

Effect of the nationwide free school fruit scheme in Norway

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In Norway, children and adolescents consume only about half of the national five-a-day recommendation. There are also rather large social inequalities in health, and in eating behaviours. In order to increase fruit and vegetable (FV) intake, a subscription programme was initiated in 1996 and made nationwide in 2003, and a free programme (without parental payment) has been implemented nationwide from 2007. The objective of the present study is to evaluate the effect of these efforts. Pupils in the sixth and seventh grades (age 10–12 years) at twenty-seven schools responded to a questionnaire in 2001 (*n* 1488, 85 %) and in 2008 (*n* 1339, 78 %). FV intake was measured by a 24-h recall. In 2001, none of the schools had any organised school fruit programme. In 2008, five schools participated in the free school fruit programme, ten schools participated in the subscription programme and twelve schools did not participate in any official programme. The increases in fruit intake at school were 0.49, 0.29 and 0.18 portions/school day, respectively, for the Free Fruit 08, Subscription 08 and No Programme 08 schools (time × group $P < 0.001$), and 0.74, 0.39 and 0.16 portions/d for fruit intake all day (time × group $P = 0.04$). No group effect was observed for vegetable intake. There has been an increase in pupils' fruit intake from 2001 to 2008 in Norway, and the school fruit programmes seem to have been effective. A great challenge remains in increasing vegetable intake.

School fruit: Intervention: Fruits and vegetables: Adolescents

A diet high in fruits and vegetables (FV) is inversely related to several chronic diseases⁽¹⁾, and an increased intake would improve global public health⁽²⁾. In Norway, children and adolescents consume only about half of the national five-a-day recommendation⁽³⁾. As food preferences and habits established in childhood to a large extent tend to be maintained into adulthood^(4,5), and in order to achieve maximum preventive potential, it is important to get children to eat more FV.

The national Norwegian authorities have made considerable efforts to increase school children's FV intake at school over the last few years. A subscription programme for grades 1–10 was initiated in 1996, and was made nationwide in 2003 in collaboration with the Norwegian Marketing Board for Fruits and Vegetables. In this programme, the schools initially choose to participate or not, and then the pupils at the participating schools can decide to subscribe or not. The cost for the parents is currently Norwegian Krone 2.50 per school day (approximately €0.30). The pupils who subscribe receive a piece of fruit or a carrot each school day, usually in connection with their lunch meal. The programme is subsidised by the Norwegian Government with Norwegian Krone 1.00 per pupil per school day.

The subscription programme and a free pilot version of the same programme (without parental payment) were evaluated in the research project Fruits and Vegetables Make the Marks. In a school-randomised trial including thirty-eight schools, a cohort of 1950 pupils (initially in the sixth and seventh grades) was followed from school year 2001/02 to

school year 2004/05 (cohort I, Table 1). The results reported were that both programmes increased FV intake, but that the free programme was much more effective than the subscription programme (effect sizes were 0.9 and 0.2 portions/d on FV intake at school, respectively, compared with control schools)⁽⁶⁾, and that 1 year of free school fruit also had a positive long-term effect on adolescents' FV intake both at 1⁽⁷⁾ and 3 years⁽⁸⁾ after the end of the free fruit intervention (effect sizes on FV intake all day were about 0.5 and 0.4 portions/d, respectively, compared with control schools). The subscription programme tended to increase social disparities^(6,9), while the free fruit pilot programme was effective in increasing FV intake among all groups including boys and children of parents without higher education^(6–9).

Only a few similar interventions, providing free or subsidised FV at school, have been evaluated, and their results have been published internationally. Two recent review studies have reported that such interventions in general tend to be effective in increasing pupils' FV intake^(10,11).

Despite the Norwegian welfare state and the large Norwegian gross domestic product per capita, there are large social inequalities in health in Norway⁽¹²⁾. Social inequalities are also seen in health-related behaviours such as eating behaviours, and among adolescents in Norway, rather large sex⁽¹³⁾ and socio-economic⁽¹⁴⁾ disparities in FV intake have been reported. For example, boys have been reported to eat FV 11.9 times/week, compared with 14.5 times/week for girls⁽¹³⁾, and adolescents of parents with higher education

Abbreviation: FV, fruits and vegetables.

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Table 1. Description of the two different study designs for evaluating different school fruit programmes in Norway (Hedmark and Telemark counties) within the Fruits and Vegetables Make the Marks project: (I) a longitudinal design (cohort I), evaluated by Bere *et al.*^(6–8), and (II) two repeated cross-sectional surveys within the same schools (cohort I v. cohort II), which is the study sample of the present study

Cohort I (thirty-eight schools, <i>n</i> 1950)*	Cohort II (twenty-seven schools, <i>n</i> 1339)
Baseline survey 2001	Intervention: Subscription programme† Free fruit nationwide‡
Intervention Subscription programme† Free fruit pilot§ Follow-up surveys 2002 ⁽⁶⁾ , 2003 ⁽⁷⁾ , 2005 ⁽⁸⁾	First survey 2008

*Of which, twenty-seven schools also participated in the 2008 survey (cohort II). *n* 1488 in these twenty-seven schools.

†The subscription programme (grades 1–10) was initiated in 1996 and made nationwide in 2003. In Hedmark and Telemark counties, this programme was initiated in 2001.

§A free fruit programme was implemented nationwide in all secondary elementary schools (grades 8–10) and all combined schools (grades 1–10) in Norway from autumn 2007.

‡A free school fruit pilot programme was implemented within nine elementary schools (grades 1–7) during the school year 2001/02.

have been reported to eat more FV than adolescents of parents without higher education. This disparity is increasing with age, 14.0 v. 12.8 times/week at age 12.5 years and 15.1 v. 12.7 times/week at age 15.5 years⁽¹⁴⁾. There is a governmental desire to reduce these inequalities, and a free school fruit programme has been suggested as an effective means of achieving this goal since all adolescents attend school⁽¹⁵⁾.

From autumn 2007, an official free school fruit programme (without parental payment) was implemented in all secondary elementary schools (grades 8–10) and all combined schools (grades 1–10) in Norway. Indeed, it is now legally established that all pupils in secondary schools are entitled to a free piece of fruit or vegetable every school day⁽¹⁶⁾. The subscription programme, with parental payment, still runs in primary/elementary schools (grades 1–7). A new repeated cross-sectional survey was conducted within the Fruits and Vegetables Make the Marks project at the same schools in 2008 (cohort II, Table 1), making it possible to evaluate the effect of the nationwide implementation of the free school fruit programme.

The main objective of the present study is to evaluate the effect of the nationwide implementation of the free school fruit programme on adolescents' FV intake by comparing cohort I (2001) with cohort II (2008). In addition, the effect of the efforts will be assessed in relation to sex and socio-economic status.

Experimental methods

Design and study sample

In 2001, forty-eight schools from Hedmark and Telemark counties (twenty-four schools in each county) were randomly selected and invited to participate in the research project Fruits and Vegetables Make the Marks, and nineteen schools from each county agreed to participate. All sixth and seventh

graders (age 10–12 years) in these thirty-eight schools were invited to take part in a questionnaire survey (which was the baseline survey for cohort I, see Table 1)^(6,7,17). These thirty-eight schools were contacted again in 2008, and were invited to participate once more in a similar survey. At that time, twenty-seven schools agreed to participate, and all sixth and seventh graders in these twenty-seven schools were invited to take part in the survey (cohort II, see Table 1). Pupils at these twenty-seven schools, from both 2001 and 2008, constitute the study sample of the present study. The present study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the Norwegian Social Science Data Services. Written informed consent was obtained from all subjects.

Initially, Hedmark and Telemark counties were chosen because the subscription programme was about to start in these two counties in the school year 2001/02. A baseline questionnaire survey was conducted in September 2001 (before the programme started). The 2008 survey was also conducted in September. In September 2001, none of the schools had any organised school fruit programme at the survey time. In September 2008, five schools participated in the free school fruit programme (schools with grades 1–10) (known as Free Fruit 08), while ten schools participated in the subscription programme (known as Subscription 08) and twelve schools did not participate in any official school fruit programme (known as No Programme 08). The free fruit programme was implemented from autumn 2007 in the five schools. We do not have data from the ten schools that participated in the subscription programme about when they entered the programme (between autumn 2001 and autumn 2008).

The questionnaire survey was completed by the pupils in the classroom in the presence of a trained project worker. One school lesson (45 min) was used to complete the questionnaire. A total of 1488 pupils (out of 1727 eligible; 86%) in 2001 and 1339 pupils (out of 1712 eligible; 78%) in 2008 completed the questionnaire and brought home a parent questionnaire to be completed by one of their parents. In the case of 1230 and 996 pupils, respectively, one of their parents completed the parent questionnaire. Descriptions of the samples in 2001 and 2008 are presented in Table 2.

Instrument

A written 24-h FV recall was used to assess pupils' FV intake. The 24-h recall was read aloud to the pupils by a project worker. FV intake of the previous day was recorded for school days (i.e. the survey was conducted on weekdays, Tuesday to Friday). The 24-h 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 FV they ate at the different time periods in household measures (e.g. one apple and twelve grapes) or in portions (e.g. one portion of mixed green salad). The household measures were coded into portions/d, and one portion was set at about 80 g (ranging from 65 g (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

Table 2. Description of the participants and the main variables at the 2001 and 2008 surveys

	2001	2008	P*
Number of schools	27	27	
Eligible pupils	1727	1712	
Pupil data			
Participating pupils	1488	1339	
Participation rate of pupils (%)	86	78	
Sex of pupils (% girls)	50	52	0.21
Age of pupils (% seventh graders)	47	49	0.50
FV intake all day (portions/d)	2.45	3.07	<0.001
FV intake at school (portions/d)	0.36	0.71	<0.001
Eating FV 4–5 d/week at school (%)	29	59	<0.001
Parent data			
Participating parents	1230	996	
Participation rate of parents (%)	83	74	
Sex of parents (% women)	85	78	<0.001
Age of parents (mean, years)	39.9	41.1	<0.001
Edu of parents (% with higher edu)	42	54	<0.001

FV, fruits and vegetables; edu, education.

* P values are based on *t* tests for continuous variables and on χ^2 for dichotomous variables.

Nutrition and Health. Juices and potatoes were not included in the FV calculations. Fruits, vegetables and FV intake at school (portions/d), and fruits, vegetables and FV intake all day (portions/d) were calculated. The 24-h recall has been presented previously⁽¹⁸⁾, and validity and reliability have been reported for FV intake among sixth graders⁽¹⁸⁾.

In addition, a frequency question was included, asking: How often do you eat fruits and/or vegetables at school? Response alternatives were every school day, 4, 3, 2, 1 d/week, less than once a week and never. The FFQ question was dichotomised into a new variable, eating FV at school 4 or 5 d/week *v.* less. Eating FV at school 4 or 5 d/week was interpreted as consuming FV at school on most school days. Based on data from a previous test–retest study involving 114 children from the sixth grade⁽¹⁸⁾, 93% of the children were classified into the same category in the dichotomised variable (4 or 5 d/week *v.* less) on two assessments, 14 d apart (data not previously published).

The pupils reported their own sex. As an indicator of socio-economic status, parents recorded their own level of education (lower: having no college or university education/higher: having attended college or university).

Statistical analyses

In the study sample, some pupils (fifty-eight in 2001 and thirty-seven in 2008) did not attend school the day before the survey day. Therefore, they were excluded from the analyses of intake at school, but they were included in all other analyses presented.

Describing the sample, differences between the 2001 and 2008 participants were analysed using *t* test, for continuous variables and χ^2 statistics for the categorical variables (Table 2). The main analyses conducted were multilevel mixed models with fruits, vegetables and FV at school and all day as separate outcome variables. All models included school as a random effect, and time (2001 *v.* 2008), group, sex and parental education level as fixed effects. A significant time $\times$ group interaction ($P\leq 0.005$), indicating different

changes in FV intake over time for the different groups, was the test for the effect of the governmental efforts. In order to assess potential differences in the effect of the school fruit programmes for different groups (based on sex and parental education level), the third-order interactions time $\times$ group $\times$ sex and time $\times$ group $\times$ parental education level were examined. An examination of the residuals did not reveal unacceptable departures from normality.

To conduct an attrition analysis, pupils at the twenty-seven schools in the study sample were compared with pupils at the eleven schools participated in 2001, but not in 2008, regarding sex, parental education level and FV intake at school and all day. For the analysis, *t* test were used for continuous variables and χ^2 statistics for the categorical variables. No significant differences between the study sample and pupils at schools that did not participate in 2008 were observed.

All analyses were conducted using SPSS 16 (SPSS Inc., Chicago, IL, USA).

Results

Unadjusted FV intake at school for the sixth and seventh-grade pupils at the twenty-seven schools increased from 0.36 to 0.71 portions/school day from 2001 to 2008 (Table 2). FV intake all day increased from 2.45 to 3.07 portions/d over the same period, and the proportion of pupils who reported eating FV at school 4 or 5 d/week increased from 29 to 59%.

The increase in FV intake, both at school and all day, was largest within the schools that had been included since 2007 in the national free school fruit programme (Free Fruit 08), and was smallest within the schools that did not take part in any of the governmental efforts to increase FV intake at school (Table 3). The time $\times$ group interaction was significant for FV intake at school ($P=0.02$), but was not significant for FV intake all day ($P=0.20$).

All effects appear to be due to an increase in fruit intake only. The time $\times$ group interactions for both fruit intake at school and fruit intake all day were significant, $P<0.001$ and $P=0.04$, respectively. The increases in fruit intake at school were 0.49, 0.29 and 0.18 portions/school day, respectively, for the Free Fruit 08, Subscription 08 and No Programme 08 schools, and the increases in fruit intake all day were 0.74, 0.39 and 0.16 portions/d, respectively (Table 3).

There were no significant differences in the change in vegetable intake between the groups from 2001 to 2008, $P=0.31$ and 0.86, respectively, for vegetables at school and vegetables all day.

No significant third-order interactions (time $\times$ group $\times$ sex or time $\times$ group $\times$ parental education level) were observed for any of the outcome variables, indicating that the effect of the governmental efforts was not significantly different for boys and girls or low and high parental education. To illustrate this, the proportion of pupils who reported eating FV at school 4–5 d/week in 2001 and 2008, stratified on group (school fruit programmes in 2008) and sex/parental education level, is presented in Table 4.

Discussion

The results show an increase in pupils' intake of FV at school in Norway from 2001 to 2008. Measured by a 24-h recall, the

Table 3. Change in fruits and vegetables (FV) intake (portions/d) from 2001 to 2008 in relation to the different school fruit programmes
(Mean values and 95 % confidence intervals)

	2001		2008		Change 2001–08
	Mean/d	95 % CI	Mean/d	95 % CI	
At school					
FV (portions/d)					
Free Fruit 08	0.34	0.17, 0.51	0.85	0.68, 1.01	0.51
Subscription 08	0.29	0.18, 0.40	0.68	0.57, 0.79	0.39
No Programme 08	0.46	0.35, 0.56	0.72	0.60, 0.83	0.26
Fruit (portions/d)					
Free Fruit 08	0.22	0.10, 0.33	0.71	0.59, 0.82	0.49
Subscription 08	0.18	0.11, 0.26	0.47	0.39, 0.55	0.29
No Programme 08	0.31	0.23, 0.38	0.49	0.41, 0.57	0.18
Vegetables (portions/d)					
Free Fruit 08	0.13	0.02, 0.23	0.14	0.03, 0.25	0.02
Subscription 08	0.11	0.04, 0.18	0.21	0.14, 0.29	0.10
No Programme 08	0.15	0.08, 0.22	0.23	0.15, 0.30	0.08
All day					
FV (portions/d)					
Free Fruit 08	2.31	1.78, 2.85	3.18	2.65, 3.71	0.87
Subscription 08	2.25	1.90, 2.60	2.86	2.50, 3.22	0.61
No Programme 08	2.82	2.49, 3.16	3.15	2.78, 3.51	0.32
Fruit (portions/d)					
Free Fruit 08	1.31	0.96, 1.66	2.05	1.70, 2.40	0.74
Subscription 08	1.43	1.20, 1.67	1.83	1.59, 2.07	0.39
No Programme 08	1.77	1.55, 1.99	1.93	1.68, 2.18	0.16
Vegetables (portions/d)					
Free Fruit 08	1.00	0.72, 1.29	1.14	0.86, 1.42	0.13
Subscription 08	0.82	0.63, 1.00	1.03	0.85, 1.22	0.22
No Programme 08	1.05	0.88, 1.23	1.22	1.02, 1.41	0.16

Free Fruit 08, free school fruit programme; Subscription 08, subscription programme; No Programme 08, schools not participating in any official school fruit programme.

FV intake at school had doubled in these twenty-seven random schools from 0.36 portions/school day in 2001 to 0.71 portions/school day in 2008. The proportion of pupils reported eating FV at school 4 or 5 d/week had also doubled over the same period, from 29 to 59 %.

The effect is clearly largest in the schools that were enrolled in the free fruit programme from 2007 (all combined schools with grades from 1 to 10). Also, there appears to be a greater increase in FV intake in the schools that participated in the subscription programme in 2008 than in the schools that did

Table 4. Proportion of pupils reporting to be eating fruits and vegetables at school 4 or 5 d/week stratified on group (school fruit programmes in 2008) and sex/parental education level
(Percentages and 95 % confidence intervals)

	2001		2008		Change 2001–08 Percentage points
	Percentage	95 % CI	Percentage	95 % CI	
Free Fruit 08					
Boys	20	7, 33	81	68, 94	61
Girls	38	24, 51	88	75, 100	50
Low parental edu	28	15, 40	79	66, 92	52
High parental edu	30	16, 44	90	77, 102	60
Subscription 08					
Boys	23	14, 31	57	48, 65	34
Girls	32	23, 40	68	60, 77	37
Low parental edu	25	16, 33	59	50, 68	35
High parental edu	29	21, 38	66	57, 74	36
No Programme 08					
Boys	25	17, 34	35	25, 44	9
Girls	45	37, 53	47	39, 56	3
Low parental edu	35	27, 42	34	25, 43	0
High parental edu	36	27, 44	48	39, 57	12

Free Fruit 08, free school fruit programme; edu, education; Subscription 08, subscription programme; No Programme 08, schools not participating in any official school fruit programme.

not take part in any public programme. These results indicate that the subscription programme and the free school fruit programme have been effective.

Only a few similar non-academically initiated school FV interventions including free or subsidised FV have been evaluated, with the results being published in international scientific journals. In three independent studies, the National School Fruit Scheme in the UK, providing one piece of fruit or vegetable to school children on each school day, initiated and implemented by the UK Government, has been reported to increase school children's intake of fruits, respectively, with about 50 g/d⁽¹⁹⁾, 4.7 pieces/week⁽²⁰⁾ and 0.5 portions/d⁽²¹⁾. In the Netherlands, the Schoolgruiten project, initiated, developed and implemented by a public-private partnership of the Netherlands Nutrition Centre Foundation, providing school children with free fruit or vegetables twice a week, has been reported to increase elementary school children's fruit intake with 0.15 servings/d⁽²²⁾. The Norwegian subscription programme and a free pilot version have been reported to increase FV intake at school with 0.2 and 0.9 portions/d, respectively⁽⁶⁾. In the USA, the Fresh Fruit and Vegetable Snack Program, administered by the United States Department of Agriculture's Food and Nutrition Service, was initiated in 2002. Recently, an evaluation of this programme has been published showing that intervention school students, compared with control school students, were more likely to report eating fruit and drinking 100 % fruit juice at least two times per day (39.3 v. 27.3 %) and consuming total fruit, juice and vegetables (22 v. 18.4 %) five or more times per day⁽²³⁾. Pilot projects from Denmark⁽²⁴⁾ (subscription programme initiated by the Danish Cancer Society) and New Zealand⁽²⁵⁾ (free fruit pilot programme funded by the New Zealand Ministry of Health) have also been reported to increase fruit intake; both with an effect size of about 0.4 pieces/school day. Recently, the European Union has also decided upon initiating a school fruit programme from the school year 2009/10, and the European Commission is allocating €90 million per year for the provision of FV in European schools⁽²⁶⁾.

All effects of the school fruit programmes in Norway appear to be on fruit intake, and there were no effects on vegetable intake, despite the fact that both the subscription and the free programmes are supposed to include both fruits and vegetables (carrots). Similar results are also reported from the British^(19,21), Dutch⁽²²⁾, US⁽²³⁾ and Danish⁽²⁴⁾ studies. The FV recommendation in Norway is to eat at least two portions of fruit and three portions of vegetables per day. Table 3 shows that the average fruit intake in 2008 is about 2 portions/d, but that the vegetable intake is only about 1 portion/d. Increasing vegetable intake among children and adolescents remains a great challenge. Clearly, fruits are more practical in a school FV programme as they come in convenient portion sizes, in their own package and, compared with most vegetables, they need less preparation before being eaten⁽⁶⁾. Fruits are also more practical to eat than vegetables in between meals. With the Norwegian tradition of having only one hot meal per day, vegetables are mostly eaten for dinner. The likeliness of Norwegians eating large amounts of vegetables with other meals is low. In a recent study, only 40 % of adolescents reported to have eaten vegetables at dinner the day before the survey day⁽²⁷⁾.

Due to the rather large socio-economic status and sex disparities in health in Norway^(12,15), and similar disparities in eating behaviours such as FV intake^(13,14), it is of utmost importance that the efforts to increase FV intake are also effective among those who need it the most, e.g. boys and children of parents without higher education. However, no significant third-order interactions were observed in the present study, and the group effect (effect of the school fruit programmes) appears to be similar for both boys and girls and for children of parents both with and without higher education. Table 4 shows that the school fruit programmes clearly have an effect for both boys and children of parents without higher education. The percentage of boys and children of parents without higher education who reported eating FV at school 4 or 5 d/week within the Free Fruit 08 schools increased from 20 and 28 % in 2001 to 81 and 79 % in 2008, respectively.

An important issue regarding potential health effects of school fruit schemes is whether they cause lasting effects, i.e. an increased FV intake is sustained also after the children stop receiving free fruit. Evaluations of the UK school fruit scheme do report no significant effect when the pupils were no longer eligible to receive free FV⁽¹⁹⁻²¹⁾. A pilot version of the Norwegian free school fruit programme (1 year of free school fruit) has, however, on the contrary reported that an increased FV intake is sustained 3 years after the end of the intervention⁽⁸⁾. A Norwegian cost-benefit analysis reported that an increase of 2.5 g/d is needed in order for the Norwegian School Fruit Programme to be cost effective, if offered for free for all 10 years of elementary and secondary school⁽²⁸⁾. However, an assumption is that the increased FV intake has to be sustained throughout life.

A limitation of the study is the non-randomisation of the different groups. The Free Fruit 08 groups constitute all combined schools (with grades 1-10), and the subscription schools are self-selected. The pupils at the different schools may be different, and as can be seen from Tables 3 and 4, there are differences in FV intake at school between the Free Fruit 08, Subscription 08 and No Programme 08 schools in 2001, before the school fruit programmes were initiated. However, the trends and results reported in the present study are clear, and a potential group effect is expected to be small. A second limitation of the study is that some schools now organise their own school fruit programmes. School fruit has been a hot topic in Norway over the last few years, maybe due to the long-term sustained public efforts. Within the No Programme 08 group, one of the schools had its own free fruit programme, and therefore the results presented in the present study may be underestimated.

The strengths of the present study are that it includes repeated data from a large number of randomly selected schools, and that it includes an evaluation of the public efforts to increase FV intake at school in a natural setting.

Conclusion

There has been a large increase in pupils eating fruit at school from 2001 to 2008 in Norway, and the school fruit programmes seem to have been effective. However, a great challenge remains in increasing vegetable intake.

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