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Free school fruit—sustained effect 1 year later

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Abstract

This study reports the effect of a school-randomized fruit and vegetable intervention consisting of a subscription to the Norwegian School Fruit Programme at no parental cost, and the Fruit and Vegetables Make the Marks (FVMM) educational programme, both delivered in the school year of 2001–02. Nine randomly chosen schools received the intervention and 10 schools served as control schools. Participating pupils completed questionnaires at baseline (September 2001), at Follow-up 1 (May–June 2002) and at Follow-up 2 (May 2003). A total of 517 pupils (84%; mean age, 11.3 years at baseline) participated in all three surveys. At both Follow-up 1 and Follow-up 2, strong intervention effects were observed for all-day fruit and vegetable intake (effect sizes were 0.6 and 0.5 portions, respectively). The sustained effect at Follow-up 2, 1 year after the end of the intervention, can partly be explained by greater participation rates in the School Fruit Programme (standard paid subscription). We conclude that the effects observed are most likely due to the no-cost subscription and not due to the FVMM educational programme, and that providing pupils with a piece of fruit or a vegetable at school at no cost for the parents is an effective strategy to increase school children's intake of fruit and vegetables. The effect is also sustained 1 year after the end of the no-cost subscription, providing increased health benefits.

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Introduction

Norwegian children eat less fruit and vegetables than the national five-a-day recommendation [1, 2], and also less than most other European children [3].

Elementary school children in Norway bring their own lunch (usually sandwiches) to school. Very few elementary schools have canteens, and traditionally fruit and vegetables have not been available at school. To increase the pupils' intake of fruit and vegetables, a School Fruit Programme, organized by The Norwegian Fruit and Vegetable Marketing Board and the Directorate for Health and Social Affairs, Department for Nutrition, is now offered to all Norwegian elementary schools [4]. The pupils receive a piece of fruit or a carrot each school day, usually in connection with their lunch. The cost for the parents was (in the school year 2001–02) NOK 2.50 per school day (~EUR 0.30), and is still the same (2005). The programme is subsidized by the Norwegian Government by NOK 1.00 per pupil per school day. A problem with the programme is low participation. Only 28% of the schools participate (school year 2003–04), and in the participating schools usually <50% of the pupils subscribe. In addition, as smaller schools tend to participate more often than larger schools, participating pupils represent only 9% of the total Norwegian school population (grades 1–10), and

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therefore, the effect of the programme is limited. A second problem is that participating pupils tend to be a healthier group than non-participating pupils; they eat more fruit and vegetables before the programme starts, they eat less unhealthy snacks and their parents are less likely to smoke [5].

Elementary school attendance in Norway is supposed to be at no cost to the parents, and therefore, several schools opt not to take part in the School Fruit Programme. A school that participates in the programme makes fruit and vegetables available at school for the pupils. The fruit and vegetables are not, however, accessible to the pupils before they and their parents decide to participate. If the programme could be offered at no cost to the parents, fruit and vegetables would be accessible for all pupils at school. No-cost subscription in the School Fruit Programme has shown to be very successful in increasing seventh graders' consumption of fruit and vegetables [5].

A major challenge in intervention research is achieving sustainable effects lasting longer than the intervention period, providing larger health benefits. Several school-based fruit and vegetable intervention studies have reported significant, but usually not very strong, increases in children's fruit and vegetable intake [6, 7]. However, long-term persistence of the effects has previously been reported to be [8], and still are, unknown.

We have reported that the Fruit and Vegetables Make the Marks (FVMM) educational programme did not have any effect on fruit and vegetable intake at the end of the intervention, or 1 year later [9].

The purpose of the present paper is to present the effect of an intervention consisting of the Norwegian School Fruit Programme provided at no cost for the parents in addition to the FVMM educational programme, at the end of the intervention and 1 year after the end of the intervention.

Method

The study sample presented in this paper is part of a larger cohort, the FVMM cohort. This cohort consists of pupils who were in sixth and seventh grade classes during the school year of 2001–02 in 38 schools in two Norwegian counties, Hedmark and Telemark. Two parallel intervention studies, one in each county, were conducted in sixth grade classes during this school year. This paper evaluates the intervention conducted in Hedmark County. The parallel intervention conducted in Telemark County is presented elsewhere [9].

Design and procedure

Of 24 randomly chosen schools in Hedmark County in Norway, 19 schools agreed to participate in the FVMM project. These schools were then randomly assigned to an intervention group or a control group. Three surveys were conducted; baseline (September 2001), Follow-up 1 (May–June 2002) and Follow-up 2 (May 2003). Each time, a survey questionnaire was completed by the pupils in their classrooms in the presence of a trained project worker who guided the pupils through the dietary assessment component (24-hour recall) of the survey. One school lesson (45 min) was used to complete the questionnaire. All participating pupils brought home a parent questionnaire to be completed by a parent at each survey. Informed consent was sought from children and their parents prior to the study. Ethical approval and research clearance was obtained from The National Committees for Research Ethics in Norway and from The Norwegian Social Science Data Services.

Study sample

A total of 618 sixth graders and their parents were invited to participate. Parents of 14 children refused to participate; 27 children did not attend class at the time of the baseline survey, and they were not re-contacted. Of the 577 pupils who participated at baseline, 59 pupils were not able, for various reasons, to participate at Follow-up 1 or Follow-up 2 and one pupil was excluded due to inconsistent responses. Thus, 517 children (84%) completed all three surveys and composed the study sample employed in this paper; 271 boys and 246 girls, 286 pupils in the intervention group and 231 in the control group. Average age was 11.3 years at baseline, 12.0 at Follow-up 1 and 13.0 at Follow-up 2. Of these, 431

pupils also had a parent/guardian who participated in the baseline survey; 84% were mothers/female guardians and the average parental age was 40.0 years.

Intervention programme

Year 1

The intervention given to all nine intervention schools consisted of the FVMM educational programme described elsewhere [9], and subscription in the Norwegian School Fruit Programme at no cost to the parents. The curriculum was delivered from October 2001 to April 2002. The subscription programme started in October 2001 and lasted throughout the school year (i.e. June 2002).

Year 2

Of the nine intervention schools, four schools continued to participate in the standard School Fruit Programme (abbreviated: Paid fruit) the subsequent school year (Year 2), while the other five schools opted not to take part in the programme (abbreviated: No fruit). Therefore, we were able to evaluate the effect of available fruit and vegetables (Paid fruit) compared with no fruit and vegetables available (No fruit) at school the year after the free school fruit intervention. The Year 2 subscription programme started in October 2002 and lasted throughout the school year (i.e. June 2003).

Instruments

Separate questionnaires were designed for the pupils and their parents. The questionnaires included a 24-hour fruit and vegetable recall, food frequency questions, questions assessing the pupils' preferences for fruit and vegetables and demographic questions.

A written 24-hour fruit and vegetable recall was used to assess pupils' fruit and vegetable intake. The 24-hour recall was read aloud to the pupils by a project worker. Fruit and vegetable intake the previous day was recorded for school days (i.e. the survey was conducted on weekdays, Tuesday through Friday). The 24-hour recall separated the day into five time periods (before school, at school, after school, at dinner and after dinner). The pupils recalled the types of fruit and vegetables they ate at the different time periods in household measures (e.g. 1 apple, 12 grapes) or in portions (e.g. one portion of mixed green salad). The household measures were coded into portions per day, and one portion was set at ~80 g [ranging from 65 (one carrot) to 105 g (one apple/one orange)]. The conversions from household measures to portions were based on household measures and food weights published by The Norwegian National Association for Nutrition and Health [10]. Juices and potatoes were not included in the fruit and vegetable calculations. Measures of the pupils' fruit and vegetable intake at school (abbreviated: FV at school) and their total fruit and vegetable intake (abbreviated: FV all day) are used in this paper to assess the intervention effect on fruit and vegetable intake. In a prior test–re-test study, the 24-hour recall provided consistent responses over a 14-day test–re-test period [11]. In a validation study, same-age pupils were capable of recalling the previous day's intake of vegetables, but overestimated their fruit intake compared with the validation method (7 days recording of pre-coded diaries) [11].

Habitual fruit and vegetable intake was measured by a sum-score of four fruit and vegetable frequency questions. Preferences for fruit and vegetables were assessed by a sum-score of four questionnaire items. Both scales have been previously well tested and described [11–13]. In the present paper, these scales were dichotomized (50th percentile) at baseline to assess the potential interaction between the intervention condition and habitual fruit and vegetable intake and preferences.

The pupils also recorded their gender. Their parents recorded their own educational level (lower: no college or university education; higher: having attended college or university) and household income (dichotomized at 50th percentile).

Statistical analysis

Of the study sample, some pupils (9 at baseline, 51 at Follow-up 1 and 15 at Follow-up 2) did not attend school the day before the survey day. Therefore, they were excluded from the respective

FV at school analyses, but they were included in all other analyses presented in this paper.

The effects of the intervention were analysed on follow-up values by mixed-model regression (the Linear Mixed Models procedure, SPSS 12.0). In addition to condition, the models included baseline score, pupil's gender and school (random, nested within condition). Additional adjustments were made for pupils' habitual fruit and vegetable intake, preferences, parent's educational level and household income. We tested for interaction effects between condition and pupil's gender, habitual fruit and vegetable intake, preferences, parent's educational level and household income. The residuals were examined and the model assumptions were met.

For assessing potential differences between pupils participating in all three surveys, and those not participating in all surveys (attrition analyses), the two-sample *t*-test was used to compare baseline values of FV at school, FV all day, habitual fruit and vegetable intake, preferences and household income and the χ^2 for comparison of parental education level.

Results

In Year 1, 100% of the intervention pupils participated (for free) in the School Fruit Programme, while 11% of the control pupils subscribed (Table I). In Year 2, 31% of the pupils in the intervention group and 7% of the control pupils subscribed (Table I).

At baseline, the intervention and control groups did not differ as regards FV at school or FV all day (Table II). At Follow-up 1, strong intervention effects were observed both for FV at school and FV all day (Table II). The average fruit and vegetable intake was 0.6 portions higher in the intervention group than the control group both at school and all day. At Follow-up 2, 1 year after the end of the intervention, significant differences between intervention and control groups were sustained for FV all day (effect size was 0.5 portions). Intervention pupils also still tended to eat more FV at school than control pupils (effect size was 0.2 portions, $P = 0.07$). Additional adjustments for parent's educational level, household income, habitual fruit and vegetable intake and FV preferences did not change these results, and no interactions were found between condition and these variables (data not shown).

In Year 2, four of the nine intervention schools (that were all participating for free in Year 1) took part in the School Fruit Programme at standard conditions (Paid fruit group), and a total of 90 pupils participated in the programme, representing 66% of the pupils in the Paid fruit group (Table I). Pupils participating in the programme were not significantly different from pupils not participating with respect to household income or parental

Table I. *Design, study participation and subscription rates in the School Fruit Programme: sixth grade classes in Hedmark County in the FVMM project*

Group		FVMM	School Fruit Programme		
		educational programme	Schools participating	Pupils subscribing	Percentage of subscribing pupils[a]
Intervention (nine schools, $n = 286$)	Year 1	×	9	286	100/100
	Year 2	—	4	90	66/31
Control (10 schools, $n = 231$)	Year 1	—	2	25	43/11
	Year 2	—	3	17	21/7

[a]Percentage of subscribing pupils at schools participating in the School Fruit Programme divided by percentage of subscribing pupil of total pupils in the group.

Table II. *Effect of the intervention on FV at school and FV all day*

Survey	Group	FV at school			FV all day		
		Crude mean	Adjusted mean[a]	CI	Crude mean	Adjusted mean[a]	CI
Baseline	Intervention	0.37	0.30	(0.11, 0.49)	2.22	2.19	(1.78, 2.59)
	Control	0.39	0.37	(0.19, 0.55)	2.54	2.52	(2.12, 2.91)
	P-value		0.58			0.23	
Follow-up 1	Intervention	0.86	0.84	(0.68, 1.00)	2.42	2.47	(2.11, 2.83)
	Control	0.28	0.27	(0.11, 0.43)	1.92	1.84	(1.49, 2.19)
	P-value		<0.001			0.02	
Follow-up 2	Intervention	0.41	0.39	(0.23, 0.54)	2.09	2.09	(1.76, 2.42)
	Control	0.21	0.18	(0.04, 0.33)	1.64	1.57	(1.24, 1.89)
	P-value		0.07			0.03	

Intervention group $n = 286$, control group $n = 231$.
[a]Linear Mixed Models adjusted for gender and school as a random factor nested within condition. Follow-up models are also adjusted for baseline scores.

educational level ($P = 0.08$ and $P = 0.63$, respectively). The remaining five intervention schools opted not to take part in the programme in Year 2 (No fruit group). At baseline, the Paid fruit and No fruit groups did not significantly differ according to FV at school or FV all day (Table III). The effect of the Year 1 intervention was not significantly different between the Paid fruit and No fruit groups (Follow-up 1 values adjusted for baseline values) (Table III). At Follow-up 2, positive effects of schools participating in the School Fruit Programme was seen for FV at school; pupils at Paid fruit schools ate 0.4 portions more FV at school than pupils at No fruit schools (Table III). Additional adjustments for parent's educational level, household income, habitual fruit and vegetable intake and FV preferences did not change these results, and no interactions were found between condition and these variables for FV at school (data not shown). An interaction was, however, observed between group and gender for FV all day, and therefore, the FV all day analyses were stratified by gender (Table III). A positive effect of school participation in the School Fruit Programme at standard conditions in Year 2 was seen for FV all day for boys but not for girls. At Follow-up 2, boys at Paid fruit schools ate ~0.7 portions more fruit and vegetables than boys at No fruit schools, but this difference was not statistically significant due to low statistical power.

No statistically significant differences in baseline data between pupils participating in all three surveys ($n = 577$) and pupils not participating in all surveys ($n = 60$) were seen for FV at school, FV all day, habitual fruit and vegetable intake, FV preferences, parent's educational level or household income.

Discussion

The present intervention consisting of a 1-year subscription in the Norwegian School Fruit Programme at no cost and the FVMM educational programme clearly increased intervention pupils' fruit and vegetable intake, both at school and all day, compared with pupils at control schools. The adjusted mean difference was 0.6 portions both at school and all day. The effect was sustained 1 year after the end of the intervention (FV all day adjusted mean difference was 0.5 portions). The sustained effect at Year 2 can partly be explained by different participation rates in the School Fruit Programme between the intervention and the control groups, as the participation rate in the intervention group was more than three times greater than the participation

Table III. *Effect of intervention schools taking part in the Norwegian School Fruit Programme (Paid fruit) in Year 2 compared with intervention schools not participating in the programme (No fruit) on FV at school and FV all day*

Survey	Group	FV at school			Sex	Group	FV all day		
		Crude mean	Adjusted mean[a]	CI			Crude mean	Adjusted mean[a]	CI
Baseline	Paid fruit	0.48	0.40	(0.08, 0.71)	Boys	Paid fruit	1.96	1.96	(1.55, 2.37)
	No fruit	0.27	0.21	(−0.08, 0.49)		No fruit	1.63	1.63	(1.24, 2.03)
	P-value		0.33			*P*-value		0.26	
					Girls	Paid fruit	2.77	2.77	(1.75, 3.79)
						No fruit	2.66	2.63	(1.59, 3.66)
						P-value		0.77	
Follow-up 1	Paid fruit	0.82	0.81	(0.42, 1.21)	Boys	Paid fruit	1.88	1.82	(1.42, 2.22)
	No fruit	0.89	0.82	(0.47, 1.18)		No fruit	2.29	2.35	(1.96, 2.73)
	P-value		0.97			*P*-value		0.06	
					Girls	Paid fruit	2.63	2.61	(2.14, 3.09)
						No fruit	2.92	2.98	(2.53, 3.43)
						P-value		0.28	
Follow-up 2	Paid fruit	0.65	0.60	(0.33, 0.87)	Boys	Paid fruit	2.28	2.02	(1.15, 2.89)
	No fruit	0.19	0.20	(−0.04, 0.44)		No fruit	1.35	1.36	(0.57, 2.15)
	P-value		0.04			*P*-value		0.22	
					Girls	Paid fruit	2.45	2.44	(2.00, 2.87)
						No fruit	2.42	2.47	(2.05, 2.88)
						P-value		0.92	

Paid fruit group $n = 136$ (boys $n = 73$, girls $n = 63$), No fruit group $n = 150$ (boys $n = 79$, girls $n = 71$).
[a]Linear Mixed Models adjusted for gender and school as a random factor nested within condition. Follow-up 1 and Follow-up 2 analyses are also adjusted for baseline scores.

rate in the control group—and also more than three times greater than the participation rate in the Norwegian population in general.

At Follow-up 2, the pupils at the Paid fruit schools reported eating 0.4 portions more fruit and vegetables at school than the pupils at the No fruit schools, further indicating that the sustained effect was due to participation in the School Fruit Programme. The significant interaction observed between Year 2 school participation in the school fruit programme and gender in the FV all day analysis (Table III) is an important finding. While the main effects of the intervention (Table II) did not differ between boys and girls, it seems that girls sustain their elevated intake more than boys, whether or not their school participated in the School Fruit Programme the subsequent year. On the other hand, boys at schools not taking part in the School Fruit Programme in Year 2 seem to decrease their intake of FV all day compared with boys at schools participating in the School Fruit Programme. This indicates that boys need an elevated accessibility of fruit and vegetables more than girls, in order to sustain the increased intake level. We did not, however, observe such a gender interaction for FV at school. The effect among the boys was large, but still not statistically significant, and in addition, the (Year 1) intervention schools decided themselves whether or not to take part in the School Fruit Program at standard conditions in Year 2. The Paid fruit and No fruit groups in Year 2 were therefore self-selected, and there are possibilities that the schools in the two groups differ. However, the interaction is especially interesting because boys tend to engage in more unhealthy behaviours than girls do, and as free school fruit is effective in increasing boys' (in addition to girls') intake of fruit and vegetables, it should be further investigated whether boys need 'extra help' to sustain a changed food behaviour more than girls do.

In the FVMM cohort there were rather large differences in the baseline fruit and vegetable intake

between boys and girls, as can be seen from Table III. Others have also found that there are clear gender differences among adults in fruit and vegetable intake, and women clearly eat more than men [14, 15]. Boys and men therefore are in greater need for increasing their intake. In addition, girls have been reported to be more receptive to increasing their vegetable consumption due to an intervention [16]. As no interaction between gender and intervention condition was found for the main intervention (free school fruit and the FVMM educational programme, Year 1), the effect of this intervention did not differ between genders, and it clearly shows that it is possible to increase both boys' and girls' intake compared with a control condition.

The effect of the intervention also did not differ among subgroups according to parental educational level, household income, baseline habitual fruit and vegetable intake or preferences for fruit and vegetables. This indicates that the intervention is an effective strategy for reaching all pupils, particularly those that need it the most, such as pupils of low social economic status families and pupils with low habitual intake and preferences.

The present results of the combined intervention of school fruit at no cost for the parents and the FVMM educational programme showed effect sizes in magnitudes of what previously has been reported for free participation in the School Fruit Programme alone [5]. The FVMM educational programme alone has, on the other hand, been found not to be effective in increasing pupils' FV at school or FV all day [9]. The degree of implementation of the FVMM educational programme was similar in the present study as in the parallel study where the FVMM educational programme was the only intervention component (data not shown). However, the pupils' enjoyment of the curriculum was higher in the present study; 4.2 versus 3.3 on a scale ranging from -5 to 8 ($P = 0.001$). The curriculum enjoyment scale is described elsewhere [9]. We conclude that the effects reported in this paper primarily are due to the no-cost subscription and not due to the FVMM educational programme. However, it could also, in part, be due to a possible interaction effect of the combination of free fruit and the FVMM educational programmes, as indicated by higher enjoyment of the curriculum when also given free fruit.

The strength of this study is that it is a school-randomized study [17] including a rather large number of schools. In addition, a high proportion (85%) of the eligible pupils participated in all three surveys, and no differences were seen between the drop-outs and the study sample.

Conclusion

Providing pupils with a piece of fruit or a vegetable at school at no cost to their parents is an effective strategy to increase school children's intake of fruit and vegetables. The effect is sustained 1 year after the end of the no-cost subscription, partly explained by increased subscription rate in the (paid) School Fruit Programme. Further research is needed to evaluate whether long-term habits have been created.

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