



Research report

Influence of choice on vegetable intake in children: an in-home study [☆]Victoire W.T. de Wild ^{a,*}, Cees de Graaf ^a, Hendriek C. Boshuizen ^{a,b}, Gerry Jager ^a^a Division of Human Nutrition, Wageningen University, Wageningen, The Netherlands^b Department of Statistics and Mathematical Modelling, National Institute of Public Health and the Environment, Bilthoven, The Netherlands

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ABSTRACT

Children's vegetable consumption is still far below that recommended, and stimulating their intake is a challenge for caregivers. The objective of this study was to investigate whether choice-offering is an effective strategy to increase children's vegetable intake in an in-home situation. Seventy children (mean age 3.7; SD 1) randomly assigned to a choice or a no-choice condition, were exposed 12 times to six familiar target vegetables at home during dinner. In the choice group, two selected vegetables were offered each time, whereas the no-choice group only received one vegetable. Vegetable intake was measured by weighing children's plates before and after dinner. A mixed linear model with age, gender, and baseline vegetable liking as covariates was used to compare intake between the choice and the no-choice group. Mixed linear model analysis yielded estimated means for vegetable intake of 48.5 g $\pm$ 30 in the no-choice group and 57.7 g $\pm$ 31 for the choice group ($P = 0.09$). In addition, baseline vegetable liking ($P < 0.001$) and age ($P = 0.06$) predicted vegetable intake to be higher when the child liked vegetables better and with older age. These findings suggest that choice-offering has some, but hardly robust, effect on increasing vegetable intake in children. Other factors such as age and liking of vegetables also mediate the effect of offering a choice.

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Introduction

Poor vegetable intake in children is a persistent problem, despite increased awareness of the health importance of vegetable consumption (Piqueras et al., 2014; Stanton, 2006; Van Duyn & Pivonka, 2000; Vereecken, De Henauw, & Maes, 2005). Parents and caregivers often struggle with putting theory into practice in order to ensure that their children meet the recommended amounts of vegetable intake through meals at home (Dennison, Rockwell, & Baker, 1998; Hulshof & Ter Doest, 2006; Ocké et al., 2008; Yngve et al., 2005). There is a need for strategies that have proven effectiveness and are relatively easy to implement at home by caregivers themselves. One

such strategy might be choice-offering. Increasing a person's options and choices has been shown to strengthen people's intrinsic motivation to actually implement lifestyle behaviours, healthy eating behaviour, and physical exercise (Chiang & Padilla, 2012; Hendy, 1999; Hendy et al., 2007). This holds true for children as well, as illustrated by an observational study where mothers indicated that it is important for 3- and 4-year-old children to have some freedom of choice over personal issues, like which clothes to wear or which game to play, in order to develop a sense of autonomy and individuality (Nucci & Weber, 1995). Evidence for the effect of choice-offering on children's vegetable consumption is mixed. Hendy (1999) found that choice-offering together with rewarding the child and insisting on trying one bite were the most effective strategies to accept new fruits and vegetables in preschool children. However, actual intake was not measured in this study (Hendy, 1999). Zeinstra and colleagues studied whether offering a pre-meal choice would affect children's vegetable liking, intake and motivation to eat familiar vegetables, but found no effect (Zeinstra, Renes, Koelen, Kok, & de Graaf, 2010). Here, ambience characteristics (children were invited to have dinner with one parent in a restaurant and were excited about this) may have overruled the impact of the experimental manipulation (choice/no-choice). A recent study from Rohlf's Domínguez et al. (2013) used a modified version of the study design from Zeinstra et al. (2010), now with unfamiliar vegetables and carried out in a school canteen. They reported a positive effect of

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* Corresponding author.

E-mail address: Victoire.dewild@wur.nl (V.W.T. de Wild).

Table 1
Experimental design showing exposure-schedule of one participant during the study for the no choice and the choice-group. As target vegetables the children received broccoli (bro), carrots (Crt), peas (Pea), cauliflower (Cfl), French beans (FB), and string beans (SB) twice per week at home. Peas (Pea) and String Beans (SB) were offered an equal number of times (i.e. two times) in the choice and the no-choice group.

Group	Day 1	Day 2	Day3	Day4	Day 5	Day 6	Day7	Day 8	Day9	Day 10	Day 11	Day12
No choice	Bro	Crt	SB	Cfl	FB	Pea	Crt	FB	Cfl	Bro	Pea	SB
Choice	Bro/SB	Crt/Cfl	FB/Cfl	Crt/Cfl	Cfl/FB	Pea/Crt	Bro/FB	Bro/Crt	SB/Bro	Bro/Cfl	FB/Pea	FB/Crt

choice-offering on children’s vegetable intake (Rohlf s Domínguez et al., 2013). Hence, choice-offering has potential, but several factors seem to differentially affect its effectiveness. For example, it matters whether novel or familiar vegetables are involved (Hendy, 1999; Rohlf s Domínguez et al., 2013; Zeinstra et al., 2010). In addition, consumption context seems to play a role (e.g. day care, school, dining out) (Aldridge, Dovey, & Halford, 2009; Herman, Roth, & Polivy, 2003; Vaughn, Tabak, Bryant, & Ward, 2013). The objective of the present study was to investigate whether choice-offering is effective in promoting young children’s vegetable intake of familiar vegetables when applied by caregivers in an in-home situation.

Materials and methods

Participants

Seventy-five children, aged 2–5 years, recruited from 3 day-care centres in Wageningen, The Netherlands, started the intervention. Parents with children in the targeted age range received an information letter and an invitation to register their child(ren) for participation via the day-cares. Participation was voluntary and parents and day care-centres were thoroughly informed about the study. Due to drop out (e.g. relocation), the reported data are based on a sample of 70 children (see Table 2, results section). Parents signed an informed consent for their child’s participation. Participants were screened for food allergies and health problems (as reported by the parents). The study protocol was approved by the Institutional Review Board of Wageningen University and registered at the Dutch Trial Registration (NTR, TC = 3757). Sample size calculation was based on the mean vegetable consumption of Dutch toddlers (=34 g) and an expected increase of one tablespoon of cooked vegetables eaten extra in the choice group (one tablespoon = 17 g = ½ SD) (Ocké et al., 2008). To detect a significant difference between groups, with alpha set at 0.05 and a power of 0.80, at least 25 children were needed per group.

Experimental design

Participants were randomly assigned to either a ‘no-choice’ or a ‘choice’ group using a two-block design (no-choice/choice), stratified for age (two, three and four to five years of age). Each child was exposed 12 times to six familiar target vegetables at home during dinner, which is the traditional hot meal including vegetables in The Netherlands. The no-choice group received only one type of vegetable per dinner session, whereas the choice group received two types of vegetables from which to choose, or they could choose to eat both vegetables during the meal. Table 1 gives an example of the total exposure schedule for one participant in each group. The vegetables were served according to a semi-randomized schedule with the restriction that participants in the no-choice group did not receive the same vegetables on two successive days. Although the same six target vegetables were offered in both groups, participants in the choice-group were exposed to a larger variety (i.e. larger number of repeated exposures) of vegetables compared to the no-choice group, as a consequence of the design. To be able to check for a potential effect of variety in addition to choice on vegetable intake, two of the six target vegetables, i.e. peas and string beans,

were offered an equal number of times (i.e. twice) during the whole intervention period in both groups (see Table 1).

Procedures

Procedures were explained to the parents in an explanatory session and to accustom the families to these procedures, the week prior to the intervention was used to practice. Families received one vegetable parcel including the vegetables for two meals, cooking instructions, a food diary, and a standardized weighing scale with a precision of 1 g (Soehnle, FIESTA, Nassau, Germany). Cooking instructions involved how to prepare the vegetables, the duration of cooking time, and to use no other vegetable(s) other than the provided ones. After dinner parents had to fill out the food diary by providing the following information: any deviation from the prescribed instructions; start and end time of the dinner; the consumed vegetables and other meal components (e.g. meat/fish, pasta/potatoes); the weight of the vegetables served to the child before and after the meal; the child’s liking of the vegetables (parent’s perception); and whether the child had physical complaints that day that might have affected appetite.

Study foods

Six target vegetables were offered in both groups: peas, carrots, broccoli, French beans, cauliflower, and string beans. Selection of the target vegetables was based on the following criteria: (i) most commonly eaten vegetables by 2- to 5-year-old Dutch children; (ii) vegetables fitting into a typical Dutch dinner (Ocké et al., 2008). The packages contained the recommended daily intake (RDA) of vegetables (raw, fresh and pre-cut) for the whole family for two dinner sessions per week (see Table 2), to ensure that every member of the family could comply with the RDA. However, parents were instructed to serve their children as much as they liked to eat or as much as they were used to eat, to minimize interference with their normal habits/schedule. As a consequence a child could eat more than the RDA of its age group.

Measures

The main outcome of the study was the children’s intake (in gram) of the vegetables. Vegetable intake was measured by weighing their plates before and after dinner (left overs). Data collected

Table 2
Amount in grams of vegetables offered per person by group based on RDA.

	No choice	Choice ^a	
	Target vegetable	Target vegetable 1	Target vegetable 2
Adult	200	150	150
Child > 4 years	150	112.5	112.5
Child < 4 years	100	75	75

^a In the choice group, where two vegetables were served per meal, each family member received ¾ of the RDA per vegetable. Thus, total portions of vegetables were 1.5 times the total portions in the no-choice condition. This was done to make sure that portion sizes per vegetable were still sufficient if children choose to eat only one out of the two offered vegetables.

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