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Implementation of four strategies in Dutch day-care centres to stimulate young children's fruit and vegetable consumption

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ABSTRACT

The day-care setting is an ideal place to encourage children's fruit and vegetable (=F&V) eating. Whereas many studies have focused on the effectiveness to increase F&V consumption, little is known about how to successfully implement effective strategies in daily practice. This study aimed to investigate how day-care professionals evaluated the implementation of a self-chosen strategy to support children's F&V eating. Thirteen day-care locations chose one out of five promising strategies and implemented this strategy for 10–12 weeks. Before (N = 98) and after the study (N = 49), day-care professionals completed a questionnaire to assess their implementation experiences, the impact on children's F&V eating as well as their future intention to use the strategy (on a 5-point scale). Parents (N = 152) completed a short questionnaire at the end of the study to capture their experiences and potential transfer effects to the home situation. Results showed that acceptability, appropriateness, feasibility and sustainability of the strategies were generally satisfactory (scores ≥3.5 on a 5-point scale), but the strategy of cooking scored less favourable on appropriateness and sustained implementation. Children's willingness to taste F&V varieties (3.4 ± 0.7 vs. 2.8 ± 0.8; $p < 0.001$) and eating pleasure for vegetables (3.4 ± 0.6 vs. 3.1 ± 0.8; $p = 0.01$) increased, whereas children's F&V consumption did not change ($p > 0.14$). Parents valued the day-cares' efforts to encourage children's F&V consumption and a small group (~20%) experienced positive effects at home. This study shows that implementing a self-chosen F&V strategy at the day-care is acceptable, appropriate and feasible for day-care professionals and has potential to positively impact children's F&V eating behaviour. Future research should investigate the effects of long-term implementation on children's eating behaviour and examine how structural implementation can be further supported.

1. Background

Despite the health benefits, many children do not consume sufficient amounts of fruit and vegetables (Lynch et al., 2014; van der Krieken et al., 2018). In the Netherlands, approximately one third of 1-3-year-old children consume the daily recommended amounts of fruit (>150g) and vegetables (>50g) (Schuurman, Beukers, & van Rossum, 2020). The fact that fruit and vegetables (F&V) are needed for healthy growth and development in children emphasizes the need to increase their consumption (Goldbohm, Rubingh, Lanting, & Joosten, 2016). Moreover, since eating habits are developed early in life and are maintained into adulthood (Craigie, Lake, Kelly, Adamson, & Mathers, 2011; Nicklaus & Remy, 2013), it is important to teach children healthy eating patterns from an early age on.

The day-care setting is an ideal setting for encouraging healthy eating among young children, because of several reasons. Many children go there in their early years and eat a fair part of their daily food consumption at the day care. More than half of all Dutch 2- and 3-year olds spent on average 17 h per week in a day-care setting (Centraal-Bureau-voor-de-Statistiek, 2016). Furthermore, day-care locations offer young children a safe and playful environment to encourage F&V eating (Goldbohm et al., 2016). Peers and day-care professionals can act as role models (Gubbels et al., 2010; Hendy & Raudenbush, 2000). On top of that, day-care employees can educate parents about how to support healthy eating patterns in their children (Goldbohm et al., 2016).

In the Netherlands, children can attend day care when they are

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between 0 and 4 years old. Most Dutch children attend day care 2–3 days per week, usually full days (7:30–18:00) and sporadically half a day. There are no nutritional guidelines set by the government for day-care centres. Common eating moments include a morning snack break, a sandwich lunch, afternoon snack break and a small snack in the late afternoon. Fruit and vegetables are regularly consumed raw as snack (1–2 times per day), and sometimes offered at lunch (e.g. cucumber or tomato on bread). A few day cares offer warm meals at lunch time, with prepared vegetables being part of such a meal. Breakfast and the evening meal is eaten at home (Battjes-Fries & Zeinstra, 2020; Gubbels et al., 2010).

Several strategies have been studied aiming to support F&V acceptance in young children. Such strategies focus on increasing liking as an important determinant of F&V intake, enlarging the number of liked F&V varieties or increasing F&V intake. Convincing and consistent evidence is found for the strategy of repeated exposure, which increases liking and intake of particularly unfamiliar vegetables (Hodder et al., 2019; Holley, Farrow, & Haycraft, 2017; Nekitsing, Blundell-Birtill, Cockroft, & Hetherington, 2018; Zeinstra, Vrijhof, & Kremer, 2018). In addition, using small non-food rewards to encourage children to taste F&V has shown to increase children's willingness to taste unfamiliar vegetables over a longer time (Farrow et al., 2019; Hodder et al., 2019; Holley et al., 2017; Nekitsing et al., 2018). Also peer and role modelling have shown promising effects on children's vegetable acceptance (Carbone et al., 2016; Farrow et al., 2019; Holley et al., 2017; Nekitsing et al., 2018; O'Connell, Henderson, Luedicke, & Schwartz, 2012), although it might have negative effects depending on the type of message the model (unintentionally) tries to convey (Greenhalgh et al., 2009; Gubbels et al., 2010). Furthermore, more frequent offering of F&V, enhanced accessibility and nudging have shown some positive effects on children's F&V intake (DeCosta, Møller, Frøst, & Olsen, 2017; Holley et al., 2017; Nekitsing et al., 2018; Sharps, Thomas, & Blissett, 2020). Hands-on approaches such as cooking and gardening have been studied less than the aforementioned strategies, but they seem to have a positive effect on children's eating behaviour (Anliker, Laus, Samonds, & Beal, 1992; DeCosta et al., 2017; Leuven, Rutenfrans, Dolfing, & Leuven, 2018). Finally, exposure via pictures, books and games might be beneficial for willingness to taste F&V, but effects are inconsistent (Appleton et al., 2016; Coulthard & Sealy, 2017; Folkvord & Laguna-Camacho, 2019; Nicklas, Lopez, Liu, Saab, & Reiher, 2017; Owen, Kennedy, Hill, & Houston-Price, 2018).

Whereas more and more research provides evidence about which strategies can be effective in increasing children's F&V acceptance (DeCosta et al., 2017; Hodder et al., 2019; Holley et al., 2017; Nekitsing et al., 2018), less research is focused on the feasibility of these strategies in the day-care setting and on how day-care professionals evaluate the use of these strategies in practice. It is important to investigate these aspects because an intervention strategy that is effective in increasing children's F&V acceptance, is not automatically a guarantee for successful implementation in daily practice (Proctor et al., 2011). Understanding the process of implementation including the factors that support or hinder successful implementation is crucial, but such evaluations are relatively scarce (Durlak & DuPre, 2008; Matwiejczyk, Mehta, Scott, Tonkin, & Coveney, 2018; Proctor et al., 2011). Previous reviews on the effectiveness of strategies to increase children's F&V acceptance have acknowledged that adoption, widespread implementation and feasibility at a large scale are challenges that need to be addressed in future studies (Hendrie, Lease, Bowen, Baird, & Cox, 2017; Nekitsing et al., 2018).

Taking this together, the aim of this study was to investigate how day-care professionals evaluate the implementation of a self-chosen strategy to support children's F&V acceptance in the day-care setting. Enhanced F&V liking, enlarging the number of liked F&V varieties or increasing F&V intake were all considered positive outcomes that contribute to children's F&V acceptance. The following research questions were defined:

1) How do day-care professionals evaluate the implementation of a self-chosen strategy to support children's F&V acceptance (main research question)?
2) Are there any differences in implementation experiences between the chosen strategies (exploratory)?
3) Do day-care professionals perceive any impact on children's F&V acceptance due to implementing this self-chose strategy?
4) How do parents value the implementation of a F&V strategy at the day care and do they experience any impact at children's F&V eating at home?

It was hypothesized that implementing a self-chosen strategy would be acceptable, appropriate and feasible for the day-care professionals, that they would perceive positive impacts on children's F&V acceptance (difference pre- and post-test) and would have a positive intention regarding sustained implementation. We expected a neutral or positive impact on children's F&V acceptance at home (post-test).

2. Methods

2.1. Selection of five promising strategies

Based on literature, interviews and a survey among day-care professionals (Zeinstra & Battjes-Fries, 2021), a set of five strategies were identified as having potential to improve children's F&V eating, as well as seeming appropriate and feasible for structural implementation in daily practice of day-care settings. In line with Millen, Overcash, Vickers, and Reicks (2019), this meant being relatively simple to execute, at low costs and easy to incorporate in daily day-care practices. The five strategies that were selected for this study, were (1) F&V gardening with the children, (2) cooking or preparing F&V with the children, (3) repeated exposure to unfamiliar F&V varieties, (4) playful learning about F&V via books, songs, games, etc., and (5) offering more F&V (i.e. a larger portion or more frequently).

2.2. Study design

Thirteen day-care locations implemented one strategy aimed at encouraging children's F&V acceptance for 10–12 weeks in the period of March–June 2021. The day cares chose their own strategy out of five promising strategies. A pre- and post-test design was used to evaluate the experiences and effects of implementing this strategy via an online questionnaire that was completed by day-care professionals. Main outcomes were implementation of the strategy assessed by the implementation concepts of the framework of Proctor et al. (2011), perceived effects on children's willingness to eat, eating pleasure and consumption of F&V, as well as professionals' motivation about current and future use of the strategy. Parents completed a short questionnaire at the end of the study to capture their experiences. The day-care professionals as well as the parents were asked to provide written consent to participate in this study at the start of the questionnaire. The study protocol was approved by the Social Ethics Committee of Wageningen University.

2.3. Procedures

The participating day cares (usually the manager, sometimes together with one or a few day-care professionals) attended an online presentation where the researchers explained the study and introduced the five strategies. Subsequently, the day cares received a flyer where the five strategies were explained including practical suggestions for implementation. They were asked to choose – in consultation with the professionals at their location - one of the five strategies to implement for 10–12 weeks, preferably on a daily basis for all children in that day care. The selection of the strategy was based on their own preferences and the current situation of the day care. Together with the researchers, each day-care location made an implementation plan on how the

selected strategy would be practically implemented in the 10-12-week period and which preparations and materials were required. We did not provide a fixed protocol, but asked questions and provided concrete suggestions to make implementation concrete and practical for the professionals to assist them in making their own plans (bottom-up approach). Questions that were discussed, were for example: How often, at which moment and how long would the strategy be implemented? How would it be ensured that all children are involved? Are there any barriers expected and how could these be solved? To facilitate implementation, the day-care locations received a factsheet with an explanation about the strategy including practical tips on how to implement the strategy in practice, a newsletter text to inform parents and a small kit with practical materials relevant to their chosen strategy. To illustrate, locations that chose cooking received a recipe book focused on young children (developed by the Netherlands Nutrition Centre), a 'Kiddikutter' children's knife and ingredients to make a vegetable spread. Locations that chose gardening received vegetable seeds, a turf tray, a cutting tray with soil and a poster to talk about vegetables. No fruit and vegetables were provided to the locations. In addition, the day-care locations received a binder (both digital and on paper) with additional tips, materials (such as recipes or colouring pages) and (website) suggestions for additional supporting materials (such as gardening or cooking tools, books for reading or recipes). During the period of implementation, one observation and/or two phone calls per day care were made to monitor implementation. The observations were done to see how the strategies were implemented in real-life, whereas the phone calls were done to monitor whether implementation was still ongoing, to support the motivation of the professionals when needed, and to check whether they encountered difficulties that required any help.

2.4. Participants

Several national, regional and local day-care organisations were approached by the researchers and those locations willing to participate received further information about the study. The location manager was usually the initial point of contact, and he/she discussed participation with the professionals at their location. There were no specific inclusion and exclusion criteria for the locations to participate in this study except for being willing to implement one of the five strategies for 10–12 weeks and willing to participate in the study measurements. With the recruitment of the day-care locations, variety was looked for in smaller and bigger locations, locations in cities and towns, and locations in lower and higher socioeconomic neighbourhoods. A total of 13 day cares were willing to participate and joined the study. They were spread over eight different towns and cities in the middle part of the Netherlands. At each participating location, all professionals were asked to participate in this study. They were responsible for implementing the strategy at their group (10–12 children) and were involved in the study measurements.

2.5. Measurements

2.5.1. Questionnaire day-care professionals

2.5.1.1. Implementation aspects. The concepts adoption, acceptability, appropriateness, feasibility and sustainability of the implementation framework of Proctor et al. (2011) were included in the current study to assess several implementation aspects. According to this framework, adoption is defined as the initial decision to try or employ a new practice, so the choice of the day care for a particular strategy. Acceptability is defined as the professional's perception on whether implementation of the strategy was agreeable and pleasurable. Appropriateness is the perceived fit, suitability and relevance of the strategy on their location. Feasibility is defined as the extent to which the strategy could be successfully used on their location and sustainability as the extent to which the strategy is maintained or institutionalized in their location. The other aspects of this framework (fidelity, implementation costs and penetration) seemed less relevant for this study and were not taken into account.

In the pre-test questionnaire for the day-care professionals, acceptability and appropriateness were assessed with several questions including motivation to implement the strategy (on a scale ranging from 1 = low to 10 = high), perceived need to support children to eat F&V and attitude, self-efficacy and perceived social norm towards implementation of the strategy. In the post-test questionnaire, several statements were included on acceptability aspects regarding the implementation of the strategy such as ease and enjoyment of implementation, duration, and attitude of colleagues. Appropriateness was operationalized by statements on whether the strategy fitted in the daily routine and way of working. Feasibility was assessed by statements about organizational support concerning time and facilities. All these statements were answered on a 5-point (Likert) scale ranging from 1 = totally disagree or never to 5 = totally agree or (almost) always. Sustainability was assessed via three statements on future use of the strategy in the post-test questionnaire, scored on a 5-point Likert scale (1 = totally disagree; 5 = totally agree) and the question which of the five strategies they were willing to implement or keep implementing in the future. In addition, two questions were asked about dose: the expected frequency of implementation in the pre-test questionnaire (on a 5-point scale ranging from 1 = never to 5 = almost always) and actual frequency of implementation in the post-test questionnaire (on a 5-point scale ranging from 1 = almost never to 5 = most days that I work).

2.5.1.2. Perceived effects of the strategies on children's F&V eating. The pre-test and post-test questionnaire for the day-care professionals included questions about children's F&V consumption on a 7-point scale (ranging from 1 = less than half a piece of fruit per day to 7 = more than 3 pieces per day for fruit; and ranging from 1 = nothing/not offered to 7 = 150 g or more per day for vegetables). Concrete examples were given for one piece of fruit (i.e. 1 apple, 2 mandarins or a handful of grapes) and 50 g of vegetables (4 cherry tomatoes, 5 cm piece of cucumber or half a bell pepper). Furthermore, day-care professionals were asked to estimate children's enjoyment of eating F&V (on a 5-point scale from 1 = very low to 5 = very high, for fruit and vegetables separately) and how many children were willing to taste unfamiliar varieties of F&V (on a 5-point scale from 1 = none to 5=(almost) all children, for fruit and vegetables separately). These three questions were answered as a group average, reflecting a general impression of each day-care professional about the children in their group.

2.5.1.3. Socio-demographic factors of the day-care professionals. Sex, age (in years), function, number of days per week working in the day care, and the name of their day-care location was assessed.

2.5.2. Parental questionnaire

At the end of the study, parents completed a questionnaire to capture their implementation experiences and to assess potential changes at home with regard to F&V eating of their child. Similar concepts as in the questionnaire for day-care professionals were included. With regard to implementation, questions were included about parental attitudes on acceptability and appropriateness, and wishes for the future towards attention and offering F&V in the day care as an aspect of sustainability. These statements were answered on a 5-point Likert scale ranging from 1 = from totally disagree to 5 = totally agree. Furthermore, the parents were asked which strategy they thought had been implemented in the day care of their child. Parents also answered questions on perceived changes at home in their child's interest in F&V, willingness to taste F&V and F&V consumption, via statements with a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree. Finally, sex and age (in years) of their (oldest) child in the day care and number of days their (oldest) child spend at the day care (1–5 days per week) were

assessed.

2.6. Statistical analyses

All statistical analyses were performed using the IBM Statistical Package for the Social Sciences (IBM SPSS, version 26). Children's F&V consumption at the day care (reported as group-average by day-care professionals) was calculated, based on the response options and using 0.25 portion for the answer option less than half a piece of fruit. Descriptive analyses were performed to describe the sociodemographic characteristics, implementation aspects and perceived effects for the day-care professionals and parents separately. Data with 5-point answering scales was normally distributed in general and the scales approach an interval scale (similar distances between answer options). Therefore, means and SD were calculated for these scales, but also the percentages agree (score 4 + 5) and disagree (score 1 + 2) were calculated for interpretation purposes. A mean score of 3.5 on the 5-point scale for the implementation aspects was considered as satisfactory, since this reflects a (slight) positive evaluation (3 = neutral). Categorical data were described as frequencies (%).

Since the day-care professionals filled out the pre-test and post-test anonymously, the day-care professionals' pre-test and post-test questionnaire could not be linked on an individual level. Therefore, differences in the perceived effects on the children's F&V acceptance (similar questions at pre-test and post-test) were tested with Independent Samples T-tests. Potential differences between strategies were explored via One-way ANOVA tests and – because of unequal group sizes – Games-Howell as post-hoc test. Results were interpreted as significant when $p < 0.05$ (two-sided).

3. Results

Of the 13 day-care locations, four chose to implement gardening, another four chose playful learning, three locations chose repeated exposure to unfamiliar varieties, and two locations chose to implement cooking. The strategy of offering more F&V was not chosen, meaning that this strategy was not adopted by any of the day cares. Table 1 shows some concrete details about how the locations implemented each strategy.

3.1. Day-care professionals

3.1.1. Characteristics of the day-care professionals

The pre-intervention questionnaire was completed by 98 day-care professionals (all 13 locations covered) and the post-intervention questionnaire by 49 day-care professionals (all 13 locations covered). They were on average 35 years old, all female and for 3.3 days per week working at the day care (Table 2). Characteristics of the day-care professionals in the pre-intervention questionnaire were not significantly different from those in the post-intervention questionnaire.

Table 1
The chosen strategies by the day-care locations and the way they implemented this strategy.

	Number of times chosen	Practical implementation
Gardening with the children	4x	Inside and/or outside; watch, sow, water, harvest; gardening moment connected to playing outside
Playful learning	4x	Theme fruit and vegetables via games, booklets, songs, crafting, play & imitate a restaurant, learning words
Repeated exposure to unfamiliar fruit & vegetables	3x	Tasting small amounts before the regular fruit and vegetable varieties; tasting & talking about the new varieties
Cooking/preparing fruit & vegetables with the children	2x	Cut, wash, prepare simple cold & warm dishes

Table 2
Characteristics of the day-care professionals: mean ± SD or N (%).

	Pre-intervention (N = 98)	Post-intervention (N = 49)
Age	34.8 ± 11.3 [a]	35.4 ± 11.5
Female	85 (100%) [b]	49 (100%)
Day-care teacher	85 (99%) [b]	49 (98%)
Nr. of days working in the day care	3.3 ± 0.8 [c]	3.4 ± 0.8 [d]
Gardening (4 locations)	32 (33%)	13 (27%)
Repeated exposure (3 locations)	25 (26%)	15 (31%)
Playful learning (4 locations)	25 (25%)	9 (18%)
Cooking (2 locations)	16 (16%)	12 (24%)

[a] N = 79.
[b] N = 85.
[c] N = 82.
[d] N = 48 due to missing data.

3.1.2. Acceptability and appropriateness pre-intervention

Before implementation, the day-care professionals scored their motivation to implement their chosen strategy on average 7.7 ± 1.1 (scale 1–10) and they estimated to implement the strategy on average 'usually' (3.9 ± 0.7), with no significant differences between the four strategies (3.9 ± 0.6 for repeated exposure, 3.8 ± 0.7 for cooking, 3.9 ± 0.7 for gardening and 3.8 ± 0.8 for playful learning; $p = 0.85$). Regarding acceptability and appropriateness, they thought that their location manager, colleagues and parents expected them to encourage the children to eat F&V (Table 3). Half of the day-care professionals (totally) agreed that the children already ate enough fruit (52%), whereas 18% thought the children already ate enough vegetables. Day-care professionals who chose cooking agreed significantly stronger with the statement that children already ate enough fruit (4.0 ± 0.6 vs. 3.1 ± 0.9; $p = 0.01$) and vegetables (3.3 ± 0.8 vs. 2.5 ± 0.9; $p = 0.04$) compared to those who chose playful learning. This was similar for the difference between cooking and gardening for eating enough fruit (4.0 ± 0.6 vs. 3.3 ± 0.9; $p = 0.04$). Furthermore, there was a significant difference between the strategies to what extent the day-care professionals reported to eat fruit together with the children with pleasure ($p = 0.004$). Those of repeated exposure (4.5 ± 0.6), gardening (4.5 ± 0.8) and playful learning (4.4 ± 0.7) gave higher scores than those of cooking (3.7 ± 0.5; with $p = 0.001$, $p = 0.001$ and $p = 0.01$ respectively).

3.1.3. Acceptability, appropriateness, feasibility and sustainability post-intervention

Almost half of the day-care professionals (46%) indicated to have implemented their strategy (almost) every day. The frequency of implementation differed significantly between the strategies ($p = 0.049$). Repeated exposure was most often implemented on a daily basis (50%; 4.5 ± 0.9) and cooking the least (9%; 3.5 ± 0.8, $p = 0.02$).

The results on acceptance, appropriateness, feasibility and sustainability post-intervention are shown in Table 4. Regarding acceptability, 71% of the day-care professionals (totally) agreed that it was enjoyable to implement their strategy and 67% agreed that the strategy was easy to implement. Concerning the duration, the 10–12 week duration of implementation was generally considered to be (a little) too long for all strategies except for gardening, which was generally considered to be (a little) too short (2.7 ± 0.5, $p < 0.001$). To illustrate this further, none of the day-care professionals that implemented gardening perceived this period of 10–12 weeks as (a little) too long (0% scored 4 or 5), whereas 33% of day-care professionals who implemented repeated exposure chose (a little) too long. This was even higher for playful learning (56%) and cooking (58%). On the other side, cooking and playful learning were

Table 3
Acceptability and appropriateness aspects scored by the day-care professionals pre-intervention on a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree: mean ± SD and % (dis)agree for overall sample and mean ± SD per strategy.

	Overall sample (N = 87)			Per strategy				
	Mean ± SD	% Agree	% Disagree	Gardening (N = 29)	Cooking (N = 12)	Repeated Exposure (N = 24)	Playful learning (N = 22)	ANOVA P-value
I eat fruit with the children with pleasure	4.3 ± 0.7	90%	2%	4.5 ± 0.8	**3.7 ± 0.5**	4.5 ± 0.6	4.4 ± 0.7	**0.004**[*1]
I eat vegetables with the children with pleasure	3.9 ± 1.0	69%	7%	4.1 ± 1.1	3.7 ± 1.0	3.9 ± 1.0	3.8 ± 1.0	0.47
The children already eat enough fruit	3.4 ± 0.9	52%	16%	**3.3 ± 0.9**	**4.0 ± 0.6**	3.6 ± 0.9	**3.1 ± 0.9**	**0.03**[*2]
The children already eat enough vegetables	2.8 ± 0.8	18%	37%	2.8 ± 0.8	**3.3 ± 0.8**	2.7 ± 0.6	**2.5 ± 0.9**	**0.03**[*3]
I think our location manager expects me to encourage children to eat fruits and vegetables	4.0 ± 0.8	81%	5%	3.9 ± 0.9	4.2 ± 0.6	3.8 ± 0.9	4.1 ± 0.8	0.48
I think my colleagues expect me to encourage children to eat fruit and vegetables [a]	3.5 ± 0.9	59%	12%	3.4 ± 1.1	3.5 ± 0.9	3.6 ± 0.8	3.6 ± 1.0	0.87
I think most parents expect me to encourage their child to eat fruits and vegetables	3.9 ± 0.7	84%	6%	4.0 ± 0.7	3.9 ± 0.5	3.8 ± 0.8	4.0 ± 0.9	0.78
I have enough knowledge to encourage the children to eat more fruit and vegetables [a]	3.7 ± 0.7	67%	6%	3.7 ± 0.8	3.7 ± 0.5	3.7 ± 0.8	3.8 ± 0.7	0.95
I have enough resources and time to encourage the children to eat more fruit and vegetables	3.8 ± 0.7	72%	6%	3.8 ± 0.7	3.9 ± 0.3	3.6 ± 0.9	3.9 ± 0.8	0.41

[*1] Post-hoc test: Mean cooking different from gardening (p = 0.001); repeated exposure (p = 0.001) and playful learning (p = 0.01).
[*2] Post-hoc test: Mean cooking different from gardening (p = 0.04) and playful learning (p = 0.01).
[*3] Post-hoc test: Mean cooking different from playful learning (p = 0.04).
[a] N = 86 for overall and N = 21 for playful learning.

Table 4
Opinion of the day-care professionals on various implementation concepts of the chosen strategy post-intervention on a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree: mean ± SD and % (dis)agree for overall sample and mean ± SD per strategy.

	Overall sample (N = 49)			Per strategy				
	Mean ± SD	% Agree	% Disagree	Gardening (N = 13)	Cooking (N = 12)	Repeated Exposure (N = 15)	Playful learning (N = 9)	ANOVA P-value
Acceptance								
The strategy was enjoyable to implement	3.8 ± 0.7	71%	6%	3.9 ± 0.3	3.3 ± 1.0	4.1 ± 0.7	3.7 ± 0.7	0.06
The strategy was easy to implement	3.7 ± 0.7	67%	4%	3.8 ± 0.4	3.4 ± 0.9	3.9 ± 0.7	3.8 ± 0.7	0.35
My colleagues implemented the strategy enthusiastically	3.7 ± 0.8	65%	8%	3.5 ± 1.0	3.7 ± 0.9	3.9 ± 0.6	3.9 ± 0.9	0.70
The duration of the strategy (10–12 weeks) was for me [a]	3.3 ± 0.7	35%	10%	**2.7 ± 0.5**	3.7 ± 0.7	3.3 ± 0.6	3.7 ± 0.7	<**0.001**[*1]
Appropriateness								
The strategy easily fitted my daily practice	3.7 ± 0.9	65%	8%	3.8 ± 0.6	**2.9 ± 1.2**	**4.1 ± 0.6**	3.8 ± 0.7	**0.01**[*2]
The strategy fits our way of working	3.7 ± 0.7	63%	2%	3.7 ± 0.6	3.4 ± 0.7	4.0 ± 0.7	3.8 ± 0.8	0.20
Feasibility								
My location facilitated implementation with budget and materials sufficiently	3.7 ± 0.8	59%	8%	3.5 ± 0.7	3.0 ± 0.7	3.0 ± 0.5	3.6 ± 1.0	0.09
My location facilitated implementation with time and personnel sufficiently	3.2 ± 0.8	39%	16%	3.8 ± 0.7	4.0 ± 0.7	3.3 ± 1.0	3.7 ± 0.7	0.13
Sustainability								
I stop implementing the strategy when the project is finished	2.4 ± 0.9	14%	65%	**1.9 ± 0.6**	**3.0 ± 1.1**	2.3 ± 0.6	2.4 ± 1.1	**0.03**[*3]
I intend to continue implementing the strategy in my daily practice in the coming year	3.5 ± 0.9	49%	14%	3.8 ± 0.6	2.9 ± 0.8	3.5 ± 1.0	3.7 ± 1.0	0.08
There is enough support from my colleagues to continue implementing the strategy	3.4 ± 0.7	43%	8%	3.7 ± 0.6	3.0 ± 0.9	3.5 ± 0.6	3.4 ± 0.7	0.12

[*1] Post-hoc test: Mean gardening different from cooking (p = < 0.002); repeated exposure (p = 0.04) and playful learning (p = 0.02).
[*2] Post-hoc test: Mean cooking different from repeated exposure (p = 0.04).
[*3] Post-hoc test: Mean cooking different from gardening (p = 0.04).
[a] On a 5-point Likert scale ranging from 1 = too long to 5 = too short.

never considered (a little) too short (0% chose score 1 or 2), whereas gardening was perceived (a little) too short by one-third of the day-care professionals (31%).

Regarding appropriateness, the strategies fitted well in the daily practice (3.7 ± 0.9), although this differed significantly between the strategies (p = 0.01). Cooking was considered to fit less in daily practice (2.9 ± 1.2) than repeated exposure (4.1 ± 0.6; p = 0.04).

The day-care professionals were neutral to positive about the organizational support from their location during the implementation period as an aspect of feasibility, with a higher score for budget and materials

(3.7 ± 0.8) than for time and personnel (3.2 ± 0.8, p = 0.004).

Concerning sustainability, the day-care professionals were on average slightly positive about continuation of implementing their strategy (3.5 ± 0.9). Intention to stop was significantly higher among those who implemented cooking (3.0 ± 1.1) than those who implemented gardening (1.9 ± 0.6; p = 0.04). Table 5 shows which strategy or strategies day-care professionals wanted to regularly implement or continue implementing. The majority of day-care professionals chose the strategy they had implemented during the project (ranging from 42% for cooking to 80% for repeated exposure). Overall, repeated exposure (65%) and playful learning (59%) were most frequently chosen to be implemented in the future.

3.1.4. Perceived effects by the day-care professionals post-intervention

More than half of the day-care professionals (65%) experienced post-intervention that the children were willing to taste more varieties of F&V and 48% of them (totally) agreed that implementation of the strategy had increased children's eating pleasure for F&V. Furthermore, the number of children willing to taste new F&V varieties was scored significantly higher in the post-intervention questionnaire than in the pre-intervention questionnaire (3.8 ± 0.7 vs. 3.4 ± 0.8; p = 0.004 for fruit and 3.4 ± 0.7 vs. 2.8 ± 0.8; p < 0.001 for vegetables, Table 6). Also children's eating pleasure for vegetables was scored significantly higher post-intervention than pre-intervention (3.4 ± 0.6 vs. 3.1 ± 0.8; p = 0.01), whereas children's eating pleasure for fruit did not change (p = 0.74). Children's eating pleasure for fruit was perceived higher than for vegetables (p ≤ 0.001 for both pre- and post-intervention).

The day-care professionals were neutral about whether the strategy had increased children's F&V consumption: 22% (totally) agreed for fruit and 20% for vegetables, whereas 35% (totally) disagreed for both fruit and vegetables. According to the professionals, children ate on average 1.3 pieces of fruit and 58.2 g of vegetables per day at baseline. The difference in children's consumption of fruit (p = 0.14) and vegetables (p = 0.38) between pre- and post-intervention was not significant.

Table 6
Children's willingness to taste, eating pleasure and consumption of fruit and vegetables pre- and post-intervention (day-care professionals' reported).

	Pre-intervention (N = 97)	Post-intervention (N = 49)	Difference P-value [a]
Number of children willing to taste unfamiliar varieties of fruit [b]	3.4 ± 0.8	3.8 ± 0.7	**0.004**
Number of children willing to taste unfamiliar varieties of vegetables [b]	2.8 ± 0.8	3.4 ± 0.7 [g]	**<0.001**
Children's eating pleasure for fruit [c]	4.0 ± 0.7	4.0 ± 0.5	0.74
Children's eating pleasure for vegetables [c]	3.1 ± 0.8 [f]	3.4 ± 0.6 [g]	**0.01**
Mean fruit consumption at the day care (in pieces/day) [d]	1.3 ± 0.5	1.5 ± 0.6	0.14
Mean vegetable consumption at the day care (in g/day) [e]	58.2 ± 34.4	63.5 ± 34.2 [g]	0.38

[a] Tested with an independent samples T-test.
[b] On a 5-point scale ranging from 1 = none to 5=(almost) all children.
[c] On a 5-point scale ranging from 1 = very low to 5 = very high.
[d] Calculated based on a 7-point answering scale ranging from 1 = less than half a piece per day to 7 = more than 3 pieces per day.
[e] Calculated based on a 7-point answering scale ranging from 1 = nothing to 7 = 150 g per day or more.
[f] N = 96.
[g] N = 48.

3.2. Parents

3.2.1. Characteristics of the parents

The post-intervention questionnaire was completed by 158 parents. Of these, 152 questionnaires (covering 8 of the 13 locations) could be linked to the implemented strategy and were used in the analyses. The majority of these parents were female (87%) and their average age was 35 ± 3.9 years. The response rates for gardening (N = 62), cooking (N = 42) and repeated exposure (N = 42) were higher than for playful learning (N = 6).

3.2.2. Implementation and perceived effects by the parents

Regarding acceptability and appropriateness, parents were in favour of encouraging children's F&V consumption at the day care, with high scores (>4.5) on the statements with regard to appreciation of F&V encouragement and the importance of offering sufficient amounts of F&V as well as sufficient F&V varieties (Table 7). This was underpinned by a low score on 'It is unnecessary that the day care stimulates children's F&V consumption' (1.4 ± 0.7). Parental importance of offering children a variety of F&V differed between strategies (p = 0.02), with a higher score for gardening compared to repeated exposure (p = 0.08).

Parents were neutral to slightly positive about whether their child liked the activities of the project, and they generally responded neutral to all statements regarding changes in F&V eating behaviours at home (Table 8). Nevertheless, about one fifth of the parents agreed on positive changes at home with regard to their child's interest for F&V (20%) and willingness to taste new fruit varieties (22%). There was a significant difference between the four strategies for buying new F&V varieties for the family (p = 0.01). Parents from the gardening locations agreed slightly more on this statement than the parents from the cooking (p = 0.09) and repeated exposure (p = 0.06) locations. Regarding sustainability, parents responded very positive to the statement whether the day care should continue with additional attention for children's F&V eating with an average score of 4.5 ± 0.7. This was significantly higher than their wish for receiving tips from the day care for their child's F&V eating at home (3.2 ± 1.0; p < 0.001).

4. Discussion

The aim of this study was to investigate how day-care professionals evaluate the implementation of a self-chosen strategy to support

Table 5
Choice of the day-care professionals on which strategy or strategies (yes or no) they wish to implement/keep implementing post-intervention (multiple answers possible).

			Strategy that was implemented during project							
	Overall (N = 49)		Repeated exposure (N = 15)		Cooking (N = 12)		Gardening (N = 13)		Playful learning (N = 9)	
Choice made in the questionnaire ↓	N	%	N	%	N	%	N	%	N	%
Repeated exposure	32	65	**12**	**80**	5	42	9	69	6	67
Cooking	21	43	5	33	**5**	**42**	6	46	5	56
Gardening	21	43	5	33	4	33	**10**	**77**	2	22
Playful learning	29	59	9	60	4	33	10	77	**6**	**67**
Offering more F&V	18	37	5	33	3	25	5	38	5	56
None of these	2	4	0	0	1	8	0	0	1	11

Table 7
Parental opinions on acceptability and appropriateness of stimulating children's fruit and vegetable consumption at the day care on a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree: mean ± SD and % (dis)agree for overall sample and mean ± SD per strategy.

	Overall sample (N = 152)			Per strategy				
	Mean ± SD	% Agree	% Disagree	Gardening (N = 62)	Cooking (N = 42)	Repeated Exposure (N = 42)	Playful learning (N = 6)	ANOVA P-value
I appreciate that the day care encourages children's fruit and vegetable eating	4.7 ± 0.5	99%	0.7%	4.8 ± 0.6	4.8 ± 0.4	4.7 ± 0.5	4.3 ± 0.5	0.17
I think it is unnecessary that the day care stimulates children's fruit and vegetable consumption	1.4 ± 0.7	1%	95%	1.4 ± 0.8	1.4 ± 0.7	1.3 ± 0.5	1.5 ± 0.5	0.81
By encouraging fruit and vegetable eating at the day care, my child learns to eat sufficient/more fruit and vegetables [a]	4.0 ± 0.9	76%	5%	4.1 ± 0.9	4.2 ± 0.7	3.7 ± 0.9	4.0 ± 0.6	0.05
For me, it is important that the day care offers my child sufficient fruit and vegetables [b]	4.7 ± 0.6	97%	1%	4.7 ± 0.5	4.7 ± 0.4	4.5 ± 0.8	4.7 ± 0.5	0.10
For me, it is important that the day care offers my child a variety of fruit and vegetables	4.6 ± 0.6	97%	0.7%	**4.7 ± 0.5**	4.7 ± 0.4	**4.4 ± 0.7**	4.5 ± 0.5	**0.02**[c]

[a] N = 151 overall and N = 61 for gardening.
[b] N = 150 overall; N = 61 for gardening and N = 41 for repeated exposure.
[c] Post-hoc test: Mean gardening borderline different from repeated exposure: p = 0.08.

Table 8
Parent-experienced changes in the child's eating behaviour at home and family buying behaviour, and parental wishes for continuation of the strategies on a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree: mean ± SD and % (dis)agree for overall sample and mean ± SD per strategy.

Question	Overall sample (N = 152)			Per strategy				ANOVA P-value
	Mean ± SD	% Agree	% Disagree	Gardening (N = 62)	Cooking (N = 42)	Repeated Exposure (N = 42)	Playful learning (N = 6)	
Wish to continue with additional attention for fruit and vegetable eating at the day care [a]	4.5 ± 0.7	92%	0.7%	3.7 ± 0.8	3.6 ± 0.7	3.4 ± 0.8	3.7 ± 0.8	0.42
Wish for specific fruit and vegetable tips from the day care for at home [a]	3.2 ± 1.0	38%	20%	3.1 ± 1.0	3.0 ± 0.7	2.9 ± 0.8	2.8 ± 0.4	0.06
Liked activities of the day-care project	3.6 ± 0.8	48%	4%	2.7 ± 0.9	2.8 ± 0.7	2.7 ± 0.8	3.0 ± 0.6	0.45
Child higher interest for fruit and vegetables	3.0 ± 0.9	20%	23%	3.0 ± 0.9	3.1 ± 0.7	2.8 ± 0.8	3.2 ± 0.8	0.68
Child ate vegetables more easily [a]	2.7 ± 0.8	12%	34%	2.8 ± 0.9	2.9 ± 0.7	3.0 ± 0.8	3.3 ± 0.8	0.74
Child ate fruit more easily	3.0 ± 0.8	16%	23%	3.0 ± 0.9	3.1 ± 0.6	3.0 ± 0.8	3.3 ± 1.0	0.32
Child tasted more vegetable varieties [b]	2.9 ± 0.8	17%	28%	2.8 ± 0.8	2.9 ± 0.6	2.7 ± 0.8	2.7 ± 0.5	0.34
Child tasted more fruit varieties	3.0 ± 0.8	22%	21%	2.9 ± 0.9	3.0 ± 0.7	2.7 ± 0.8	3.0 ± 0.6	0.78
Child ate more vegetables [b]	2.8 ± 0.8	12%	33%	2.8 ± 1.0	2.3 ± 0.8	2.3 ± 0.8	3.2 ± 0.8	0.71
Child ate more fruit	2.9 ± 0.8	16%	30%	3.7 ± 0.8	3.6 ± 0.7	3.4 ± 0.8	3.7 ± 0.8	0.35
Bought new fruit and vegetable varieties as family	2.5 ± 0.9	13%	51%	**3.1 ± 1.0**	3.0 ± 0.7	**2.9 ± 0.8**	**2.8 ± 0.4**	**0.01**[c]

[a] N = 151 overall and N = 61 for gardening.
[b] N = 151 overall and N = 41 for cooking.
[c] Post-hoc test: Mean gardening borderline different from cooking (p = 0.09) and repeated exposure (p = 0.06).

children's F&V eating in the day-care setting. Results of this study showed that acceptability, appropriateness, feasibility and sustainability of the implemented strategies were satisfactory, with cooking showing less favourable outcomes for appropriateness and sustained implementation. Implementing these strategies for 10–12 weeks showed promising effects on children's willingness to taste F&V varieties and their eating pleasure for vegetables. Parents welcomed the day-cares' efforts to encourage children's F&V consumption via serving sufficient amounts and varieties of F&V.

A main finding of our study is that the implemented strategies were enjoyable and relatively easy to implement. Furthermore, the strategies generally fitted well into the daily routines and way of working, although cooking scored somewhat less favourable on fit in daily practice. Ease of use and contextual fit have been acknowledged in previous research as important factors for successful implementation (Day, Sahota, & Christian, 2019; Menon et al., 2014; Millen et al., 2019). Insufficient resources, capacity and facilities have been recognized as important challenges for implementation (Battjes-Fries et al., 2016; Day et al., 2019; Jones et al., 2012). In our study, the day-care professionals felt higher support from the organization for budget and materials than for time and personnel. This may be explained by the fact that some starting materials were provided by the research team. Furthermore, some locations were dedicated to start with a new strategy and reserved some budget for this (create a garden or expand F&V varieties), whereas for others, the required budget for implementation was in line with the costs for their habitual activities. As a result, materials, facilities and costs may not have been felt as a barrier. On the other hand, time and personnel were scored neutral, suggesting that these were not yet perceived as a barrier now, but could hinder sustainability in the long term (Day et al., 2019).

There were some differences between the four strategies with regard to implementation. Cooking was perceived to fit less in the daily routine,

was least frequently implemented on a daily basis, almost 60% of day-care professionals considered the implementation period (slightly) too long and intention to stop was highest. There are a few reasons why the experiences with cooking may have been slightly less positive. Despite the fact that cooking was presented as a general involvement in the process of food preparation (Anliker et al., 1992), such as involving the children in washing and cutting the F&V (Zeinstra, Vrijhof, & Kremer, 2020), day-care professionals felt that this strategy encompassed cooking special (hot) dishes with various ingredients. In addition, cooking was considered a special activity, which requires extra time and effort. This is in line with an implementation study among parents where time and scheduling conflicts were identified as a barrier for involving children in vegetable preparation (Millen et al., 2019). Furthermore, our preparatory interviews suggested that some day-care professionals may find it dangerous to involve children in the food preparation process due to risks of cutting or burning. Finally, it is important to acknowledge that the day-care professionals who chose cooking, more often agreed that children already ate sufficient F&V before the start of the intervention and agreed less to eat fruit with the children. On the one hand, this may indicate that cooking was selected by locations that already pay active attention to F&V eating, and that cooking was selected as an additional step on top of regular encouragement. On the other hand, this could indicate less active locations because they perceived a lower need to stimulate children's F&V eating. This latter reasoning seems consistent with the lower frequency of day-care professionals eating fruit together with the children compared to the locations that implemented other strategies.

In contrast with cooking, repeated exposure scored highest on fit in daily routine and daily implementation. Repeated exposure has been previously valued for its simplicity and easy fit in daily routine (Holley et al., 2017; Zeinstra et al., 2018), but since it generally focusses on one novel fruit or vegetable at a time, it has also been described as time-consuming (Appleton et al., 2016). The fact that in our study the unfamiliar fruit or vegetable was used in small amounts for tasting at the start of the eating moment, with subsequently the habitual varieties offered for eating sufficient amounts, may have contributed to the success of this strategy (Hendrie et al., 2017).

A few previous studies have identified several barriers for gardening in the day-care setting, such as a lack of time and insufficient gardening knowledge, financial support, man power, and gardening equipment, as well as natural/seasonal challenges (Davis & Brann, 2017; Dunham & Bersamin, 2014). Therefore, it was interesting to see that sustainability was rather positive for the day cares that implemented gardening (intention to stop lowest). This promising finding may be linked to the fact that the duration of gardening was perceived as too short by about one-third of the day-care professionals. Gardening encompasses the whole process from sowing to harvesting, and 10–12 weeks may have been too short to cover this process fully. In addition, the locations that chose gardening intended to have this garden for multiple years and consequently, invested budget and time to create the garden. A recommendation for future research is to investigate the underlying causes of implementation differences between the various strategies.

Positive effects on children's willingness to taste new F&V varieties and enhanced vegetable eating pleasure were reported by the day-care professionals. Although this did not translate to a higher F&V intake, these effects are valuable for children's F&V eating behaviour. Consuming a variety of F&V supports an intake of different micronutrients and bioactive components, and as such may provide health benefits (Aune et al., 2017; Slavin & Lloyd, 2012). In addition, being presented with a wide variety of F&V may encourage consumption in itself (Nekitsing et al., 2018; Roe, Meengs, Birch, & Rolls, 2013). Moreover, being exposed to a variety of foods may enhance children's acceptance of novel foods (Maier, Chabanet, Schaal, Leathwood, & Issanchou, 2008; Mennella, Nicklaus, Jagolino, & Yourshaw, 2008). Because the context of eating vegetables is usually more negative than for eating fruit due to the use of pressuring practices (Zeinstra, Koelen, Kok, van der Laan, & de Graaf, 2010) and previous interventions aimed at improving F&V intake were often more effective for fruit compared to vegetables (Evans, Christian, Cleghorn, Greenwood, & Cade, 2012; Nekitsing et al., 2018), it is promising that a positive effect was observed for children's eating pleasure for vegetables. Successful implementation of a F&V strategy at the day care therefore has the potential to enhance children's vegetable enjoyment and may – on the long-term – stimulate their vegetable consumption. It would therefore be interesting for future research to investigate also the long-term effects of implementing these strategies on children's F&V eating behaviour.

4.1. Strengths & limitations

A strength of the current study is that day cares could choose themselves which strategy they wanted to implement. Based on the self-determination theory, we expected that this would increase the intrinsic motivation of the day-care professionals (Ryan & Deci, 2000). An additional benefit is that a self-chosen strategy ensured that the day cares took a next step in supporting children's F&V eating on top of their current activities. A drawback of this approach is that it is unknown in advance how often each strategy will be chosen and whether a balanced distribution will be achieved. In our study, the strategies were chosen between the two and four times, thus relatively balanced. Another strength of this study is the ecological validity. The study was executed in a real-life setting, by the day cares themselves, being able to explore how the day cares implemented the strategies and how this was perceived by the day-care professionals. Several insights were obtained from implementing these different strategies. Nonetheless, we recommend further research to advance our understanding of the underlying mechanisms that support structural implementation. Furthermore, the day-care locations varied in socio-economic background, area and size, which is a strength supporting generalizability of the findings. A limitation of the current study is the fact that the number of completed questionnaires from day-care professionals varied between pre- and post-intervention, which prohibited the use of paired t-tests and reduced the power of the study to some extent. Besides, our sample was too small to correct for a possible clustering effect of day-care professionals within the day-care locations. Further, we used a cut-off of 3.5 (above neutral) on a 5-point scale as satisfactory, which may be somewhat arbitrary. However, by looking also at the percentages agree and disagree, we believe the results have been carefully interpreted. Nevertheless, future implementation studies – with larger sample sizes - are recommended to confirm and extend our findings. Another limitation is the somewhat unequal group sizes per strategy for the parental questionnaire and the fact that not all locations provided completed parental questionnaires. Finally, the impact of the implemented strategy on children's F&V eating was assessed by self-reporting which is less accurate than objective measures. However, this was not the main outcome of the study, and the perception of day-care professionals about its effectiveness may be more important for sustained implementation than the actual effects. Also the impact at home was self-reported by parents. Although we emphasised that they should keep the whole project period (March–June) in mind when answering the questions to capture direct and later effects, we cannot exclude that parents forgot about positive home effects that they perceived more at the beginning of the implementation period. Therefore, it would be interesting to measure the effects of implementing these strategies in the day-care setting on children's F&V tasting and eating in future studies, taking into account the effects at the day care itself as well as at home.

4.2. Conclusion

This study showed that the strategies repeated exposure, playful learning, and gardening were acceptable, appropriate and feasible to implement in the Dutch day-care setting. They generally fitted well in the daily day-care routine and day-care professionals were on average

slightly positive about continued implementation of the strategy. The strategy of cooking scored less favourable on daily implementation, appropriateness, and sustained implementation. Children's willingness to taste F&V varieties and their eating pleasure for vegetables increased according to the day-care professionals, whereas children's F&V consumption at the day care did not change. Future research should further investigate the underlying causes for the slight differences between the four strategies, the long-term effects of implementing these strategies in the day care on children's F&V eating behaviour, and shed further light on how to support structural implementation.

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Ethics statement

This study was approved by the Social Sciences Ethics Committee of the Wageningen University.

Ethical statement

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Social Ethics Committee of Wageningen University.

CRediT authorship contribution statement

Gertrude G. Zeinstra: were responsible for formulating the research questions, designing the study, collecting and analysing the data, and writing the article. **Femke A. Hoefnagels:** assisted with analysing the data and reviewing the article. **Saskia Meijboom:** assisted with analysing the data and reviewing the article. **Marieke C.E. Battjes-Fries:** were responsible for formulating the research questions, designing the study, collecting and analysing the data, and writing the article. All authors have approved the final article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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