Int J Public Health 54 (2009) 142–149
1661-8556/09/030142-8
DOI 10.1007/s00038-009-8028-2


**Original article**

# Results from a dietary intervention study in preschools "Beastly Healthy at School"

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Submitted: 28 February 2008; revised: 21 September 2008; accepted: 31 January 2009

Published online first: 20 März 2009

**Abstract**

**Objective:** Applying the Intervention Mapping Protocol, an intervention was developed to assist Belgian preschools in the implementation of a healthy school food policy. In the present study the impact of the intervention on children's food consumption is investigated.

**Methods:** Teachers and parents from 16 schools (8 intervention; 8 control) were asked to participate in the study. Teachers registered the children's available food and beverages during the morning and afternoon breaks (data of baseline and follow-up was matched for 618 intervention and 445 control children). Parents were asked to complete a food frequency questionnaire on their children's general consumption (308 intervention and 168 control matches).

Linear mixed model analyses were used to investigate the intervention effect.

**Results:** Both assessment methods indicate an increased fruit consumption for intervention children in comparison with control children, although the effect was only significant for the parental reported fruit consumption. Additionally the results suggest that the change is mainly due to increased availability at school. No significant associations were found for the other food items (snacks, vegetables and different types of beverages).

**Conclusion:** The results indicate that a healthy food policy at school can improve young children's diet.

**Keywords:** Preschool – Fruit – Intervention – Snacks – School food policy – Beverages.

## Introduction

Good nutrition is especially important during the first years of life, since these are crucial years for normal physical and mental development. In addition, healthful eating habits in childhood not only help to prevent undernutrition, growth retardation and acute child nutrition problems, but also chronic, long-term health problems, such as obesity, coronary heart disease, type 2 diabetes and stroke.[1] Nevertheless, many preschool children in Flanders (Belgium) do not meet the recommended daily intake of fruit, vegetables, cereals and milk, while many children consume considerable amounts of sugared beverages and sugared & savoury snacks[2] indicating a need for actions to improve the diet of preschool children.

Early childhood education is free in Flanders from the age of 2.5 years onwards. More than 95 % of the children 2.5–3 years old already go to school, therefore schools are one of the best arena's to reach young children and their families for nutrition education and interventions. Furthermore, most children have their lunch (4 days a week) and one or two snack meals (5 days a week) at school. Moreover, evidence suggests that schools can make a difference[3, 4] and school based interventions can improve the diet of children.[5–7]

However, effective programs must be tailored to community needs and take into consideration factors concerning individuals such as cultural background.[8] Therefore a teacher training college developed an appropriate healthy eating intervention program for preschoolers in Flanders: "Beastly Healthy at School". The Intervention Mapping Protocol was

Int J Public Health 54 (2009) 142–149



**Table 1.** Main goals and strategies of the intervention "Beastly Healthy at School".

**Main goals**
- During school hours, preschoolers eat more servings of fruit and vegetables and drink more water and less sugared beverages.
- Preschoolers appreciate a variety of foods from different groups of the Active Food Triangle (Flemish, VIG) using all of their senses.
- Under teacher supervision preschoolers are able to examine their eating habits using the Active Food Triangle with justification of its importance.
- Under supervision preschoolers can adequately handle food.
- Preschoolers spontaneously apply rules of daily food hygiene.

**Main strategies to influence the child and the different environmental factors**

*Child*
- Guided and self-guided activities based on experiential education (e. g. tasting) and developmental education (e. g. explanation of concepts of food triangle)
- Role model, feed back and reinforcement by teachers
- Educational role-model story and characters
- Availability of healthy foods
- Availability of cooking equipment

*Parents*
- Newsletters
- Suggestions for the back and forth diary
- Work sheets and creations by children
- Parent evenings and other school activities with parents

*Teacher*
- Training sessions
- Manual including didactic and policy aspects
- Digital learning environment
- Newsletters
- Group discussions with teachers
- Examples of good practices

*School environment*
- Newsletters
- Training sessions for principals and cafeteria staff
- Help on demand via e-mail
- Examples of good practices
- Policy aspects in the teachers' manual
- Feedback to schools

used to target the intervention at the class and school level and the home environment. The main objectives were to increase the consumption of fruit, vegetables and water and to decrease the consumption of sugared milk drinks and fruit juice. A two-days training was given to the school staff. An educational package, including an educational map for the teachers, an educative story and educational material (e. g. life-size food education model based on the Flemish "Active Food Triangle") was developed. Food messages and newsletters directed at the school staff and parents were made available. An overview of the main goals and strategies are presented in table 1.

In the present paper the impact of the intervention after six months is investigated.

## Methods

*Sampling design*

Four hundred and three schools in East Flanders were asked by mail if they would be willing to participate in an intervention study to promote healthy eating, bearing in mind that there was a 50 % chance that they would be randomised to the control group: 40 schools agreed to participate. Eight control and eight intervention schools were randomly selected, stratified on school authority, location and size of the school. For one school in the intervention group, three departments at different locations participated.

*Measurements*

Data was collected in both intervention and control schools at the start of the program (September 2006) and six months later (March–April 2007).

Data on available snacks and drinks during midmorning and afternoon breaks were obtained from observational recording by the teachers at the beginning of the school day or before recess, prior to any food/drink being consumed. Data on the overall food consumption pattern of the children were obtained from the parents.

In Flemish schools there is a morning and afternoon break, the so-called 'eat-drink-toilet time', during which most children consume a snack and a beverage. In most preschools the snacks and drinks are consumed together in the classroom. Most drinks are pre-ordered and delivered by the schools, while most snacks are brought from home.

All teachers of the participating schools were provided with five registration templates to register the foods the children had available for consumption during the midmorning and afternoon breaks on a daily basis and this for one school week. Written instructions and a completed example were provided. On each template the teachers had to write the names of the children in order to be able to match baseline data with follow-up data.

Further the teachers had to mark the snacks and drinks the children had available on a predefined list (For food items: fresh fruit, dried fruit, vegetables, pastry & cake, bread, breakfast cereals, yoghurt & other milk snack, nuts, crisps, sweets and other. For beverages: chocolate milk, other sugared milk beverages, regular milk, soy beverages with/without flavour, sugared soft drinks, water and other beverages). For biscuits they had to write down the type and brand of biscuits the children brought with them and for fruits they had to indicate if the children brought it from home or received it at school. If a child was absent or did not have any snacks on a day, this had to be indicated at the appropriate box.

All parents of the preschoolers within the selected schools (n = 1 432 at the beginning of the school year) were asked to

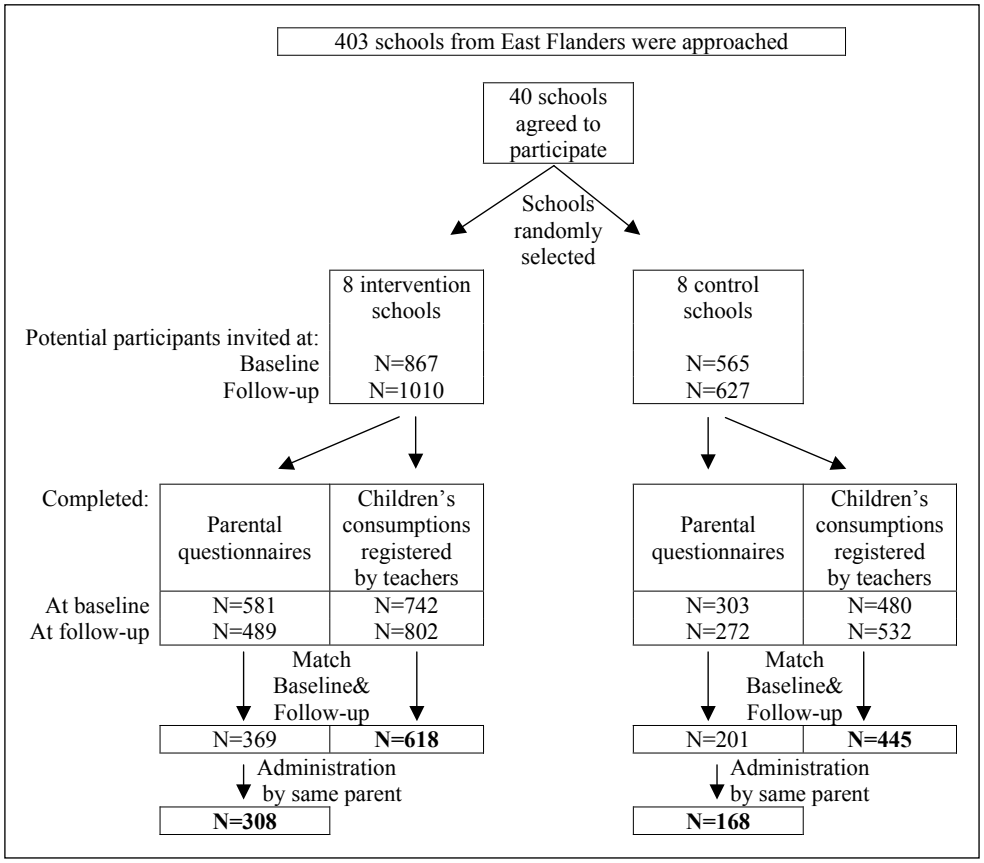


**Figure 1.** Response at the school level and response for the parental questionnaires and teachers' registrations at baseline and follow-up.

fill in a general questionnaire including socio-demographic information about the child, a food frequency questionnaire (FFQ) and questions related to the school food policy. It was explicitly asked that the parent who spent most time with the child outside school, would complete the questionnaire.

The FFQ contained questions on the average consumption of 47 food groups during the past year with as response options: "never or less than 1 day per month", "1–3 days per month", "1 day per week", "2–4 days per week", "5–6 days per week" and "every day". Additionally they were asked to select for each food group the average consumption on a day that it was consumed: for each item 3 to 4 portion sizes were defined (e. g., for fruit juice: "less than 200 ml", "between 200 and 400 ml", "between 400 and 600 ml", "more than 600 ml") and examples of standard measures were given (e. g. "1 glass = 150 ml", "1 carton = 200 ml", "1 mug = 225 ml)". A more in depth description of the FFQ has been given elsewhere.[9]

The school food policy questionnaire contained items relating to parents opinions about the school food policy in general (11 items, e. g., "parents should receive information about what the children learn about physical activity and nutrition"), opinions about restrictions at school (four items, e. g., "soft drinks should be forbidden at nursery schools"), being informed about the school food policy at THEIR CHILD'S school (two items, e. g., "I'm sufficiently informed about my child's food and physical activity learning activities") and satisfaction with the food policy at THEIR CHILD'S school (two items, e. g., "I'm satisfied with the school food policy at my child's school"). In addition, four items related to the child asking for healthy food(s) (e. g., "my child asks fruit or vegetables as a snack") and fifteen food-related activities at/from school (e. g. "my child prepares healthy items at school") were added at the second measurement occasion. Parents had to indicate their responses on a five-point scale ranging from (1) "completely disagree" to (5) "completely agree" for the first three scales or from (1) "never" to (5) "very often/always" for most items of the remaining scales. Chronbach's alpha's of the scales were respectively: 0.79, 0.63, 0.69, 0.53, 0.60, and 0.88.

Parental education was coded as follows: low = secondary school or less, medium = bachelor and high = bachelor with supplementary education or master.

*Analysis*

The primary outcome variables selected for analyses were the key items of the intervention, namely changes in consumption of fruit, vegetables, snacks (including pastry, savoury snacks and sweets) and different types of drinks.

Int J Public Health 54 (2009) 142–149



| | | Intervention N = 308 | Control N = 168 | *p* (chi-squared) |
|---|---|---|---|---|
| Gender | | | | |
| | Boys | 47 | 56 | 0.078 |
| | Girls | 53 | 44 | |
| Year of birth | | | | |
| | <2002 | 41 | 51 | 0.109 |
| | 2002 | 28 | 24 | |
| | ≥2003 | 31 | 26 | |
| Education mother | | | | |
| | Low | 49 | 49 | 0.971 |
| | Medium | 34 | 35 | |
| | High | 16 | 16 | |
| Education father | | | | |
| | Low | 60 | 57 | 0.598 |
| | Medium | 22 | 26 | |
| | High | 18 | 17 | |
| Completed by | | | | |
| | Mother | 94 | 95 | 0.620 |
| | Father | 6 | 5 | |

**Table 2.** Characteristics of the sample (%; parental questionnaire).

Data of the teachers' audits are expressed in average standard portions per day except for snacks, which are expressed in the number of days a snack was consumed divided by the number of days the child was present, as no information on consumed amounts were requested.

FFQ amounts were expressed in gram per day (for foods) or millilitre per day (for beverages).

Secondary outcome variables are the (changes in) parents' opinions about the school food policy. For this outcome variable, mean scores of the food policy scales were computed.

Descriptive statistics are presented for baseline and follow-up data, by condition (intervention versus control).

Linear mixed models (SPSS 15.0) were used to investigate the effect of the condition on changes in consumption and food policy aspects. For the variables of which no baseline information was available, follow-up data were compared.

Analyses of the FFQ were controlled for gender of the child and year of birth (< = 2001; 2003; > = 2004). No socio-demographic information was registered on the teachers' registration forms. *P*-values <0.05 are considered significant.

## Results

Of all children approached at baseline (n = 1 432) and follow-up (1 637), respectively 884 (62 %) and 761 (46 %) returned a completed questionnaire; of whom 570 could be matched. Only those completed by the same respondent at both measurement occasions were kept for analyses: 308 intervention children and 168 control children (Fig. 1).

Characteristics of the study sample are presented in Tab. 2. The majority (94.5 %) of the questionnaires included in the analyses was completed by the mothers of the children. The control group contained considerably (borderline significantly) more boys and children from the youngest age group.

The teachers registered data on 1 222 (85 %) children at baseline and on 1 334 (81 %) children at follow-up of which 1 063 could be matched: 618 intervention children and 445 control children.

Average daily consumptions as reported by the parents at baseline are presented in Fig. 2.

Data registered by the teachers are presented in Fig. 3.

On average, children are drinking mainly water, followed by natural milk, fruit juice, sugared milk drinks and sugared soft drinks (Fig. 2). Nevertheless, during school breaks the preferred drink was fruit juice, followed by sugared milk drinks, water and natural milk (Fig. 3). Sugared soft drinks were only consumed by a minority during school breaks.

For most items the consumption at baseline was quite similar between the control and intervention group, except for milk and fresh fruit during school breaks for which a considerable lower intake in intervention children is noticed at baseline. Furthermore, the consumption of most food groups reported by the parents during the second measurement was lower than at baseline (Fig. 2).

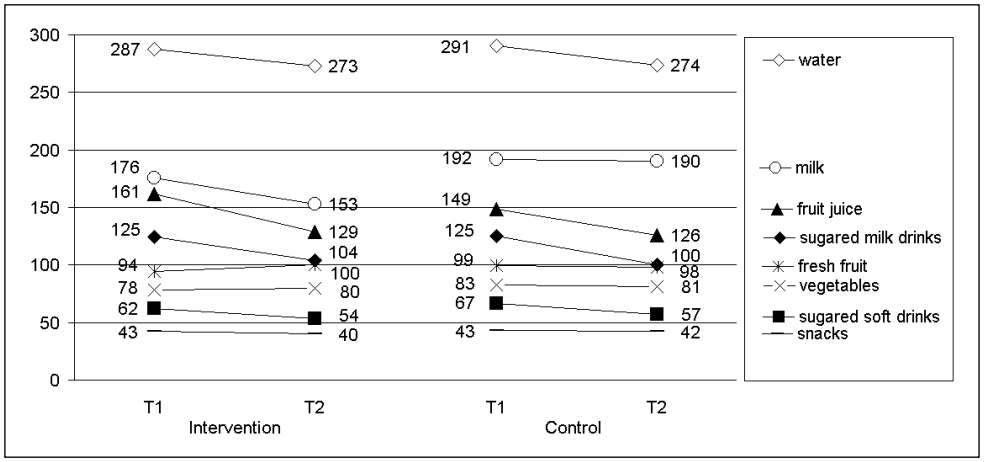


**Figure 2.** Average daily consumption (ml for beverages / g for food) at baseline (T1) and follow-up (T2) by condition (parental questionnaire).

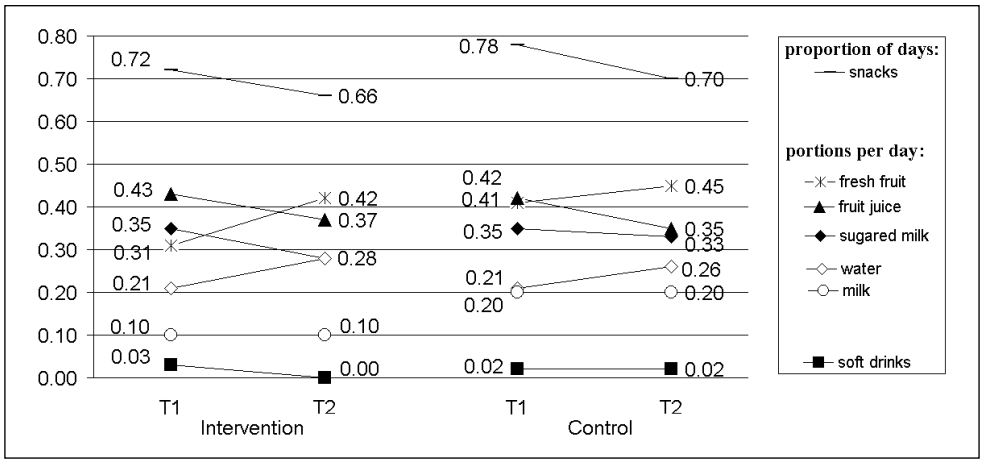


**Figure 3.** Average daily consumption during midmorning and afternoon breaks (teachers' audit) at baseline and follow-up.

Tab. 3 shows the estimated changes in consumption from baseline to follow-up by condition and the corresponding parameter estimates of the intervention effect. The results show an increased fruit consumption for intervention children in comparison with control children for both measurement methods, although the effect was only significant for the overall parental reported fruit consumption, and not for the teachers' audit. Also for the remaining items no significant associations with the intervention were found.

A more in depth analysis of fruit consumed at school, showed that this increase in consumption at school was due to an increase in fruit made available at school in intervention schools (parameter estimate intervention effect = 0.11 (95 % CI: 0.00–0.21) $p < 0.044$) and not due to an increase in fruit brought from home (intervention effect = –0.02 (95 % CI: –0.13–0.08) $p = 0.677$).

The averages on the food policy scales at baseline and follow-up are presented in Tab. 4. Parents from the intervention group report more food related actions at and from school, nevertheless, no significant effect on the children's request for healthy items is noticed.

Parents did also not change significantly differently in their general opinions about school food policy, restrictions or satisfaction with the school food policy. Nonetheless, all parameters were in the positive direction.

## Discussion

Schools are recognized as the platform for social, environmental and health initiatives aiming to engage, educate and influence the next generation.[10] In the present paper the impact of a school intervention on the dietary intake of preschool children is examined. To our knowledge this is the first study investigating the impact of a school food intervention in this young population of preschool children.

A significant positive intervention effect was only noticed for the consumption of fresh fruit: children from interven-

Int J Public Health 54 (2009) 142–149



**Table 3.** Estimated marginal means of the changes in consumption between baseline and follow-up by condition and parameter estimate of the intervention effect.

| | Intervention | | Control | | Parameter estimate for intervention effect | | |
|---|---|---|---|---|---|---|---|
| | Mean | SE | Mean | SE | (95% CI) | | *p* |
| Parental Reports: Average Daily Consumption | | | | | | | |
| Water (ml) | –19 | 12 | –20 | 15 | 1 | (–39–41) | 0.968 |
| Fruit juice (ml) | –29 | 12 | –19 | 14 | –10 | (–49–29) | 0.594 |
| Sugared soft drinks (ml) | –8 | 5 | –6 | 6 | –2 | (–17–14) | 0.822 |
| Sugared milk drinks (ml) | –22 | 7 | –31 | 10 | 9 | (–15–32) | 0.458 |
| Milk (ml) | –23 | 9 | 0 | 12 | –23 | (–51–5) | 0.106 |
| Fresh fruit (g) | 6 | 3 | –4 | 4 | 9 | (0–18) | 0.039 |
| Snacks (g) | –2 | 2 | –2 | 3 | –1 | (–9–7) | 0.819 |
| Vegetables (g) | –1 | 2 | –4 | 3 | 3 | (–5–11) | 0.485 |
| **Teachers' Audit: Portions per Day during Breaks** | | | | | | | |
| Water (ml) | 0.08 | 0.06 | 0.03 | 0.07 | 0.05 | (–0.14–0.23) | 0.581 |
| Fruit juice (ml) | –0.05 | 0.05 | –0.09 | 0.06 | 0.04 | (–0.13–0.20) | 0.629 |
| Sugared milk drinks (ml) | –0.07 | 0.05 | 0.00 | 0.06 | –0.07 | (–0.23–0.09) | 0.391 |
| Milk (ml) | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | (–0.04–0.05) | 0.841 |
| Fresh fruit (g) | 0.14 | 0.04 | 0.04 | 0.05 | 0.09 | (–0.04–0.23) | 0.161 |
| Snacks (g) | –0.07 | 0.03 | –0.09 | 0.03 | 0.02 | (–0.07–0.11) | 0.621 |

The models were adjusted for age and gender

**Table 4.** Means (SE) at baseline (T1) and follow-up (T2) by condition and parameter estimate (95% CI) of the intervention effect and significance of the effect.

| | | Intervention | | Control | | Parameter estimate intervention effect | | |
|---|---|---|---|---|---|---|---|---|
| | | Mean | SE | Mean | SE | B | 95%CI | p |
| opinions about school food policy in general | T1 | 4.09 | 0.02 | 4.09 | 0.04 | 0.06 | (–0.01–0.13) | 0.090 |
| | T2 | 4.11 | 0.02 | 4.04 | 0.03 | | | |
| opinions about restrictions | T1 | 3.32 | 0.04 | 3.51 | 0.06 | 0.04 | (–0.10–0.17) | 0.585 |
| | T2 | 3.29 | 0.05 | 3.46 | 0.07 | | | |
| being informed about school food policy | T1 | 3.77 | 0.04 | 3.60 | 0.07 | 0.07 | (–0.24–0.38) | 0.591 |
| | T2 | 3.96 | 0.04 | 3.76 | 0.06 | | | |
| satisfaction with school food policy of child's school | T1 | 3.81 | 0.04 | 3.69 | 0.05 | 0.17 | (–0.09–0.42) | 0.159 |
| | T2 | 3.94 | 0.04 | 3.69 | 0.06 | | | |
| child asking for healthy food | T2 | 2.62 | 0.04 | 2.44 | 0.05 | 0.15 | (–0.07–0.38) | 0.160 |
| food related actions at/from school | T2 | 3.20 | 0.03 | 2.86 | 0.05 | 0.29 | (0.08–0.51) | **0.011** |

tion schools increased their consumption in comparison with control children with 9.2 gram/d (95% CI: 0.4–18.0). A comparable but non significant effect (0.094 portions (95% CI: –0.042–0.230), or 0.094*120 gram per portion = 11.3 gram) was noticed for fruit consumed during morning and afternoon breaks at school, suggesting that the effect was mainly due to changes in fruit consumed at school. Moreover, our results indicate that this increase in fruit intake at school was primarily due to fruit made available in intervention schools, suggesting that mainly the practical approach, i.e. simply providing nutritious foods directly to young children caused changes in intake. The latter has already been shown an effective mean of promoting a healthier diet in the study of Fogarty et al.[11] In addition many parents (79%) indicated at baseline that it would be and advantage if a piece of fruit could be obtained at school on a daily basis (unpublished data).

Despite the positive effect of the intervention on the children's fruit consumption, no decrease in snack consumption was noticed. However snacks are mainly provided by the home environment and pursuing dietary changes in the

home environment is likely to be a greater challenge. Families' decisions about foods available in their home are shaped by a myriad of complex factors including taste preferences of family members, cultural preferences, and work or school schedules, therefore, occasional messages about healthy food choices to parents are not likely to be sufficiently powerful to change the family food environments.[12]

No significant associations with the different types of beverages were found. However since the start of the program no changes were made in the assortment of drinks available at school (this decision needs more time to be implemented and usually happens at the start of a school year). Therefore changes in beverage consumption were still mainly depending on the parents (and children's preferences).

Several limitations of the study should be noted. The "Beastly Healthy at school" programme was primarily funded to develop the health promotion intervention, hence, extra budget for the evaluation of the intervention and data collection was very limited. Therefore, this evaluation study depended mainly on school staff's and parents' willingness and efforts to fill in questionnaires and observation sheets. Nonetheless, autonomic completion of the forms by the teachers might offer several additional advantages. Firstly, it is likely less intrusive than a daily visit by an external researcher in the classroom, especially in this young age group. Secondly, teachers in Flanders have quite some experience with registrations (e. g. absences, food and beverages consumed at school). Thirdly, the registrations resulted in a lower drop out than the parental questionnaires, which in its turn offers some possibilities for attrition analysis of the parental questionnaires.

Parentally completed food frequency questionnaires have been shown to provide reasonable accurate estimates of fruit intake in children of this age.[13] Moreover in the study of Parrish *et al*.[14] meal providers in addition to the parents did not seem to compromise the validity of the parental reported FFQ in preschool children. On the other hand, it is noteworthy that the consumption of most food groups was lower at the second measurement which might be due to underreporting caused by high burdensomeness and measurement fatigue[15] especially when this type of questionnaire has to be completed a second time within a short time period. This decrease in reported intake in subsequent administrations has been noted in several other studies.[15–20] Another limitation of the large food frequency questionnaire is the lower response rate, which might be due to the large efforts required to complete the questionnaire. Berg et al. reported that for sensitive topics and/or when large efforts are required, the risk of low response rate and herewith selection bias is great.[21] Comparison of the teachers' registrations between those included in the analyses versus those not included resulted in no significant difference for fruit juice, milk, sugared milk beverages and snacks; however a lower intake of water and fruit was registered for the non-participants.

A further limitation is that the teachers registered what type of snacks and drinks children had available rather than what they actually consumed, as such food wastage or swapping by the children was not considered.

Finally data of the second measurement were already collected after six months of intervention, while adaptations in the school (food) policy and the successful transfer of the healthy food messages to the school staff and the parents might be a process that requires much more time. Appropriate communication strategies are necessary to convince all actors that they all have responsibility in the successful implementation of the new policy. Additionally schools differ substantially in these communication strategies: some have a very democratic style, while in other schools the communication is much more top-down. These communication styles definitely had an impact on the implementation of the intervention in the different schools. In addition all schools had different starting points and could have emphasized different aspects according to their own expectations and adapted to their own situation.

An important strength of the study is the use of two independent assessment instruments, namely the parental questionnaire and the teachers' audit.

To conclude, structural forces and sources ensuring a healthy food policy at school are an important way to improve the healthiness of young children's diet. From the present study it could be concluded that the availability of healthy foods like fruit at school can stimulate the consumption of those healthy foods among young children. Although this (short-term) study already showed a positive effect of this "Beastly Healthy at School" dietary programme, further research over a longer time-period is needed in order to investigate the long-term effect of healthy food policies on preschool children's diet.

*Acknowledgements*

The development of the intervention was funded by the PWO(Project-related Scientific Research)-funding of University College Arteveldehogeschool. Funds for the evaluation were provided by the Provincial Government East-Flanders. Carine Vereecken is a postdoctoral researcher funded by the Research Foundation–Flanders (FWO–Flanders).

Further, the authors would like to thank Leen Lambrecht and Bianca Van Eeckhout, last year students Nutrition and Dietetics, University College Ghent, for their assistance with data collection, as well as the school principals, teachers and parents who participated in the study.

Int J Public Health 54 (2009) 142–149



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