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## My idol eats carrots, so do I? The delayed effect of a classroom-based intervention on 4–6-year-old children's intake of a familiar vegetable

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### ABSTRACT

This study aimed to investigate the effect of a role modelling intervention on children's intake of a familiar vegetable. Ninety nine 4–6-year-old children participated at school in a between-subject experiment with three conditions. Two popular Dutch TV idols acted as enthusiastic role models in a video film that was specifically designed for this study. In the convivial eating (CE) condition, children ate raw carrots while they watched the role modelling video for eight sessions (2x/week). Children in the positive restriction and convivial eating (PR + CE) condition were – prior to eight convivial eating sessions – involved in five sessions where they watched the video without eating carrots themselves. The control group ate carrots twice only, and never watched the role modelling video. The main outcome was vegetable intake. Information on demographics and child eating characteristics was collected via a parental questionnaire. A longer-term follow-up was executed at nine months (N = 93). Children's average carrot intake was  $22 \pm 24$  g per intervention session. There was no increased intake directly after the intervention, but carrot intake in both intervention groups (CE: 45 g; PR + CE: 52 g) was 20–30 g higher at nine months ( $p < 0.01$ ), whereas intake remained stable for the control group ( $p = 0.31$ ). About 40% of all children consistently ate (almost) no carrots; higher fussiness and neophobia, and lower vegetable liking typified these non-eaters. So, although the intervention did not immediately increase children's vegetable intake, it was associated with a higher intake at follow-up. The high numbers of non-eaters points to the need for tailored interventions that encourage non-eaters to consume relatively familiar – but previously rejected – vegetables.

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### 1. Introduction

A diet high in fruit and vegetables is associated with a reduced risk of cardiovascular disease, diabetes, and certain types of cancer (Dauchet, Amouyel, Hercberg, & Dallongeville, 2006; Key et al., 2004; WHO, 2003). However, many children fail to achieve the recommended levels of vegetable intake in many countries (Geller & Dziewaltowski, 2009; Ocke et al., 2008; Yngve et al., 2005). In The Netherlands, 4–6-year-old children consume on average 44 g of vegetables per day (Ocke et al., 2008), whereas 100–150 g is recommended for this age group. Therefore, developing strategies that enable children to increase their vegetable intake is an important goal for chronic disease prevention.

It is particularly challenging to increase children's vegetable intake (Zeinstra, Koelen, Kok, & de Graaf, 2009). Various intervention programs show significant increases for children's fruit intake, but only minor to no changes for vegetable intake (Blanchette & Brug, 2005; Evans, Christian, Cleghorn, Greenwood, & Cade, 2012). Children's low liking for vegetables (Nicklaus, Boggio, Chabanet, & Issanchou, 2004; Skinner, Carruth, Wendy, & Ziegler, 2002) – due to for example the bitter taste of some vegetables, their low energy content and their texture or appearance – may explain why it is difficult to increase children's vegetable intake.

One strategy that proves to be effective for increasing infants' and young children's intake of novel or relatively disliked vegetables is repeated exposure (Caton et al., 2012; Hausner, Olsen, & Møller, 2012; Maier, Chabanet, Schaal, Issanchou, & Leathwood, 2007; Remy, Issanchou, Chabanet, & Nicklaus, 2013; Wardle et al., 2003). Nevertheless, this strategy is not always sufficient (O'Connell, Henderson, Luedicke, & Schwartz, 2012; Osborne & Forestell, 2012). Furthermore, as children become older, more foods are familiar to them. Based on experiences with these foods,

Abbreviations: CE, convivial eating; PR, positive restriction; S, session; NA, not applicable.

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cognitive schemas – i.e. a set of linked mental representations to understand the world – have been formed (Aldridge, Dovey, & Halford, 2009; Zeinstra, Koelen, Kok, & de Graaf, 2007). Children will or will not accept these foods based on these schemas and experiences. Bearing in mind the low consumption levels, it is of crucial importance to also encourage intake of familiar vegetables.

Modelling or imitation is another important strategy for the development of children's eating habits: children learn by observing the eating behaviour of others. Various cross-sectional studies have shown a positive association between role modelling behaviour and children's fruit and vegetable intake (Bere & Klepp, 2004; Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008; Cullen et al., 2001). In experimental studies, role modelling has been mainly applied to encourage children to taste novel foods (Addressi, Galloway, Visalberghi, & Birch, 2005; Greenhalgh et al., 2009; Harper & Sanders, 1975; Hendy, 1999, 2002; Hendy & Raudenbush, 2000; Jansen & Tenney, 2001). To our knowledge, fewer role modelling studies have been executed for familiar foods and only one study applied role modelling to eating vegetables in particular. This study showed that preference, choice and intake of previously less liked vegetables increased in 2–4-year-old children when they ate lunch together with peers who had a high preference for the target vegetable (Birch, 1980). Whether role modelling for vegetables also works for somewhat older children in a classroom setting remains unclear.

Restriction is another strategy that influences children's food choice behaviour. This strategy may lead to a higher interest in the restricted food, and children may consume more of it as soon as the restricted food becomes available to them (Fisher & Birch, 1999a, 1999b; Jansen, Mulkens, & Jansen, 2007). The majority of these studies have focused on the restriction of unhealthy foods such as candies or chocolate. There is one study suggesting that the restriction effect can also occur for healthy foods. After a 5-min restriction period, 5–7-year-old children increased their intake of the restricted fruits banana and pineapple (Jansen, Mulkens, Emond, & Jansen, 2008). It is not known whether this restriction paradigm is also effective for vegetables, or how long this effect will last.

This paper describes the results of a classroom-based intervention that combines the strategies of restriction, role modelling and repeated exposure. The objective was to investigate the effect of TV idol role modelling in combination with repeated exposure on children's intake of a familiar vegetable, and to study whether a period of restriction would enhance this effect. The study was executed in a classroom setting and tailored as much as possible to the habitual school routines in order to facilitate future implementation of such an intervention in schools. We hypothesized that role modelling in combination with repeated exposure would increase children's vegetable intake and that a prior period of restriction would strengthen this effect. Since Caton et al. (2014) observed large individual differences in children's responsiveness to a vegetable intervention, the data were also explored at an individual level.

## 2. Material & methods

### 2.1. Study design

This study had a between-subject design with three conditions: a convivial eating condition (=CE), a positive restriction and convivial eating condition (=PR + CE), and a control condition (see Fig. 1). Children in the CE condition participated in eight convivial eating sessions (S1–S8), where the children ate raw carrots while watching a role modelling video film. The video showed two Dutch child idols who are very enthusiastic about carrots; the same video was shown each time. Children in the PR + CE condition were first

exposed to five sessions of positive restriction, in which the children watched the role modelling video film while they did not receive carrots themselves. After this PR period, the PR + CE children participated also in eight convivial eating sessions: eating raw carrots while watching the role modelling video. A control group was included to assess any changes in time due to environmental influences or age effects. The control group ate raw carrots twice without watching the role modelling video. Choice tests with four different vegetables were included to measure whether carrots were more frequently chosen over three other vegetables after the positive restriction and/or after the convivial eating period. Vegetable intake was the main outcome. The study protocol was approved by the Medical Ethical Committee of Wageningen University.

### 2.2. Participants

Children aged 4–6 years were recruited via a primary school in the city of Arnhem, The Netherlands. Healthy children without any allergies for the foods used in the study were allowed to participate. A sample size calculation aiming for a clinically relevant increase in children's vegetable consumption ( $\Delta = 25 \text{ g} \sim 1/3$  of a portion) indicated that 33 children per condition were sufficient with a power of 0.8,  $p < 0.05$  and SD of 36 (Ocke et al., 2008). The eligible school expected five school classes with each 20–25 children during the study period. Since individual randomisation is not possible in a classroom-based study, two school classes were assigned to the CE condition, two to the PR + CE condition and one class to the control condition. Assignment was random on condition that school classes that could see each other physically (through large windows between class rooms) were in the same experimental condition. A smaller control group at the same school was preferred above including an additional control class from another school, as this gives rise to between-school variation (e.g. school policy, daily (eating) routines and socio-economic background).

All parents received an information booklet to inform them about the aim and the study procedures. Hundred and two parents out of 112 (91%) signed the informed consent.

### 2.3. Selection of target vegetables

Raw carrot was chosen as the target vegetable as it is familiar to most Dutch children (Ocke et al., 2008), and a raw vegetable would fit easily into the Dutch school routine. A previous questionnaire from another Dutch HabEat study (Zeinstra & Kremer, in preparation) among parents of a similar age group showed that raw carrot was on average perceived as neutral to medium liked, but with quite some variation between children. For the choice tests (see Section 2.5.1 for details), three other raw vegetables were selected with relatively similar familiarity: cucumber, tomato, and red bell pepper. All vegetables were presented in small pieces and supplied by a local greengrocer.

### 2.4. Role modelling video film

A video film was created specifically for this study with the help of two Dutch children's TV idols (adults), called Ernst and Bobbie (<http://www.ernstbobbie.nl/>). In the 4-min video, they are enthusiastic about vegetables in general, and about carrots in particular. While they eat carrots enthusiastically, the story illustrates that carrots will make you strong and superfast. The film includes a catchy song about vegetables. Because children may associate healthy with distaste (Wardle & Huon, 2000), no explicit emphasis was given to the healthfulness of vegetables. The same video was

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