Appetite 163 (2021) 105235

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Strategies to increase primary school children's fruit and vegetable intake during 10AM snack time

Gertrude G. Zeinstra [a,*], Sandra van der Haar [a], Annemien Haveman-Nies [b]

[a] Wageningen Food & Biobased Research. Food, Health & Consumer Research, Bornse Weilanden 9, 6708, WG, Wageningen, the Netherlands
[b] Wageningen University & Research. Consumption and Healthy Lifestyles, PO Box 8130, 6700, EW, Wageningen, the Netherlands

ARTICLE INFO

Keywords:
Fruit and vegetable consumption
Healthy eating
School food policy
Fruit bowl
Intervention
Parental views

ABSTRACT

In this observational study, children's fruit and vegetable (F&V) consumption during the 10AM school break was assessed for two promising strategies: a 5-day-a-week F&V policy and free provision of F&V presented in an attractive fruit bowl. Schools without a school food policy served as reference group. A secondary aim was to explore the feasibility of the two strategies. A total of 569 children aged 6–9 years participated. Children's F&V consumption at school was assessed on two different week days via observations and weighing snack portions. Parents completed an online-questionnaire on their perceptions and experiences with the two strategies. Main outcomes were the proportion of children and frequency of eating F&V, and children's F&V portion sizes. Data were analysed via ANOVA and Chi-Square ($p < 0.05$). Average F&V consumption differed significantly between the three situations ($p < 0.001$): 250 g in the fruit bowl situation, 130 g in the 5-day-policy situation and 60 g in the no-policy situation. The proportion of children eating F&V was high for the 5-day-policy (97–98%) and fruit bowl situation (87–97%), whereas this was substantially lower (50–60%; $p < 0.001$) in the no-policy situation. The majority of parents considered both strategies as feasible. A 5-day-a-week F&V policy seems an effective, feasible and structural strategy to support children's fruit and vegetable consumption at school. The fruit bowl strategy with an additional eating moment may enhance children's intake even further, although additional requirements are needed for structural implementation at school.

1. Introduction

Fruit and vegetables (=F&V) are an essential part of a healthy diet and provide health benefits in the short and long term (Slavin & Lloyd, 2012). Eating F&V is necessary for growth and development, and is associated with a healthy weight and less chronic diseases, such as diabetes and cardiovascular diseases (Aune et al., 2017; WHO, 2004). Given the fact that eating habits tend to track into adulthood (Nicklaus & Remy, 2013), childhood is a critical time for adopting a healthy eating pattern including sufficient intake of F&V.

Unfortunately, in many European countries, children's F&V intake does not reach the World Health Organization population goal (Lynch et al., 2014). In The Netherlands, children aged 4–8 years consume on average 73 g of vegetables and 135 g of fruit per day, whereas the recommended daily intake for this age group is 100–150 g and 150 g respectively. F&V consumption of 9–18-year-old children is even further below the recommended guideline (Van Rossum et al., 2016).

Children's dietary behaviour is complex and is influenced by individual and environmental factors. Quantitative reviews show that sex, age, taste preference, socio-economic position, parental intake, accessibility and availability are important determinants of F&V intake (Blanchette & Brug, 2005; Rasmussen et al., 2006). More specifically for the school environment, these reviews show that school-based programmes can contribute to daily F&V intake. Schools are therefore promising settings for health promotion considering that children of different ages, ethnic and socio-economic backgrounds all go to school (Scriven & Hodgins, 2011; van Ansem, Schrijvers, Rodenburg, Schuit, & van de Mheen, 2013). Fruit and vegetable consumption can be stimulated during different eating moments at school. Dependent on country and region, eating occasions can vary from a 10AM snack during the morning break to complete school lunches. Schools can promote F&V intake directly by providing free or subsidized F&V programmes, or indirectly by education programs enhancing healthy dietary behaviour, or by the development of food policies instructing parents to give F&V as

Abbreviations: F&V, fruit and vegetables; F and/or V, fruit and/or vegetables.

* Corresponding author.
E-mail addresses: Gertrude.zeinstra@wur.nl (G.G. Zeinstra), Sandra.vanderhaar@wur.nl (S. van der Haar), Annemien.haveman@wur.nl (A. Haveman-Nies).

https://doi.org/10.1016/j.appet.2021.105235
Received 24 June 2020; Received in revised form 23 March 2021; Accepted 25 March 2021
Available online 31 March 2021

snack to school. Furthermore, schools can influence the delivery of F&V in the classroom, for example by the way F&V is presented and introduced by the teacher. Evans, Christian, Cleghorn, Greenwood, and Cade (2012) performed a meta-analysis of school-based interventions that were designed to improve daily F&V intake in children aged 5–12 years. These interventions consisted of multi-component programs or single-component F&V distribution programs. Results indicate an improvement of 0.24 portions for fruit (95% CI: 0.05, 0.43) and 0.07 portions of vegetables (95% CI: 0.03, 0.16). More specifically, Micha et al. (2018) systematically reviewed the effect of school food environment policies on dietary behaviours in children aged 2-18 years. Pooled analysis show that direct provision of F&V increased habitual fruit intake with 0.27 servings/day (95% CI: 0.17, 0.36) and habitual vegetable intake with 0.04 servings/day (95% CI: 0.01, 0.08). Overall, an increase in F&V intake of 25 g a day (0.31 portions) seems feasible in children.

Research suggests that the effect of school food policies on F&V intake can be further improved. van Ansem et al. (2013) investigated schools' (principals and teachers) and parents' opinions on Dutch school food policies and identified opportunities for improvements. Schools should formulate clear food rules, and supervision and enforcement of these rules should be simple and supported by the entire school staff. Next to improving school food policies, provision of F&V at schools could be improved. A systematic review of qualitative studies of determinants of children's F&V intake indicates that availability should not be treated as a one-dimensional concept, representing whether F&V are present in school or not, but as multidimensional. Other dimensions include variety and choice, visibility, methods of preparation, time and setting for eating, quality of F&V, and the relative importance of these aspects is not yet known (Krølner et al., 2011).

Based on these insights, two promising strategies were investigated to further enhance F&V intake in the school environment. The first strategy concerned clearly formulated and specific school food policies. The second strategy concerned the provision of F&V at school through an attractive presentation of F&V in a fruit bowl in the classroom, focusing on multiple dimensions of availability such as variety, visibility, eating time, the possibility to choose, and guided by clear rules regarding eating occasions. This study was part of a larger project that aims to investigate strategies to increase children's fruit and vegetable consumption during the morning break at Dutch primary schools (TU 16007).

The aim of this study was to investigate children's fruit and vegetable consumption during 10AM snack time at schools having 1) a 5-day-a-week F&V policy, and 2) free provision of F&V presented in an attractive fruit bowl. Schools without a school food policy served as reference group.

2. Methods

2.1. Design

This study used an observational design with three situations. Schools with a 5-day-a-week fruit & vegetable policy (strategy 1) and schools with a filled fruit bowl in the classroom (strategy 2) were compared to schools without a food policy (reference group). Children's snacks for the morning break were registered and weighed to determine the number of children that ate F&V, their F&V intake, and the frequency of eating F&V during the morning break at school. Parents from the 5-day-policy and fruit bowl schools completed an online-questionnaire to get insight into the feasibility of the applicable strategy. The study protocols were approved by the Social Ethics Committee of Wageningen University.

2.2. Participants

Primary school children of grade 3, 4 and 5 (usually 6–9 years) and their parents participated in the study. In total, nine schools participated in the study: four schools without a school food policy (N = 196); three schools with a 5-day-a-week F&V policy (N = 265) and two schools with a filled fruit bowl in the classroom (N = 108).

The three schools with an existing 5-day-a-week F&V policy were searched via https://www.gezondeschool.nl. Two schools without a school food policy that had previously participated in the EU-school-fruit programme (20 weeks free F&V delivery for 3 days per week) were invited to test the fruit bowl strategy. The rationale behind was that these schools had some previous experience with free F&V delivery, which might facilitate implementation of the fruit bowl strategy. Four schools without a F&V policy were recruited by health professionals; these schools were participating in a larger project, and formed the reference group for this study. After the principal and teachers agreed on participation, parents were informed about the study aim and procedures, and consent for participation of their child in the study was requested. Table 1 shows an overview of the study design and the characteristics of the participating schools. Harderwijk (no policy) and Renkum (fruit bowl) are both villages with a comparable Social Status Score, whereas Utrecht (5-day policy) is a large city with a lower Social Status Score. The measurements for the three strategies were executed in the school year 2018–2019.

2.3. Situation description

In The Netherlands, children habitually bring a morning snack from home to eat during the 10AM break at primary school. There is no national policy in terms of what food should be provided during the morning snack break at school and there are no general arrangements for children from low income families. Schools decide themselves whether they apply healthy food rules or not.

Whereas the no-policy schools did not have any policy or rule concerning what children should eat during this break, the 5-day-policy schools had the rule that children should bring fruit and/or vegetables on all five school days of the week. The three participating schools had implemented this 5-day policy seven, ten and 14 years ago on advice of, and in collaboration with, the regional health services to combat childhood obesity in the neighbourhood.

The fruit bowl schools received a fruit bowl from the research team and free F&V delivery for a period of 3 weeks. Per week, five fruit types and two vegetable types were delivered (the three most common fruit types: apple, pear and banana; two other fruits: plum and mandarin or nectarine and apricot; two vegetables: cucumber and tomato or cucumber and carrot). The teachers were asked to fill the fruit bowls with fruits and vegetables, with at least four different varieties, and to place the filled fruit bowl in the classroom at 8h30, when the school started. Children were invited to choose from the fruit bowl during two fixed moments in the morning: their habitual 10AM snack moment and an additional snack moment which was introduced during the study period. Children could take multiple pieces as they liked, on condition that they finished their first piece before taking a new one. Teachers, parents and children were told that the children did not need to bring a snack from home for the morning break during the study period.

2.4. Measurements

The 10AM snack assessments were done on two different week days to obtain a more representative picture than measuring one day only (Crawford, Obarzanek, Morrison, & Sabry, 1994; O'Connell, Henderson, Luedicke, & Schwartz, 2012). All measurements were done by trained research assistants, who received written information about the measurement procedures as well as a 1-h instruction session. Parents knew that two measurements would take place, but they were not aware of the exact days.

Table 1
Overview of study with characteristics of the participating schools.

Strategy	Number of schools	Consent procedure	Mean Social Status Score	N (children)	City	Study period
No policy	4	Active consent	0.28 (RIVM, 2010)	196	Harderwijk	September 2018
5-day F&V policy	3	Passive consent[a]	−1.54 (Sociaal-Cultureel-Planbureau, 2019)	265	Utrecht	May 2019
Fruit bowl	2	Passive consent[a]	0.43 (Sociaal-Cultureel-Planbureau, 2019)	108	Renkum	June 2019

[a] Due to the observational (non-medical) character of the study, passive consent was sufficient.

2.4.1. No-policy and 5-day-policy snack assessments

In the no-policy and 5-day-policy schools, children were requested - when arriving at school - to put their 10AM snack in carton packs with compartments outside the classroom for a period of two weeks. The compartments were labelled with the children's name. The research team visited the schools on two random days. Individual snacks were weighed to the nearest 0.1 g with Kern EMB6000-1 weighing scales. A registration form was used to register the type of snack, the weight, and for F&V additionally whether it was a whole piece or cut into pieces, as well as it had a peel or not. This procedure was executed between 8h30 and 10h00, out of sight of the children in order to not disturb the lessons. It was assumed that children consumed what they brought to school as their 10AM snack, since we expected parents to provide F&V varieties that their children like, as well as portion sizes that are generally eaten.

2.4.2. Fruit bowl snack assessments

The fruit bowl schools were visited in the second and third week, also on two random days. Observations were chosen as the most objective measurement method for this situation. Based on two pilot tests, the procedures were optimized and finalized. Two observers per classroom registered which product the children took from the fruit bowl and whether they ate each piece. The children wore a sticker with a three-digit number (in large font) to identify them. They were requested to come forward and take something from the fruit bowl in small groups of 4–5 children. In cases when children also brought a snack from home, the type of snack was recorded. The two observers in one classroom cross-checked their data immediately after the eating moment on completeness for each child and for any inconsistencies in both reports. If this was the case, these were discussed and – when not clear – the child was asked to confirm what they ate from the fruit bowl.

Additionally, one weighing moment was carried out each week to assess the average product weight by weighing 10 pieces of an F&V variety (i.e. apples) and taking the average weight. This was done for all the F&V varieties that were available in that week.

2.4.3. Demographics

To describe the study population, age and sex lists were collected per class.

2.4.4. Questionnaire parents

Parents were invited to complete a short online questionnaire (Eye-Question, version 4.11.55) to assess parents' perceptions of, and experiences with, the two strategies. For each strategy, a questionnaire was developed covering five main themes: 1) parental opinions about the strategy implemented (~their attitudes), 2) parent-perceived feasibility of the strategy, 3) their child's responses to the strategy (child experiences), 4) home experiences (potential transfer of effects of the school strategy towards home eating practices), and 5) habitual practices regarding the morning break. The specific items were based on preparatory expert interviews and previous research on facilitating and hindering factors for children's fruit and vegetable provision (Clelland, Cushman, & Hawkins, 2013; Jongenelis, Pettigrew, Pratt, Wright, & Myers, 2017; Krølner et al., 2011; Yeh, Obenchain, Viladrich, Watson, & Preedy, 2010). Parents completed the statements via a 7-point Likert-scale with the anchors 'completely disagree' (=1) to 'completely agree' (=7). Parents also completed questions about their age, gender and education level. Primary education and lower secondary education were subsequently classified as 'lower education'. Higher secondary education and secondary vocational education were defined as 'middle education'. Higher vocational education and university were classified as 'high education'.

2.5. Data analyses

F&V were defined as fresh F&V; canned F&V and F&V juices were not regarded as F&V.

The *proportion of children* with specific snack types for the 10AM break are presented per strategy per measurement day. The type of snacks were categorized as fruit, vegetables, other snacks (bread, biscuits, candies), nothing, or a combination of these. The proportion of F&V eaters was compared between the three situations using a Chi-Square test.

For F&V, *edible portion sizes* were calculated per child based on the assessed weights and the application of corrections for inedible peels, piths and cores, using standard weights and percentages (Donders-Engelen, Van der Heijden, & Hulshof, 2003). Children who were present, but did not bring or take any fruit or vegetables, received a zero-gram F&V portion.

For children in the fruit bowl situation who also brought F&V from home (day 1: N = 2; day 2: N = 3), a portion of 80 g was used as a conservative proxy for the weight of one home-brought portion (British-Nutrition-Foundation, 2018). The observations in the fruit bowl situation showed that children generally ate the whole piece of F&V that they took from the fruit bowl (as requested before taking another piece). When children did not finish an F&V piece taken subsequently, they ate a few bites. For these few occurrences (20 out of 548 = 3.6%) when children took a few bites, 10% of the weight of that F&V piece was included in their total F&V portion size. The portions of home-brought F&V and fruit bowl F&V were added together to get the total F&V portion sizes (in grams) for a specific measurement day in the fruit bowl situation.

For all three situations, F&V portion sizes were averaged across the two days, because there were no significant differences between the two measurement days. F&V portion sizes are shown as means and SD per strategy for the total group, and for the F&V eaters only (children who actually ate F&V). To investigate differences in F&V consumption between the three situations, a one-way ANOVA was applied with Fisher's LSD post-hoc tests. Correlation analysis showed that age was not a confounder.

For the F&V eaters, the *number of F&V varieties* that children brought to school/took from the fruit bowl was calculated. The average variety and SD per measurement day is shown.

The number of days that children brought F&V to school (*F&V provision frequency*) were categorized as 'never' (0% of the measurement days), 'sometimes' (50% of the measurement days: 1 out of 2), and 'always' (2 out of 2: 100% of the measurement days). When children had a missing value for one day, F&V provision frequency was calculated based on one day only. Chi-Square was used to test for differences in provision frequency distributions between the three situations.

Means and SD were calculated for the items in the parental questionnaires. Additionally, the percentage of parents agreeing (score 5-6-7) or disagreeing (score 1-2-3) on a statement were calculated to get a more detailed picture.

All analyses were done with IBM SPPS Statistics version 23 and a p-

value <0.05 was considered significant.

3. Results

3.1. Sample characteristics

The three groups of children involved in the observational study did not differ in terms of sex ($p = 0.24$), but differed significantly in terms of age ($p < 0.001$). Children in the no-policy schools - measured in autumn - were significantly younger with 7.46 years compared with the two other groups ($p < 0.001$), whereas the fruit bowl children were significantly older with 8.26 years compared with the no-policy children ($p < 0.001$) and the 5-day-policy children ($p = 0.02$), as a few sixth-graders were included (see Table 2).

3.2. Proportion of F&V eaters

For each situation, Table 3 shows which 10AM snacks the children ate on the two measurement days, as well as whether they ate F and/or V. The proportion of children having F and/or V as their 10AM snack was highest in the 5-day-policy schools with 97–95%, second in the fruit bowl schools (87–98%), and lowest in the no-policy schools with 50–60% of the children eating F and/or V as their morning snack. The differences between the strategies were significant for both day 1 and day 2 ($p < 0.001$). Bringing fruit was most common in the 5-day-policy schools (~85%) and the no-policy schools (~30%), while the combination of F&V was most popular in the fruit bowl schools (~45%). For all three situations, only a few children had no 10AM snack (often ~2%).

In the fruit bowl schools, more children picked something from the fruit bowl during the first eating moment (Day 1: 98% [N = 103]; Day 2: 83% [N = 76]) compared with the second eating moment (Day 1: 79% [N = 83]; Day 2: 65% [N = 60]). Fruit bowl eaters took three pieces on average (Day 1: 2.98 ± 1.43; Day 2: 3.05 ± 1.47).

3.3. F&V portion sizes

The average F&V portion sizes are shown in Fig. 1. At group level, F&V portions were highest in the fruit bowl schools (~250 g per child per day), second in the policy schools (~130 g), and lowest in the no-policy schools (~60 g; $p < 0.001$ + all post-hoc p-values <0.001; Fig. 1a).

When considering F&V eaters only (Fig. 1b), the differences in F&V portion sizes remained significant ($p < 0.001$ + all post-hoc p-values <0.001). So, F&V eaters at the no-policy schools still ate a smaller F&V portion (~90 g) than F&V eaters in the 5-day-policy schools (~130 g), with F&V eaters in the fruit bowl schools eating the largest portion (~250 g).

When looking at fruit consumption only, the same pattern was seen, whereas another pattern was observed for vegetable consumption. Children in the fruit bowl schools consumed significantly more vegetables, with a ~70 g portion, compared with both the no-policy (~7 g; $p < 0.001$) and policy schools (12 g; $p < 0.001$), while the latter two were not significantly different ($p = 0.13$).

In the no-policy schools, around 35% of the children brought F and/or V as their only snack for the morning break, whereas around 18% of the children brought F and/or V in combination with a non-F&V snack (see Table 3). Children who brought F and/or V as their only snack (day 1: 129.13 ± 48.75 g, N = 63; day 2: 118.67 ± 37.86 g, N = 72) ate a substantially larger F&V portion than children who brought a non-F&V snack on top of F and/or V (day 1: 96.20 ± 46.21 g, N = 34; day 2: 96.41 ± 44.99 g, N = 35), with a difference of 22–33 g (day 1: $p = 0.002$; day 2: $p = 0.01$). So, F&V portions of children at no-policy schools who brought F and/or V as their only snack (~120–130 g) were similar to those of children at 5-day-policy schools (~130 g).

In the fruit bowl schools, F&V eaters ate on average two F&V varieties during the morning at school (day 1: 2.2 ± 1.0; day 2: 2.2 ± 0.9). This was significantly higher ($p < 0.001$) compared with the other two situations, where children brought on average one F&V variety for the school morning break (5-day policy day 1: 1.2 ± 0.6; day 2: 1.2 ± 0.5 and no policy day 1: 1.2 ± 0.4; day 2: 1.2 ± 0.4).

3.4. F&V provision frequency

Table 4 shows the frequencies (number of days) that children ate F and/or V as their 10AM snack. In the no-policy schools, 41% of the children brought F and/or V during both measurement days (always), whereas this percentage was double for the fruit bowl schools (88%) and even higher (96%) for the policy schools ($p < 0.001$). Around one third of the no-policy children never brought any F and/or V for the morning break, whereas these percentages were nihil for the 5-day-policy and fruit bowl schools.

The bottom part of Table 4 focuses on the children that brought F and/or V as their only snack for the morning break. In the 5-day-policy schools, practically all children (94%) brought F and/or V as their only 10AM snack during both measurement days (always), whereas this percentage was somewhat lower for the fruit bowl schools (67%) and much lower for the no-policy schools (25%; $p < 0.001$). Around half of the children in the no-policy schools never brought F and/or V as their only snack for the morning break, whereas this group was very small for both the 5-day-policy and fruit bowl schools.

3.5. Parental opinions regarding 5-day policy

A total of 113 parents completed the questionnaire (response rate: 43%), with an average age of 38.0 ± 6.5 years, 82% women, with 43% high education, 39% middle and 17% lower education.

Table 5 shows that - in general - parents were positive about the 5-day-a-week rule. They experienced it as useful, encouraging and pleasant, and not as annoying or over the top. Parents also indicated that it was easy to adhere to this rule, and they had sufficient time and financial resources for offering and preparing the daily school F&V. However, some 8–10% of the parents did not agree with these statements.

Around 20% of the parents enjoyed making something special of the 10AM snack, whereas 20% also indicated that they need more inspiration for the type of 10AM snack to provide. Parents indicated that the 5-day-a-week F&V policy had an impact on their child's F&V consumption, and - to a lesser extent - on their family's F&V consumption. 50% of the parents agreed that their child ate more F&V due to the 5-day-policy rule, whereas a quarter of the families started to eat more F&V and other F&V varieties due to the rule. Around one quarter to one third of the parents agreed that their child learned to eat new F&V varieties, wanted to try new foods and ate vegetables more easily. A similar proportion indicated that they pay more attention to promotional offers, buy less

Table 2
Participant characteristics of the observational study investigating children's fruit and vegetable intake during the 10AM school break for three different strategies.

	No policy (N = 196)	5-day F&V policy (N = 265)	Fruit bowl (N = 108)
Sex			
Boys	97 (49.5%)	141 (53%)	47 (43.5%)
Girls	99 (50.5%)	124 (47%)	61 (56.5%)
Age: mean (SD)	7.46 (0.93)[a]	7.94 (0.99)[b] *	8.26 (1.19)[c]
Grade 3	58 (29.6%)	98 (37%)	26 (24%)
Grade 4	66 (33.7%)	92 (35%)	34 (31.5%)
Grade 5	72 (36.7%)	75 (28%)	41 (38%)
Grade 6	N.A.	N.A.	7 (6.5%)

[a] Different superscript letters indicate significant differences ($p < 0.05$).
* Unknown age 2x, N = 263.

Table 3
Number and proportion of children consuming different types of 10AM snack, per situation and measurement day.

	Day 1			Day 2		
	No policy N = 193	**5-day F&V policy N = 254**	**Fruit bowl N = 105**	**No policy N = 182**	**5-day F&V policy N = 256**	**Fruit bowl N = 92**
Type of snack						
Fruit only	55 (28.5%)	223 (87.8%)	35 (33.3%)	63 (34.6%)	215 (84.0%)	18 (19.6%)
Vegetables only	6 (3.1%)	9 (3.5%)	12 (11.4%)	7 (3.9%)	24 (9.4%)	5 (5.4%)
Fruit & vegetables	2 (1.0%)	13 (5.1%)	46 (43.8%)	2 (1.1%)	8 (3.1%)	43 (46.7%)
F and/or V with other snacks	34 (17.6%)	2 (0.8%)	10 (9.5%)	35 (19.2)	4 (1.6%)	14 (15.2%)
Other snacks only	82 (42.5%)	3 (1.2%)	2 (1.9%)	66 (35.3%)	1 (0.4%)	7 (7.6%)
Bread only	7 (3.6%)	0 (0%)	0 (0%)	3 (1.7%)	0 (0%)	0 (0%)
Bread + other snack	5 (2.6%)	0 (0%)	0 (0%)	3 (1.7%)	0 (0%)	0 (0%)
No snack	2 (1.0%)	4 (1.6%)	0 (0%)	3 (1.7%)	4 (1.6%)	5 (5.4%)
Fruit and/or vegetables as morning snack						
Yes	97 (50.3%)	245 (97.2%)	103 (98.1%)	107 (58.8%)	251 (98.0%)	80 (87.0%)
No	96 (49.7%)	7 (2.8%)	2 (1.9%)	75 (41.2%)	5 (2.0%)	12 (13.0%)

F&V = Fruit and vegetables.

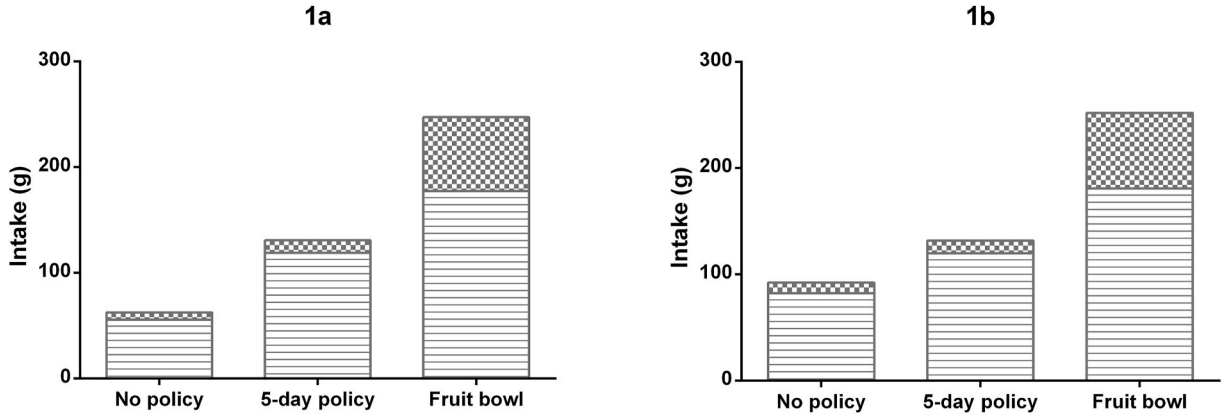

Fig. 1. Fruit and vegetable portion sizes (in grams) for the three situations separately, at group level (1a) and for the fruit and vegetable eaters only (1b). Striped = fruit; squared = vegetables.

Table 4
Fruit and vegetable provision frequency: number of times children had fruit and/or vegetables as 10AM snack at school for two outcome measures.

	No policy (N = 196)	5-day F&V policy (N = 265)	Fruit bowl (N = 108)
Fruit and/or vegetables as morning snack [a]			
Never (0 out of 2 days)	63 (32.1%)	2 (0.8%)	2 (1.9%)
Sometimes (1 out of 2 days)	53 (27.0%)	9 (3.4%)	11 (10.2%)
Always (2 out of 2 days)	80 (40.8%)	254 (95.8%)	95 (88.0%)
Chi-Square p-value		$p < 0.001$	
Fruit and/or vegetables as only snack			
Never (0 out of 2 days)	103 (52.6%)	3 (1.1%)	5 (4.6%)
Sometimes (1 out of 2 days)	43 (21.9%)	13 (4.9%)	31 (28.7%)
Always (2 out of 2 days)	50 (25.3%)	249 (94.0%)	72 (66.7%)
Chi-Square p-value		$p < 0.001$	

[a] Fruit and vegetables as only 10AM snack as well as fruit and vegetables with an additional snack.

prepacked snacks or visit other stores to buy F&V due to the 5-day policy.

3.6. Parental opinions regarding fruit bowl

50 parents completed the questionnaire (response rate: 46%), with an average age of 40.5 ± 5.8 years, 82% women, and 50% high education, 31% middle, and 19% lower education. Table 6 shows their responses.

Parents indicated that their children were moderately positive about the fruit bowl, with 65–75% agreeing that their child enjoyed choosing and picking, was enthusiastic and spoke about the fruit bowl. Around 20% of the children were less enthusiastic, due to not knowing in advance what they would eat and having to eat something other than their own snack. Most parents agreed that a fruit bowl in the class room would be a good idea (82%), and 50% would be willing to make a financial contribution to this. For the majority (~70–75%), the fruit bowl did not lead to positive changes in eating behaviour at home, or to a compensation effect (eating less F&V at home due to the fruit bowl). One quarter to one fifth of the parents indicated that their child complains that F&V are not enough to satisfy their appetite, and asks for other snacks than F&V for their 10AM break.

Table 5
Parental (N = 113) opinions and experiences regarding the 5-day-F&V policy (rule) reported via a 7-point Likert scale ranging from totally disagree (1) to totally agree (7).

	Mean	SD	% agree (5-6-7)	% disagree (1-2-3)
Opinions (N = 112)				
This rule policy is useful	6.2	1.6	85.7%	8.9%
This rule is pleasant	6.0	1.6	82.1%	8.0%
This rule is encouraging	6.0	1.7	82.1%	10.7%
This rule is important for my child	6.1	1.5	86.6%	8.0%
It is good that the school takes its responsibility here	5.8	1.8	78.6%	13.4%
This rule is patronizing *	2.7	1.8	14.5%	63.6%
This rule was for our family a reason to choose for this school	2.7	1.8	9.8%	56.3%
This rule is over the top	2.0	1.6	8.0%	81.3%
This rule is annoying	1.9	1.5	8.0%	87.5%
Preparing and bringing F&V 5 days a week				
It is important to me that my child eats F&V every day	6.3	1.5	87.6%	7.1%
This rule is easy to follow	6.0	1.6	84.1%	8.0%
I can explain sufficiently to my child why it is important to bring F&V for the 10AM break every day	5.8	1.8	80.5%	10.6%
This rule provides clarity to our family about what to bring for the 10AM break	5.6	1.9	75.2%	15%
The school explains sufficiently why it is important to eat F&V	5.3	1.5	61.1%	8.8%
I enjoy making something special of the F&V that my child brings for the 10AM break	4.5	1.6	52.2%	21.2%
The school provides us with sufficient concrete tips about what to bring for the 10AM break	4.5	1.7	39.8%	21.2%
I need more knowledge/inspiration about what I can give my child for the 10AM break	2.7	1.8	18.6%	62.8%
I have too little time to prepare F&V for my child every day	1.9	1.5	8.0%	84.1%
I think it is too much of a hassle to prepare F&V for my child every day	1.9	1.6	8.0%	83.2%
This rule is a financial burden to our family	1.8	1.5	8.0%	85.8%
My child				
My child is allowed to choose himself which F&V variety he/she brings for the 10AM break	5.4	1.6	73.5%	12.4%
My child likes this rule	5.3	1.7	61.1%	12.4%
My child usually brings the same F&V varieties for the 10AM break every day	3.5	1.8	32.7%	48.7%
My child asks for other snacks than F&V for the 10 a.m. break	2.4	1.7	16.8%	72.6%
My child occasionally brings something else than F&V for the 10 a.m. break	2.4	2.0	18.6%	75.2%
My child complains that F&V for the 10AM break is not enough to satisfy his/her appetite	2.2	1.7	8.8%	77.9%
Home eating behaviour (N = 112)				
Due to this rule, my child learns a good habit	5.9	1.6	79.6%	7.1%
Due to this rule, my child feels comfortable with him/herself	5.1	1.7	57.5%	9.7%
Due to this rule, my child eats more F&V	4.6	1.9	51.3%	23.9%
Due to this rule, my child has become more positive about F&V	4.5	1.7	42.5%	17.7%
Due to this rule, my child has learned to eat new types of F&V	3.9	1.9	33.6%	37.2%
Due to this rule, my child wants to try more other products	3.9	1.7	33.6%	37.2%
Due to this rule, my child more easily eats vegetables at home	3.6	1.8	26.5%	45.1%
Due to this rule, our family started eating more F&V	3.5	2.0	26.5%	46.9%
Due to this rule, our family started eating other types of F&	3.2	1.9	25.7%	53.1%
Groceries				
Due to this rule, F&V is always on our groceries list	5.1	2.1	62.8%	20.4%
Due to this rule, I am more aware of F&V promotional offers	4.2	2.1	33.6%	43.3%
Due to this rule, our family buys less prepackaged snacks	3.5	2.0	25.7%	47.8%
Due to this rule, I visit other stores/places to buy F&V*	3.4	2.2	29.5%	52.7%

F&V = Fruit and vegetables.
*N = 110.

4. Discussion

The aim of this study was to investigate the effects of two F&V promoting strategies on children's F&V consumption during the 10AM break in comparison with a reference group. Children's F&V intake was highest in the fruit bowl situation, second highest in the 5-day-policy situation and lowest in the schools where no 10AM food policy existed. Frequency of eating F&V at 10AM snack time was most optimal for the 5-day-policy situation. In general, parents appreciated both the 5-day-policy and the fruit bowl strategy, and evaluated them as feasible.

This study indicates that both the 5-day-policy and fruit bowl strategy may contribute to children's F&V consumption. Children at schools with a 5-day-a-week F&V policy had a substantially higher F&V consumption with 130 g compared to having no policy, where F&V consumption at group level was 60 g, a difference of almost one portion. Interestingly, F&V eaters at 5-day-policy schools still ate a larger portion than F&V eaters at no-policy schools with a 90 g portion. This difference of 30 g is of the same magnitude as the 25 g difference that is found in recent reviews of school-based intervention programs that aimed to increase children's F&V intake (Evans et al., 2012; Micha et al., 2018).

Implementing a fruit bowl in the classroom with two eating moments may enhance intake even further. The fruit bowl portion size of 250 g was about two times the portion of the 5-day-policy schools, which may reflect the two eating moments of the fruit bowl strategy. The finding that offering children free F&V at school may increase children's F&V consumption, is in line with earlier studies with subsidized F&V programs (Bere, Hilsen, & Klepp, 2010; Evans et al., 2012). Our findings imply that when F&V are offered in an attractive way during multiple eating moments at school, children's consumption may be boosted further. Whereas children at 5-day-policy schools ate about 45% of the daily F&V recommendation during the 10AM snack moment, an attractive fruit bowl presentation with free picking and an additional eating moment may cover 83% of the daily intake recommendation (Netherlands-Nutrition-Centre, 2015).

Advantages of the fruit bowl were the attractive presentation, clear visibility, different F&V varieties, and the option to choose and to take multiple pieces. These aspects have been linked to availability (Krølner et al., 2011), and can also be linked to feelings of autonomy, which in turn may enhance children's intrinsic motivation (Ryan & Deci, 2000; Zeinstra, Renes, Koelen, Kok, & de Graaf, 2010). The fruit bowl resulted in the highest F&V intake, and also a higher intake for vegetables in particular. This is interesting as current school-based interventions mainly find increases in fruit intake, with only minor effects for vegetable intake (Bere et al., 2010; Blanchette & Brug, 2005; Evans et al.,

Table 6
Parental (N = 50) opinions and experiences regarding the fruit bowl filled with fruit & vegetables in the class room reported via a 7-point Likert scale ranging from totally disagree (1) to totally agree (7).

	Mean	SD	% agree (5-6-7)	% disagree (1-2-3)
My child and the fruit bowl				
My child liked to choose and pick fruit from the fruit bowl	5.7	1.8	76%	12%
My child told us about the fruit bowl in the classroom	5.4	2.1	74%	20%
My child was enthusiastic about the fruit bowl	5.2	1.9	64%	18%
My child ate more F&V than on regular school days without fruit bowl	4.5	2.1	56%	30%
My child ate other F&V varieties because of the fruit bowl in the classroom	3.9	2.2	42%	40%
My child experienced the fruit bowl in the classroom as exciting	3.0	1.9	20%	54%
My child thought it was annoying to eat something other than the snack he/she brought from home	2.7	2.2	22%	68%
It bothered my child not knowing in advance what he/she would eat during the 10AM break	2.4	2.0	18%	76%
My thoughts on the fruit bowl				
I think a fruit bowl in the classroom is a good idea	6.1	1.4	82%	4%
I would be willing to financially contribute to a fruit bowl with F&V in the classroom	4.6	1.8	50%	22%
Due to the fruit bowl in the classroom, my child wanted to try more different products at home	2.5	1.8	14%	72%
Due to the fruit bowl in the classroom, we talked more about F&V at home	2.4	1.6	12%	72%
Due to the fruit bowl in the classroom, we ate different types of F&V at home	2.2	1.5	8%	74%
Due to the fruit bowl in the classroom, we ate less F&V at home	2.0	1.7	10%	82%
Fruit and vegetables				
It is important to me that my child eats F&V every day	6.4	1.4	92%	4%
I can sufficiently explain to my child why it is important to eat F&V	6.2	1.7	90%	8%
I am happy when my child eats more than one piece of F&V at school	5.7	1.5	76%	6%
The school provides us with sufficient concrete tips for healthy snacks to bring for the 10AM break	3.7	2.0	34%	44%
I need more knowledge/inspiration about what I can give my child for the 10AM break	2.1	1.6	8%	80%
Morning break				
My child is allowed to choose which F&V variety he/she brings for the 10AM break	5.6	1.8	78%	14%
My child occasionally brings something else than F&V for the 10 a.m. break	4.3	2.1	56%	34%
My child usually brings the same F&V varieties for the 10AM break every day	4.0	1.8	38%	36%
My child asks for other snacks than F&V for the 10 a.m. break	3.2	2.1	26%	50%
My child is allowed to decide which 10AM snack he/she brings to school	3.0	1.8	16%	64%
My child complains that F&V for the 10AM break is not enough to satisfy his/her appetite	2.5	2.1	18%	76%

F&V = Fruit and vegetables.

2012; Micha et al., 2018; Ransley et al., 2007). The high availability and accessibility (Cullen et al., 2003), the presence of vegetable variety (Meengs, Roe, & Rolls, 2012) and the choice aspect supporting autonomy (Ryan & Deci, 2000; Zeinstra et al., 2010) may all have supported vegetable consumption, and may be essential elements to include in future studies aiming to increase vegetable intake. For future research, it would also be interesting to study the effects of offering a bowl with fruit only versus a bowl with vegetables only, or whether the combination is more effective in stimulating F&V intake.

Although parents and children appreciated the fruit bowl strategy, and considered it as feasible to execute in the school setting, additional requirements need to be fulfilled for structural implementation. Whereas the fruit bowl and the 3-week F&V delivery were provided for free in our study, this is not a sustainable option for the long-term. Arranging structural payment for this strategy may be challenging. In our study, only half of the parents reported to be willing to financially contribute to the delivered F&V on the fruit bowl. Additionally, organisational and logistic aspects (e.g. creating an additional eating moment) require further attention.Whereas parents experienced no general changes in home eating behaviour due to the fruit bowl, the 5-day policy seemed to have positive effects on children's and family's eating behaviour for a substantial subgroup. Fifty percent of the parents indicated that their child ate more F&V due to the 5-day policy, about 30% of parents indicated their family ate more F&V and their child more easily ate vegetables at home or tried other products due to the 5-day policy. By repeated exposure, modelling from peers and setting a norm (Laureati, Bergamaschi, & Pagliarini, 2014; Sharps & Robinson, 2015), children may eat F&V more easily, which translated partly to the family. The fact that these effects were not present in the fruit bowl condition, is presumably due to the short study period of 3 weeks, whereas the 5-day policy was already present for many years. Still, children did not seem to eat less F&V at home due to eating F&V from the fruit bowl in the classroom, so from our findings, there is no evidence for a negative compensation effect. Nevertheless, causal inferences cannot be made from our observational study, so these results need to be interpreted with some caution. Future studies should investigate long-term effects of the fruit bowl strategy. This is also recommended because the number of children who took from the fruit bowl seemed to decline between the two measurement days, which might be explained by a novelty effect or the fact that more children brought a snack from home and teachers were more lenient on this. In addition, home eating effects for both strategies may be investigated more in detail in future studies (Ransley et al., 2007), including an assessment of whole day F&V consumption.

Professionals from the field indicate that schools are afraid for parental resistance when implementing a food policy, which can be explained by the reactance theory (Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). When parents are obliged to follow a rule, this may lead to reactance. Our study indicated that about 10% of the parents do not appreciate the 5-day-a-week rule, and may show resistance. Still, the majority of parents value the rule, presumably because it helps them to guide their child towards healthy eating behaviour, which may be easier when all children eat F&V (Addessi, Galloway, Visalberghi, & Birch, 2005; Greenhalgh et al., 2009). These findings are in line with a previous Dutch study, where most parents (77%) reported that they appreciated the school food policy and comply with the food rules, and about 8% of the parents disagree with the rules (van Ansem et al., 2013). A similar 10% of the parents seemed to experience barriers, such as costs, time and fuss, which have been recognized in previous studies as well (Clelland et al., 2013; Jongenelis et al., 2017; Krølner et al., 2011; Yeh et al., 2010). Nevertheless, our study suggests that these barriers and parental reactance have been overcome by the 5-day policy, since the behavioural outcome shows that practically all children brought F&V to school and 95% of the children always brought F&V as their 10AM snack. To overcome reactance, the participating schools advised a personal talk with parents explaining the rationale for implementing the eating policy, which is for the benefit of their children. They also advised applying a transition period during implementation, so that parents can smoothly get accustomed to the new policy. The fact that the 5-day-policy schools were in lower SEP

areas indicates that this strategy is also realistic for the lower socio-economic groups, who often have unhealthier eating patterns (De Irala-Estévez et al., 2000; Krølner et al., 2011; Thornton et al., 2016), and may need support for healthy eating the most. These findings together imply that a 5-day-a-week F&V policy for the 10AM break seems promising to implement in all primary schools.

Exploratory analyses showed that children in the no-policy schools ate more F&V when they brought F&V as only snack compared to when they brought F&V in combination with another snack. This finding is in line with previous research that found an association between offering F&V in the absence of competing foods and increased consumption (Spill, Birch, Roe, & Rolls, 2011; van Kleef, Bruggers, & de Vet, 2015). This implies that the school food policy should advise to bring and eat F&V as only snack during the 10AM break, as a way to encourage children's F&V intake. In addition, such a school food policy should pay special attention to encourage vegetable provision for the morning break, since our study showed that vegetable provision is still low at schools with a 5-day-a-week F&V policy.

4.1. Strengths and limitations

A strength of the current study is that actual F&V portions were assessed, based on real weighing, which is more accurate than self-reported consumption data. Another strength is that the study was executed in real-life situations, increasing ecological validity. The combination of data about children's behaviour as well as about parental experiences provided a more comprehensive picture, than focusing on one aspect. Finally, to our knowledge, this is the first study that investigated a fruit bowl strategy.

A limitation of our study is that actual consumption was not measured in the 5-day-policy and no-policy situation. We assumed that parents generally provide F&V portions that their children finish. Yet, at hindsight, checking afterwards whether children ate their portions or performing post-measurements in at least a subset of children would have been a valuable addition. Another limitation of our study is the fact that the studies were observational, not intentionally set up as an experiment with three arms, and based on convenience samples. This resulted in slight differences regarding study samples concerning size, age and socioeconomic background. In addition, little individual information was collected, so we could not control for individual variables such as children's F&V liking, neophobia, hunger state or parental education level. Furthermore, due to the observational design, causal inferences cannot be made from our results, and we cannot disentangle the effect of strategy and town or socioeconomic area of the schools. If all strategies were tested in low socioeconomic areas, the differences in portion size between the three strategies may have been enlarged, whereas the differences might have been similar or somewhat smaller when all schools were in high socioeconomic areas. Nevertheless, the differences in consumption between the situations were substantial and the consumption results of the separate schools and grades within a strategy showed a comparable picture. This strengthens us that the differences are due to the implemented strategy. Still, our findings should be further confirmed in future studies.

5. Conclusion

A 5-day-a-week F&V policy seems an effective, feasible and structural strategy to support children's fruit and vegetable consumption during 10AM snack time at school. The fruit bowl strategy with an additional eating moment may enhance children's F&V intake during the 10AM break even further, although additional requirements are needed for structural implementation of the fruit bowl strategy at primary schools.

Declaration of competing interest

None.

Acknowledgements

The schools, parents and children are gratefully acknowledged for participating in the study. The students that assisted with data collection are thanked for their help: Marije Stoelinga, Annelies Hansen and Suzanne Berlang. Marlies Willemsen-Regelink is thanked for her input during the project.

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. For two strategies, passive consent was deemed sufficient due to the observational (non-medical) character of the studies. Parents were informed via different ways about the study aim and procedures and could object to participation of their child in the study.

Author contributions

GZ formulated and designed the study with input from SH and AH. GZ and SH coordinated the execution of the study. GZ and SH performed the data analyses. GZ and AH wrote the manuscript and SH provided feedback.

Funding

This work was supported by the Ministry of Agriculture, Nature and Food Quality (TU 16007) and the partners in this public private project: GroentenFruit Huis, Nestlé Nederland, GreenCo, VanRijsingencarrot-concepts, Vuurrood, Freshweb.nl, JOGG. Freshweb.nl provided the F&V for the participating fruit bowl schools. The funders had no role in the design, data analyses or writing of the manuscript.

Research data

Data will be made available on request.

References

Addessi, E., Galloway, A. T., Visalberghi, E., & Birch, L. L. (2005). Specific social influences on the acceptance of novel foods in 2–5-year-old children. *Appetite, 45*(3), 264–271. https://doi.org/10.1016/j.appet.2005.07.007

van Ansem, Wilke, J., Schrijvers, Carola, T., Rodenburg, G., Schuit, A. J., et al. (2013). School food policy at Dutch primary schools: Room for improvement? Cross-sectional findings from the INPACT study. *BMC Public Health, 13*. urn:nbn:nl:ui:31-e435100a-cbe6-4bd8-bbb1-732828351c65.

Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N., Norat, T., et al. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose-response meta-analysis of prospective studies. *International Journal of Epidemiology*. https://doi.org/10.1093/ije/dyw319

Bere, E., Hilsen, M., & Klepp, K.-I. (2010). Effect of the nationwide free school fruit scheme in Norway. *British Journal of Nutrition, 104*(4), 589–594. https://doi.org/10.1017/s0007114510000814

Blanchette, L., & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6–12-year-old children and effective interventions to increase consumption. *Journal of Human Nutrition and Dietetics, 18*(6), 431–443. https://doi.org/10.1111/j.1365-277X.2005.00648.x

British-Nutrition-Foundation. (2018). *Fruit and vegetables: What is a portion?*.

Clelland, T., Cushman, P., & Hawkins, J. (2013). Challenges of parental involvement within a health promoting school framework in New Zealand. *Educational Research International, 8*. https://doi.org/10.1155/2013/131636. *2013*.

Crawford, P. B., Obarzanek, E., Morrison, J., & Sabry, Z. I. (1994). Comparative advantage of 3-day food records over 24-hour recall and 5-day food frequency validated by observation of 9- and 10-year-old girls. *Journal of the American Dietetic Association, 94*(6), 626–630. https://doi.org/10.1016/0002-8223(94)90158-9

Cullen, K. W., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L., de Moor, et al. (2003). Availability, accessibility, and preferences for fruit, 100% fruit juice, and

vegetables influence children's dietary behavior. *Health Education & Behavior, 30*(5), 615–626. https://doi.org/10.1177/1090198103257254

De Irala-Estévez, J., Groth, M., Johansson, L., Oltersdorf, U., Prättälä, R., & Martínez-González, M. A. (2000). A systematic review of socio-economic differences in food habits in europe: Consumption of fruit and vegetables. *European Journal of Clinical Nutrition, 54*(9), 706–714. https://doi.org/10.1038/sj.ejcn.1601080

Donders-Engelen, M., Van der Heijden, L., & Hulshof, K. F. A. M. (2003). *Maten, gewichten en codenummers (portions, weights and code numbers)*. Zeist, The Netherlands: Joint publication of the Division of Human Nutrition Wageningen University & TNO Nutrition.

Evans, C. E., Christian, M. S., Cleghorn, C. L., Greenwood, D. C., & Cade, J. E. (2012). Systematic review and meta-analysis of school-based interventions to improve daily fruit and vegetable intake in children aged 5 to 12 y. *American Journal of Clinical Nutrition, 96*(4), 889–901. https://doi.org/10.3945/ajcn.111.030270

Greenhalgh, J., Dowey, A. J., Horne, P. J., Fergus Lowe, C., Griffiths, J. H., & Whitaker, C. J. (2009). Positive- and negative peer modelling effects on young children's consumption of novel blue foods. *Appetite, 52*(3), 646–653. https://doi.org/10.1016/j.appet.2009.02.016

Jongenelis, M. I., Pettigrew, S., Pratt, I. S., Wright, S., & Myers, G. (2017). Assessing parents' receptiveness to a vegetable-focussed in-school nutrition intervention. *Appetite, 117*(Supplement C), 359–364. https://doi.org/10.1016/j.appet.2017.07.017

van Kleef, E., Bruggers, Ilse, de Vet, & Emely. (2015). Encouraging vegetable intake as a snack among children: The influence of portion and unit size. *Public Health Nutrition, FirstView*, 1–6. https://doi.org/10.1017/S1368980015001329

Krølner, R., Rasmussen, M., Brug, J., Klepp, K.-I., Wind, M., & Due, P. (2011). Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part II: Qualitative studies. *International Journal of Behavioral Nutrition and Physical Activity, 8*(1), 112. https://doi.org/10.1186/1479-5868-8-112

Laureati, M., Bergamaschi, V., & Pagliarini, E. (2014). School-based intervention with children. Peer-modeling, reward and repeated exposure reduce food neophobia and increase liking of fruits and vegetables. *Appetite, 83*, 26–32. https://doi.org/10.1016/j.appet.2014.07.031, 0.

Lynch, C., Kristjansdottir, A. G., te Velde, S. J., Lien Nanna, R., Eva, T. I., et al. (2014). Fruit and vegetable consumption in a sample of 11-year-old children in ten European countries – the PRO GREENS cross-sectional survey. *Public Health Nutrition, 17*(11), 2436–2444. https://doi.org/10.1017/s1368980014001347

Meengs, J. S., Roe, L. S., & Rolls, B. J. (2012). Vegetable variety: An effective strategy to increase vegetable intake in adults. *Journal of the Academy of Nutrition and Dietetics, 112*(8), 1211–1215. https://doi.org/10.1016/j.jand.2012.05.013

Micha, R., Karageorgou, Dimitra, Bakogianni, Ioanna, Trichia, E., et al. (2018). Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. *PloS One, 13*(3). https://doi.org/10.1371/journal.pone.0194555. e0194555-e0194555.

Netherlands-Nutrition-Centre. (2015). *Gezond eten (Healthy eating)*.

Nicklaus, S., & Remy, E. (2013). Early origins of overeating: Tracking between early food habits and later eating patterns. *Current Obesity Reports, 2*(2), 179–184. https://doi.org/10.1007/s13679-013-0055-x

O'Connell, Meghan, L., Henderson, K. E., Luedicke, J., & Schwartz, M. B. (2012). Repeated exposure in a natural setting: A preschool intervention to increase vegetable consumption. *Journal of the Academy of Nutrition and Dietetics, 112*(2), 230–234. https://doi.org/10.1016/j.jada.2011.10.003

Ransley, J. K., Greenwood, D. C., Cade, J. E., Blenkinsop, S., Schagen, I., Teeman, D., et al. (2007). Does the school fruit and vegetable scheme improve children's diet? A non-randomised controlled trial. *Journal of Epidemiology & Community Health, 61*, 699–703.

Rasmussen, M., Krølner, R., Klepp, K.-I., Lytle, L., Brug, J., Bere, E., et al. (2006). Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *International Journal of Behavioral Nutrition and Physical Activity, 3*(1), 22. https://doi.org/10.1186/1479-5868-3-22

Rivm. (2010). *Gemeentelijk gezondheidsprofiel harderwijk (health profile of municipality harderwijk)*.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78.

Scriven, A., & Hodgins, M. (2011). *Health promotion settings: Principles and practice*. SAGE Publications.

Sharps, M., & Robinson, E. (2015). Perceived eating norms and vegetable consumption in children. *International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 135. https://doi.org/10.1186/s12966-015-0296-z

Slavin, J. L., & Lloyd, B. (2012). Health benefits of fruits and vegetables. *Advances in Nutrition, 3*(4), 506–516. https://doi.org/10.3945/an.112.002154

Sociaal-Cultureel-Planbureau. (2019). *Statusscores*.

Spill, M. K., Birch, L. L., Roe, L. S., & Rolls, B. J. (2011). Serving large portions of vegetable soup at the start of a meal affected children's energy and vegetable intake. *Appetite, 57*(1), 213–219. https://doi.org/10.1016/j.appet.2011.04.024

Steindl, C., Jonas, E., Sittenthaler, S., Traut-Mattausch, E., & Greenberg, J. (2015). Understanding psychological reactance: New developments and findings. *Zeitschrift fur Psychologie, 223*(4), 205–214. https://doi.org/10.1027/2151-2604/a000222

Thornton, L., Olstad, D., Lee, L., Karen, B., Kylie, Watson, R. R., et al. (2016). Chapter 1 - socioeconomic inequalities in fruit and vegetable intakes. In *Fruits, vegetables, and herbs* (pp. 3–22). Academic Press.

Van Rossum, C. T. M., Buurma-Rethans, E. J. M., Vennemann, F. B. C., Beukers, M., Brants, H. A. M., De Boer, E. J., et al. (2016). *The diet of the Dutch : Results of the first two years of the Dutch national food consumption survey 2012-2016 (2016-0082)*. Retrieved from Bilthoven:.

Who. (2004). *Fruit and vegetables for health: Report of a joint FAO/WHO workshop*. Japan: Retrieved from Kobe, ISBN 92 4 159281 8.

Yeh, M.-C., Obenchain, J., Viladrich, A., Watson, R. R., & Preedy, V. R. (2010). Chapter 6 - barriers and facilitating factors affecting fruit and vegetable consumption. In *Bioactive foods in promoting health* (pp. 85–98). San Diego: Academic Press.

Zeinstra, Gertrude, G., Renes, Reint, J., Koelen, Maria, A., et al. (2010). Offering choice and its effect on Dutch children's liking and consumption of vegetables: A randomized controlled trial. *American Journal of Clinical Nutrition, 91*(2), 349–356. https://doi.org/10.3945/ajcn.2009.28529