is hypothesized to underlie the effect of choice availability.

Keywords: *Children Choice School Intervention Vegetables Consumption*

1. Introduction

Vegetable intake during childhood is essential for maintaining a good state of health and preventing diseases such as obesity and cancer (Aranceta et al., 2007; Van Duyn & Pivonka, 2000; WHO, 2002). However, vegetable consumption rates in young children – defined as being 6 years old or younger (Goldstein, Daun, & Tepper, 2007) do not meet worldwide recommendations (Lorson, Melgar-Quinonez, & Taylor, 2009; Yngve et al., 2005).

What humans (and particularly children) eat is based primarily on their liking for the taste of the food (Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008; Nasser, 2001; Sorensen, Möller, Flint, Martens, & Raben, 2003; Zeinstra, Koelen, Kok, & de Graaf, 2007). Indeed, most children show a natural rejection response to bitterness and sourness (Mennella & Beauchamp, 1998). Low intake of vegetables during childhood has thus been attributed to their bitter taste (Anliker, Bartoshuk, Ferris, & Hooks, 1991; Bell & Tepper, 2006; Blanchette & Brug, 2005; Forestell & Mennella, 2007; Gibson, Wardle, & Watts, 1998). However, it is possible that early experiences with edibles, including vegetables, may induce and modify the establishment of stable food preference patterns and nutritional habits (Birch, 1999; Gibson et al., 1998; Menella & Beauchamp, 2002; Mennella, Kennedy, & Beauchamp, 2006; Skinner, Carruth, Wendy, & Ziegler, 2002). Thus, the discovery of strategies that can increase young children's vegetable intake is essential for reinforcing healthy eating behavior.

Research on nutrition has identified that choice is a key factor in determining food acceptability (Meiselman, 2002). Similarly, it has been shown that allowing choice results in higher hedonic ratings when subjects have to make food evaluations (De Graaf, Cardello, Kramer, Lesher, Meiselman, & Schutz, 2005; King, Meiselman, & Henriques, 2008; King, Meiselman, Hottenstein, Work, & Cronk, 2007; King, Weber, Meiselman, & Lv, 2004). With regard to pediatric nutrition, the effectiveness of offering choice to children, together with other strategies, in increasing their food preferences and food intake has been explored in several studies. In one study (Hendy, 1999), teachers offered choice to young children (mean age = 4 and 5 years) twice during the meal at school in the context of a three-day long repeated exposure to four new foods. Acceptance of

new foods, measured by analyzing the number of eaten foods, number of meals in which children were present, and number of bites, was higher under choice conditions than in a simple food exposure situation. In subsequent studies choice has been used as part of multi-component programs (Hendy, Williams, & Camise, 2005; Perry et al., 2004) that include extrinsic motivation by adult encouragement or prizes, sensory enrichment by mixing fruits and vegetables of different colors, and having meals with adults. In comparison to control conditions, children subjected to these multi-component programs increased their fruit and vegetable consumption, and these preferences remained enhanced two weeks later.

Finally, the KIK-study1 from the Netherlands (Zeinstra, Renes, Koelen, Kok & De Graaf, 2010) tested, for the first time, the effectiveness of providing choice alone as a strategy to increase vegetable consumption in children between 4 and 6 years old. However, these authors found choice to have no effect on children's vegetable intake and they attributed this result to the novel meal-related setting, since the dinner took place in a restaurant. They suggest that it might be worthwhile to explore the effects of offering choice in more familiar meal settings (Zeinstra et al., 2010).

According to the self determination theory (Deci, 1980), the perception of having a choice increases the sensation of personal control and autonomy and also the intrinsic motivation to carry out an activity (Iyengar & Lepper, 2000; Katz & Assor, 2007; Patall, Cooper, & Robinson, 2008; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). It also improves learning processes and leads to a general state of well-being (Chatzisarantis, Hagger, & Smith, 2007; Iyengar & Lepper, 1999; Patall et al., 2008; Ryan, Patrick, Deci, & Williams, 2008). Thus, if there is intrinsic motivation, there is self-determination (Burón, 2000; Iyengar & Lepper, 1999), and thus personal autonomy (Deci, Eghari, Patrick, & Leone, 1994). Therefore, providing choice to young children might facilitate an increase in children's vegetable intake because the perception of choice is congruent with the experience of personal autonomy (Hoerr, Utech, & Ruth, 2005; Shepherd et al., 2006), self-determination and an enhanced intrinsic motivation (Iyengar & Lepper, 1999; Ryan & Deci, 2000).

On the other hand, we know that presenting a variety of flavours increases food intake in adults (Hetherington, Foster, Newman, & Norton, 2006; Norton, Anderson, &

Hetherington, 2006) and infants (Gerrish & Mennella, 2001; Mennella, Nicklaus, Jagolino, & Yourshaw, 2008), whilst the absence of variety leads to decreases in the rates of food intake in infants (Gerrish & Mennella, 2001), young children (Birch & Deysher, 1986) and adults (Rolls, Rolls, Rowe, & Sweeny, 1981; Sorensen et al., 2003). This reduction in consumption has been explained in terms of the sensory-specific satiation (SSS) mechanism (Rolls, Rowe, & Rolls, 1982). SSS has been defined as the progressive decline during a meal in liking the flavour and appearance of a specific food. This is thought to be related to the sensory processing of taste cues (Rolls, 1985, 1986).

In order to assess the proposal advanced by Zeinstra et al., 2010, the present study aimed to evaluate the effectiveness of providing either choice between two vegetables simultaneously available in the dish, or the possibility to pre-select one of them, in increasing vegetable consumption during the regular school meal setting. Therefore, the present study was a continuation of the KIK study described above, although there are some procedural differences (see Table 1).

There were two main hypotheses in this study. If sensory-specific satiation plays a role in reducing the intake of vegetables, children having choice availability during the meal will exhibit a higher consumption than those having only one vegetable available (forced or chosen previously). On the other hand, if, according to the self-determination theory the provision of choice is the critical factor, children provided choice (previously or during the meal) will show higher consumption than those not allowed to choose. No differences between choice conditions are expected**.**

2. Methods

The present study was approved by the Research Ethics Committee of the University of Granada. This study was developed at the schools during the children's main meal (lunch) under real life conditions. A total of one hundred and fifty-two healthy schoolaged children (between 4 and 6 years old) belonging to two consecutive academic courses of four public primary schools (Granada Educa Foundation. Granada. Spain) and their parents took part in the study. They were assigned to one of three groups: Discrete choice condition (DDC; n = 50) including choice at the beginning of the meal, continuous discrete choice plus variety condition (CDCP; n = 56), having two vegetables available

during the meal and a no-choice condition (NCC; n = 44) receiving only one vegetable. The term discrete refers to the fact that the options (one of two vegetables) are finite and mutually exclusive and it is commonly used in market studies, in which human choice behavior is examined (Train & Winston, 2007). In DDC there is only one choice before the meal while CDCP implies a choice whenever the children made a bite. Thus, children belonging to CDCP were given the opportunity to make a choice between two vegetables with high frequency and they could enjoy a variety of vegetables during the whole meal.

2.1. Procedures

The present study was conducted over a period of two weeks and included two phases. During the first phase an evaluation of children's preference for six different vegetables was carried out. During the second phase children were exposed to cooked vegetables – zuchini and/or green beans according to the experimental group- in a single session and their intake was recorded.

2.1.1. Evaluation of children's preference for vegetables

Two target vegetables were selected based on participants' individual preferences assessed among six vegetables (chard, spinach, zucchini, green beans, cauliflower and peas). The six vegetables were selected based on published reports on young children's frequency of vegetable consumption in Spain (Serra & Aranceta, 2002). In addition the information provided by parents and cooks was used, since it has been shown that a low food-related familiarity decreases food intake (Wardle & Cooke, 2008). We also took into account the color of the vegetables because it has been shown that food colors influence flavour perception, food choice and food acceptability in humans (Clydesdale, 1993; Clydesdale, Gover, & Fugardi, 1992). In the specific case of fruit and vegetables, color has been shown to be one of the sensory properties influencing children's preference (Burchett, 2003). Therefore, we selected vegetables with the same type of colors, specifically cold-color vegetables.

In order to assess children preferences a category-related ordered preference task was applied according to Birch's methodology (Birch, 1979). The ordered ranking of preference for vegetables was built showing the six vegetable pictures to each child in

random order one by one. A total of ninety-one children were evaluated according to the following procedure.

First, each child was asked to classify each vegetable into one of three hedonic categories represented by three smiley faces or emoticons (see Table 2). These categories corresponded to ‘‘I like it’’, ‘‘I neither like it or dislike it’’, and ‘‘I do not like it’’.

Researchers had explained to the children that faces did not only represent emotions such as happiness or anger, but also liking and disliking, and each child had only to point at the picture of the specific emoticon which corresponded to his liking-related feeling for the specific vegetable shown in each picture.

Second, the children were asked to order vegetables in each category ranging from the most to the least preferred vegetable. This method has been shown to satisfactorily discriminate the level of preference for several food stimuli in young children, because it forces them to consider each food differently in comparison to the others (Birch, 1979). Once the preference for vegetables was measured for each participant, numbers 3 and 4 (zucchini and green beans) of the preference rank order were selected on the basis of the moral values. They were used as targets because we aimed to include two vegetables that were approximately similarly liked and reasonably accepted by the children, in order to avoid ceiling and floor effects.

2.1.2. Assessment of vegetable intake

Several issues were taken into account regarding the meal setting and protocol. First, the assessment of vegetable intake was performed in the same environment where children had lunch every day, this procedure being constant across the three conditions. Thus, children consumed the vegetables in their own classrooms as they usually do. It has been reported that a novel meal-related environment decreases young children’s intake of even familiar foods (Birch, McPhee, Steinberg, & Sullivan, 1990; Zeinstra et al., 2010). Second, the influence of peers (Birch, 1980; Romero, Epstein, & Salvy, 2009) and teachers (Birch, Zimmerman, & Hind, 1980) was controlled by keeping the children belonging to each condition in different classrooms and instructing the adults present during the meal to refrain from showing any signs of approval or

disapproval. One teacher, an attendant teacher, and two researchers were present during the whole meal.

A total of ninety-one children participated in this session. The target vegetables (zucchini and/or green beans) were served alone as the first dish in order to avoid confounding effects of flavours which would be provided by other foods served in the same dish. They were cooked, since this is the typical local way to prepare the selected vegetables.

The vegetable samples were weighed and placed in plain hard plastic plates in a trolley. In all conditions, the vegetable samples were served in a portion with a mean weight of 149 g, without any other food. This aimed to ensure that children paid attention only to the target vegetables, and therefore, ate only vegetables without any additional confounding flavour. Vegetables were boiled and dressed with salt and olive oil. This is a novel form of presenting cooked vegetables, since the participants were accustomed to eating them accompanied by meat or potatoes as the second course of the meal.

Children were instructed by the researchers to approach the trolley, one by one, and to take their plate of vegetables served by the researchers. They were told to eat as much as they wanted, without it being necessary to eat the whole portion. They were also allowed to repeat as many portions as they wanted. Depending on the condition, children were given a different instruction. Those belonging to the NCC group were told the following sentence ‘‘Today, we have zucchini/green beans for lunch’’. Those assigned to the DCC group were told: ‘‘Today, we have zucchini or green beans for lunch; you can choose the vegetable you want to eat’’. Finally, the instructions received by the CDCP groups were ‘‘Today we have zucchini and green beans for lunch; you will receive both vegetables on your plate; you can choose what you want to eat’’. The type of vegetable served in the NCC group was counterbalanced between different classrooms, i.e., only one vegetable was available to all the children belonging to the same classroom.

After finishing their vegetable intake, the children returned their plates to the researchers, who weighed the plates again, in order to record the amount of vegetables consumed in grams. 3.

3. Data análisis

Two subjects were eliminated from the analysis because they were vegetarians. A one-factor ANOVA with total consumed as the dependent variable and condition x school x age x gender as fixed factors was carried out and HSD Tukey applied as a post hoc test.

4. Results

A significant effect of condition x children's total vegetable intake, without any additional interaction effects (condition x school x age x gender) was found. Specifically, vegetable intake differed significantly between the NCC and the DCC as well as between the NCC and the CDCP. Statistical confirmation of these results was obtained from the one-factor ANOVA and post hoc analyses [$F(2,149)=5.19$, $p < 0.05$] (Fig. 1). There were no differences between the DCC and the CDCP groups.

5. Discussion

Irrespective of their age and gender, our data show that children's intake of vegetables was significantly higher when children could choose the target vegetable (DCC and CDCP) than when they had no choice (NCC). There were non-significant differences between the amount eaten by groups CDCP and DCC. Thus, it appeared that the presence of vegetable variety and a high frequency of choice during the meal did not increase consumption with respect to the group having chosen at the beginning of the meal.

To our knowledge, the present study shows for the first time that the provision of choice to young children as a single strategy increases their vegetable consumption. This significant effect of choice on children's vegetable intake is in agreement with earlier research showing the increasing impact of choice on childhood food preference and

food consumption (Hendy, 1999; Hendy et al., 2005; Perry et al., 2004). The enhancing effect of choice on human behavior has also been demonstrated with adults in several contexts such as food acceptability (King et al., 2004, 2007; Weber, King & Meiselma, 2004), purchasing (Szrek & Baron, 2007) and physical activity (Chatzisarantis et al., 2007), yielding an increased rate in relation to the behavior under study.

There are several explanations of the intake enhancing effect of providing choice to participants. One account might be related to an increase in the children´ s motivation to eat vegetables. Indeed, it has been observed that having choice increases the sense of personal control over the activity, and thus the intrinsic motivation for persisting at any activity (Burón, 2000; Deci, 1980; Iyengar & Lepper, 1999). Consequently, children assigned to the DCC and to the CDCP might have persisted in the activity of eating vegetables due to a potential choice-driven increased motivation that facilitated them to persist at that activity. Moreover, our experimental design gave children the opportunity to choose the specific vegetable to consume and thus to increase their personal autonomy regarding their choice of food to be eaten for lunch.

Another possible explanation is that children in the DCC and the CDCP groups might have liked the served vegetables more than the rest of the participants, since earlier research has shown that the possibility to choose personally the food is a determining factor in food liking, leading to higher hedonic ratings within experimental contexts of food evaluations (De Graaf et al., 2005; King et al., 2004, 2007, 2008; Meiselman, 2002).

Finally, it is also possible that children in the DCC and the CDCP conditions had attended more to the stimuli for making their choice, in comparison to children in the NCC condition. This increased attention to the food stimuli might then have resulted in an increase tendency to accept the vegetables. In this regard, Prescott (2005) demonstrated a direct link between an increase in attention to the stimuli under choice conditions and higher rates of food acceptance.

To conclude, the choice of vegetables is likely to have helped to induce an enhanced level of intrinsic motivation. In particular, it can be proposed that the explicit provision of choice to young children in our study had an enhancing effect on their motivation to eat vegetables and their liking for them, since the provision of choice afforded them a

higher degree of personal control over the situation, and also caused them to attend more to the stimuli.

In relation to the role of specific sensory satiation, our data indicated no difference in vegetable intake between the DCC and the CDCP groups. These results are not consistent with previous findings. Previous research indicates that the presentation of a variety of food stimuli, including vegetables, usually leads to an increased food intake during the meal due to the interruption of SSS in children (Adams, Pelletier, Zive, & Sallis, 2005; Mennella et al., 2008) as well as adults (Brondel et al., 2009).; Hetherington et al., 2006; Rolls et al., 1982a This satiation has been suggested to be specific to the sensory characteristics of the food, and not of the satiety linked to postingestive consequences (Hetherington, Rolls, & Burley, 1989; Rolls et al., 1982a). In particular, the provision of variety has been shown to have an enhancing effect on vegetable consumption in infants (Mennella et al., 2008) and elementary school children (Adams et al., 2005). Accordingly we hypothesized that the CDCP group would consume more vegetables than the DCC group, because children of the former group could choose the vegetable to eat as many times as they made a bite during the whole meal, that is, with higher frequency than DCC. However, the results show that using the present procedure the children's choice frequency itself had no effect on children's vegetable intake and that the fact that children can choose the vegetable to eat was a sufficient condition for increasing their vegetable intake.

Potential reasons for this apparent discrepancy might concern the number of vegetables served to the CDCP group as well as the method of presentation. First, only two vegetables – zucchini and green beans- were offered, and this level of variety in CDCP was probably not enough to interrupt SSS. In fact, previous findings have suggested that the simultaneous presentation of a variety of foods, three at least, leads to an increased intake, thus interrupting SSS (Pliner, Polivy, Herman, & Zakalusn, 1980). Adams et al. (2005) obtained a difference in vegetable consumption in elementaryaged children that was explained by the number of vegetables offered to participants (seven vs. four). Therefore, it is probable that a higher number of vegetables are required in order to obtain a variety effect on children's vegetable intake. It is conceivable that a vegetable multiple-choice condition could have induced further intake increase than the

present two-choice condition. Second the successive presentation of a variety of foods, two at least, has been shown to increase food consumption (Rolls et al., 1981) whilst our vegetable variety presentation was simultaneous.

In general, although our results support no effect of variety on children's vegetable consumption, a potential role of the number of vegetables offered and the kind of vegetable presentation – simultaneous vs. successive vegetable presentation cannot be discarded.

In addition, some limitations of the present study should be considered. First, our data are transversal, so no firm conclusions can be drawn in relation to the effect of choice on children's vegetable intake in the long term. Follow-up studies aimed at examining the maintenance of the choice effect across weeks, months or even years are needed. Second, we did not assess either the participants' intrinsic motivation during the meal such as liking and preference for the target vegetables after the meal, or of participant's attentional focus while they were making their vegetable choice.

It is also important to take into account potential cultural differences regarding children's level of intrinsic motivation in carrying out an activity when choice is provided to them (Iyengar & Lepper, 1999). Indeed, these authors demonstrated that Anglo American children, coming from a non-culturally interdependent background, showed more intrinsic motivation for carrying out word puzzles if they could personally choose the category of anagrams that they had to work on. In contrast, Asian American children, whose background is interdependent, showed the opposite motivational pattern; they were more intrinsically motivated if the category of anagrams were chosen by others. Thus, the effectiveness of offering choice to children in increasing their persistence at any activity is probably culturally-dependent. Given the fact that to our knowledge there are no previous data on this issue regarding the Spanish culture, our results might indicate that the Spanish children show more intrinsic motivation as long as they can choose. This would be more similar to Anglo American than to Asian American children. We therefore suggest that one line of future research could focus on cross-cultural factors affecting choice in childhood vegetable intake.

In summary, the present data indicate, for the first time, that providing choice explicitly to young children without any other additional strategy may increase their vegetable intake.

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FIGURES

Table 1

Main differences between the KIK study and the Granada study. The changes introduced into the present replication were aimed to adapt the children's meal to more closely match the characteristics of a Spanish meal, and to avoid disturbances in children's school rhythm and everyday life.

Experimental setting	KIK study	The present study
Meal place	Restaurant	Children's classrooms
Meal time	Dinner	Lunch
Vegetable presentation	Familar	Non familiar
Parental presence	Yes	No

Table 2

Three-category facial hedonic scale based on our ad hoc made pictures of emoticons.

Liking category	Emoticon
"I like it"	
"I neither like it or dislike it"	
"I do not like it"	

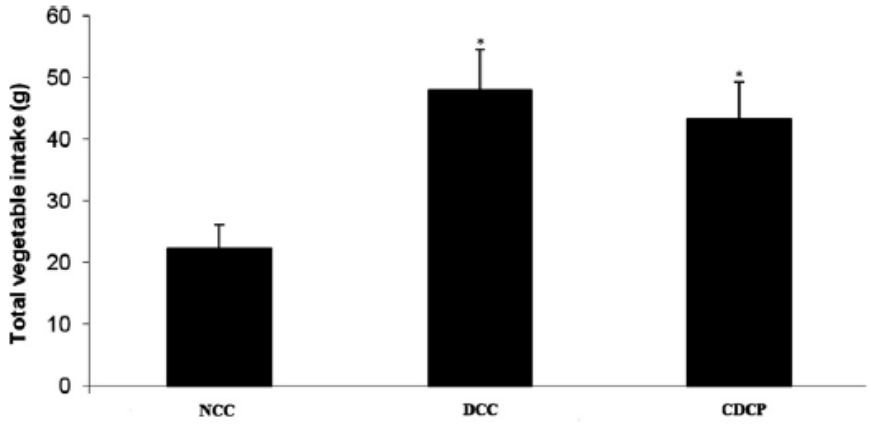

Fig. 1. Means and standard error means of total vegetable consumption, including one or two vegetables, depending on the condition ($p<0.05$).