EFFECTS OF A SCHOOL-BASED INTERVENTION ON FRUIT AND VEGETABLE INTAKE AT SCHOOL AND AT HOME

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Abstract

Objective: To further explore the effects of the school-based intervention "Nutrition in Icelandic 7 – 9 - year-old children" on fruit and vegetable intake in the midmorning-break, in the school-lunch and at home. Gender difference was explored and the effects on those children with lowest levels of fruit and vegetable intake, at baseline, versus those with the highest level.

Design: School-based dietary intervention study on fruit and vegetable intake in 7 – 9 -year-old children, assessed with three-day weighed dietary records.

Setting: Six randomly selected schools in Reykjavik, Iceland. Three intervention schools and three control schools.

Subjects: 7 – 9 -year-old school children. 163 children were studied for baseline values, and 105 for comparison of baseline and follow-up fruit and vegetable intake.

Results: The highest proportional increase, 65% (P=0.047), in fruit intake was in the midmorning-snack but increase in vegetable intake was more evenly distributed. Boys in the intervention group increased their fruit intake by 61 g/day (P=0.001) in the midmorning-snack and the girls in the control group decreased their fruit intake by 72 g/day (P<0.001) in the midmorning-snack. The lowest tertile in the intervention group increased its schoolday fruit and vegetable intake by 109 g/day (P<0.001) and the highest tertile in the control group decreased its intake by 256 g/day (P=0.028).

Conclusion: Intervention and/or multi component nutritional education in schools are very effective in sustaining and improving fruit and vegetable intake in school-children. Most changes in intake from the present intervention are seen in the midmorning-snack.

Key words: school-based interventions, children, food-based dietary guidelines, fruits and vegetables

Introduction

Intake of fruits and vegetables is important in preventing severe public health problems, e.g. cancers, cardiovascular diseases and obesity[1,2]. These known health benefits are the main ground for the recommended intake of at least 400g of fruit and vegetables per day[2]. The Icelandic Public Health Institute recommends 500 g/day, thereof at least 200g fruits and 200g vegetables[3]. In northern Europe, large population groups seem to eat far less fruit and vegetables than recommended[4,5]. A pan-European cross-sectional study performed in 9 countries showed that 11 year old children consume far less than the recommended amount of fruit and vegetables and the intake was lowest among Icelandic children[6].

Schools provide optimal settings for health promoting interventions such as healthy eating and fruit and vegetable promotion[7,8]. The present study was a part of a school-based intervention study “Lifestyle of 7-9 year old children”. The aim of the study was to further integrate physical activity into the school routine and to find ways to promote healthy food habits. The main focus of the dietary part of the intervention was on increasing fruit and vegetable intake[9]. The intervention components were based on determinants of food intake, especially determinants of fruit and vegetable intake[5,8,10-15] and on former findings of effective school-based interventions[8,16-18].

In the autumn 2006, a baseline study of the school based intervention showed that a large group of 7 year old children were far from reaching the food based dietary guidelines set for fruit and vegetable intake[19]. This is in line with previous studies of children’s fruit and vegetable intake[20-22]. Two years later, the children in the intervention school had increased their intake of fruit and vegetable by 47%, while the children in the control schools decreased their intake by 27%[9].

Important information on where interventions have most impact can be found with further analysis of food diaries. The division of total intake into measurements of what is consumed at home and in schools is an important aspect to consider[13]. One study has analysed where and in which meal of the day fruit and vegetable intake is most common[23] and one intervention-study analysed in which meal of the day the change in intake took place[24]. Difference in intake as well as disparity of difference related to genders is an interesting aspect in intake. In a former review, 27 of 49 papers showed that girls tend to have a higher or more frequent intake of fruits and vegetables than boys, 4 papers observed higher intake among boys and 18 papers found no gender difference in intake[13]. Gender difference in intake seems to be more prevalent in European countries than in the U.S.A.[13,25]. Few studies have analyzed where the intervention has the most impact compared to baseline intake amount, but some have tough found a tendency to a regression to the mean, that is, the ones with the lowest intake increase their intake and the ones with the highest intake decrease theirs[26-29].

The aim of the present study was to further explore the effect the intervention had on fruit and vegetable intake. The present study explored where the change in intake took place, if it was at home, at school during midmorning-snack or lunch. It explored if there was a gender difference in the intake change. It moreover explored the intervention-effect on schoolchildren according to baseline intake with the intervention- and control-group split into tertiles. It analyzed if those children classified as low consumers of fruits and vegetables changed their intake levels differently than higher consumers of fruit and vegetables.

Methods

Study population and design of the study

The data was collected in six randomly selected schools in Reykjavík – Iceland. Baseline measurements were performed in the autumn 2006 with a follow-up in autumn 2008. The schools were paired for similarity of size and quarters of Reykjavík[30] and the two schools in each pair were randomly assigned to the intervention or control group. Data collection took two weeks in each school and was performed from September to the end of November in the same sequence during the autumns of 2006 and 2008. Written consent of both parent and child was secured before measurements at baseline and follow-up. At baseline, 265 children were invited to participate in the present study and 216 returned dietary records (18% drop-out). After exclusion of incomplete records and records not done for one weekend day and two weekdays wherein children were attending school, 185 complete records where left for data analysis (70%). After exclusion of underreports[19]163 records were studied for baseline values. At follow-up all children that participated in the baseline study and were still in the same school were invited to participate, in total 171 returned dietary records (21% drop-out). After exclusion of incomplete records and underreports[9]130 records where left for data analysis, thereof 105 children were included in the data analysis at both occations and used for the analysis of the present intervention study.

Approval for the study was obtained from the National Bioethics Committee (VSN b2006050002/03) as well as the Icelandic Data Protection Commission.

Intervention programme

The main focus of the dietary intervention was on increasing fruit and vegetable intake. Educational strategy was made based on the determinants of fruit and vegetable intake. Educational material was developed in collaboration with the teachers and was the same in all of the intervention schools. Homework assignments were set up and letters were sent out to involve the parents. The letters gave the parents information about the aims of the study and advice on how to encourage healthy food habits in children. Teachers encouraged the children to bring fruit and vegetables to school for midmorning-snack in all of the intervention schools. Intervention components are represented in more details elsewhere[9].

Assessments

The children's diet was assessed with three days weighed dietary records. The records were continuous over two weekdays and one weekend day. Parents received instructions at a meeting at baseline on how to record the child's diet. Written instructions were a component in the dietary record sheet at baseline and follow-up.

The children's intake of food was weighed with accurate electronic scale (PHILIPS HR 2393), provided by the researchers, except the school lunch which was recorded for each child by research staff members. Standard portion size was weighed at each school lunch, adjusted for leftovers and refills for each child.

Food based dietary guidelines and school meals

The Public Health Institute of Iceland published food-based dietary guidelines, for adults and children from 2 years of age (FBDG) in the year 2006. The guidelines for fruit and vegetable intake are "5 portions of fruit and vegetables, corresponding to 500 g per day for adults; children younger than ten years require smaller portions". In the present study this was defined as 400 g of fruit and vegetables or more per day, 200 g fruit and 200 g vegetables. To obtain this amount per day, it is recomended to distribute the intake over various meals and snacks in the day[3].

In Iceland, elementary schools offer lunch subscription programs. Parents have the option to subscribe their children in the lunch program and pay fees for the lunches. Most schools offer vegetables and/or fruits at lunch. For the midmorning-snack, the children bring snack from home.

Data analysis

Nutrient calculations were performed with ICEFOOD (program of the Icelandic Nutrition Council), using The Icelandic Nutrient Database (revised), as well as the Icelandic Nutrition Council Recipe Database 2002.

All statistical analysis were carried out using SPSS for Windows, version 11.0. The level of significance used was $P<0.05$. Food group intake was checked for normality by visual inspection and by using the Kolmogorov-Smirnov test. Food intake distribution was generally skewed, and there were some zero values; therefore a non-parametric test (Mann-Whitney U) was used to test differences in food intake between intervention and control groups and Wilcoxon Signed Rank Test for difference in intake on individual level.

All results are shown for different time and places of intake. Habitual total intake is calculated from individual mean intake of two weekdays and one weekend-day. Schoolday total intake is calculated from individual mean intake of two weekdays wherein the children attended school. Schoolday at home intake is calculated from individual mean intake at home on two weekdays wherein the children attended school. Schoolday at morning-snack intake is calculated from individual mean intake of food eaten during the morning-snack at school on two weekdays wherein the children attended school. Schoolday at lunch intake is calculated from individual mean intake of food eaten at lunch in school on two weekdays wherein the children attended school.

Results

Table 1 shows the mean intake of fruit and vegetables for 7 year old children at baseline. The mean habitual intake was 133 g/d, but the mean fruit intake on schooldays was 33.8 g/day higher than the mean habitual intake ($P<0.001$). On schooldays, girls consumed significantly more fruit during the midmorning-snack at school than boys, 90.1 g/day vs. 50.1 g/day respectively ($P=0.005$). There was an insignificant difference in vegetable intake between boys and girls at all times or places at baseline.

Table 2 shows the mean fruit and vegetable intake at baseline and follow-up for the intervention and the control group separately and shows the mean of individual difference in food intake between baseline and follow-up. The intervention group changed their habitual fruit intake insignificantly by 25 g/day ($P=0.142$) while the control group decreased their fruit intake by 37 g/day ($P=0.008$) with significant disparity between groups ($P=0.002$). The disparity of the mean difference of fruit intake in the intervention and the control group was also significant on schooldays ($P=0.005$) and in the morning snack ($P=0.001$). At lunch at school, the control group increased their fruit intake by 12.6 g/day ($P=0.232$) while the intervention group decreased their intake by 5.2 g/day ($P=0.055$) with significant disparity between groups ($P=0.032$).

Figure 1a shows the mean difference in fruit intake for girls in the intervention and the control group. There was always a significant disparity of difference between girls in the intervention and the control group, but at lunch in school the disparity between the two groups was inverted ($P=0.048$), the intervention group decreased their intake ($P=0.170$) and the control group increased theirs ($P=0.077$). Girls in the control group decreased their total habitual intake from 181g/day to 122 g/day ($P=0.001$), their total schoolday intake from 227 g/day to 143 g/day ($P=0.002$), intake at home on schooldays from 87 g/day to 62 g/day ($P=0.050$) and intake in the midmorning-snack at school from 127 g/day to 55 g/day ($P<0.001$). No significant difference in fruit intake was seen for girls in the intervention group.

Figure 1b shows the mean difference in fruit intake between baseline and follow-up for boys in the intervention and in the control group. Significant increase in intake from 30 g/day to 98 g/day ($P=0.001$) was found in the intervention group during the midmorning-snack at school. No other occations or places showed a significant difference in intake.

The change in fruit intake was different for boys and girls between baseline and follow-up. Boys in the intervention group increased their intake of fruits during the midmorning-brake by 68 g/day (P=0.001) while the girls in the intervention group decreased their intake insignificantly, making the disparity between genders significant (P=0.003). No other gender disparity of difference in fruit intake was seen in the intervention group.
The girls in the control group decreased their habitual total intake by 60 g/d, (P=0.001) while the boys increased their total intake insignificantly with significant disparity of difference (P=0.018). On schooldays, the girls decreased their total intake by 84 g/day (P=0.002) but the boys increased their total intake insignificantly, making a significant gender disparity of difference in the total intake schooldays (P=0.006). In the control group, the girls decreased their fruit intake during the midmorning-snack by 73 g/day (P<0.001) while the boys increased their intake insignificantly making the gender disparity of the difference significant (P=0.006).

Table 2 shows that vegetable intake increased significantly at all times and places but during the midmorning-snack in the intervention group, but decreased significantly in the control group only during the morning-snack (P=0.030) and increased significantly in lunch at school in the control group (P=0.014). The disparity of the difference in intake between intervention and control group was significant for total habitual intake (P<0.001) total schoolday intake (P<0.001), intake at home on schooldays (P=0.025) and during the midmorning-snack at school (P=0.001).

Figure 2a shows the mean difference of vegetable intake between baseline and follow-up for girls. The intervention group had significant increase in total habitual intake (P=0.006), total schoolday intake (P=0.003) and at lunch at school (P=0.004). Significant disparity of difference between intervention and control group was seen in total habitual intake (P=0.003), total schoolday intake (P=0.002), on schooldays at home (P=0.027) and during the midmorning-snack at school (P=0.020).
Figure 2b shows the mean difference of vegetable intake between baseline and follow-up for boys. The intervention group had significant increase in total habitual intake (P=0.001), total schoolday intake (P=0.003) and at lunch at school (P=0.003). Significant disparity of difference between intervention and control group was seen in total habitual intake (P=0.007), total schoolday intake (P=0.036) and during the midmorning-snack at school (P=0.017). No

disparity of difference in vegetable intake was detected between boys and girls neither in the intervention nor in the control group.

Table 2 shows total intake of fruit and vegetable combined. The intervention group increased their total habitual intake ($P<0.001$), total schoolday intake ($P<0.001$), schoolday intake at home ($P=0.037$) and intake during the midmorning-snack at school ($P=0.001$). The control group had significant decrease in total fruit and vegetable intake habitually ($P=0.005$), total intake on schooldays ($P=0.018$) and in the morning-snack at school ($P<0.001$). The control group increased their intake significantly in lunch at school ($P=0.007$). The disparity of the difference in fruit and vegetable intake was significant between intervention and control group in total habitual intake ($P<0.001$), total schoolday intake ($P<0.001$), intake at home on schooldays ($P=0.009$) and in the midmorning-snack at school ($P<0.001$).

To further analyse the intervention-effect on fruit and vegetable intake on schooldays, the intervention group and the control group were divided in to tertiles. In the intervention group (Figure 3a), the first tertile (N=19) had total schoolday fruit and vegetable intake less than 128 g/day at baseline. The intake increased by 109 g/day ($P<0.001$) to a mean intake 168 g/day at follow-up. The increase at home was 37% ($P=0.005$) and 55% during the midmorning-snack at school ($P<0.001$). The second tertile in the intervention group (N=20) had total schoolday fruit and vegetable intake between 128 g/day and 219 g/day at baseline. Their mean difference between baseline and follow-up was 81 g/day ($P=0.005$) raising the mean intake to 249 g/day ($p=0.005$). Increase in intake at home was of borderline significance ($P=0.064$) but explains 54% of the total schoolday increase. Significant increase in the midmorning-snack ($P=0.040$) explains 43% of the increase.

In the control group (Figure 3b), the first tertile (N=16) had total schoolday fruit and vegetable intake less than 169 g/day at baseline. There was a non significant increase of 81 g/day between total schoolday intake at baseline and follow-up. The intake at lunch was 72% of the total increase ($P=0.007$). The second tertile in the control group (N=15) had total schoolday fruit and vegetable intake between 169 g/day and 304 g/day at baseline. The decrease of total schoolday fruit and vegetable intake between baseline and follow-up was 115 g/day ($P<0.001$), to mean intake of 174 g/day, with 40% of the total decrease in intake at home ($P=0.015$) and 65% of the total decrease in the midmorning-snack ($P=0.001$). Small insignificant increase of 5% of the total decrease was in the lunch at school. The third tertile in the control group (N=16) had more than 304 g/day intake in total schoolday fruit and vegetable intake at baseline and decreased their mean intake from 539 to 283 g/day (P=0.028). The decrease in intake at home was 59% of total decrease (P=0.028), 61% of the total decrease of borderline significance was in the midmorning-snack (P=0.075) but significant increase was seen in lunch at school (P=0.028) lowering the total decrease by 19%.

Discussion

The intervention had the strongest effect in increasing fruit and vegetable intake among boys and prevented decrease in intake of fruit and vegetables among girls. In the intervention group the largest proportion of the increase in fruit intake was in the midmorning-snack, and the most significant decrease in the control group was also in the midmorning-snack. For vegetables, the increase was similar for boys and girls and was evenly distributed over the day. The intervention effect had the greatest impact on the children having the lowest initial intake, and the decrease in the control group happened with the children having the highest initial intake. Encouragement and education in schools, similar to this intervention, is necessary to increase fruit and vegetable intake in school-children and hinder a decrease in intake from 7 to 9 years of age.

At baseline, when the children where 7 years old, their average intake of fruit and vegetables was less than half of recommendations. Mean habitual fruit intake was 133 g/day, or 67% of recommended amount and vegetable intake was 20% of recommended amount. Total schoolday intake was higher than habitual intake and that is probably because of high intake proportion in the midmorning-snack at school. This low intake of fruit and vegetables has also been seen in previous studies of the diet of Icelandic children[5,20-22].

Previous studies have either shown no age effect or decrease in fruit and vegetable intake with higher age. The decrease with age is more prevalent in European studies than U.S.A. studies[13,31-35]. In the control group this tendency clearly existed. The largest proportional decrease was in the midmorning-snack. In the intervention group the intervention did not only prevent this decrease but increased habitual total fruit and vegetable intake and the largest proportional increase was in the midmorning-snack. The increase was proportionally more in vegetable intake than in fruit intake, but the baseline intake was much lower for vegetables than fruit. The largest proportional increase in vegetable intake was at lunch in school. The control group did also increase their intake in lunch at school at follow-up. One might conclude that better vegetable availability in lunch at schools explains this increase in both groups but the present research does not examine that aspect.

Association between parental involvement and positive changes in vegetable intake has been found in previous studies[36]. A former paper from the same intervention study concludes that encouraging children to bring fruit and vegetables from home to eat in the midmorning-snack may be a good strategy for increasing fruit and vegetable intake because the parents know what their children like and how to prepare it[9]. This seems to be the case because the largest increase in fruit and vegetable intake in the intervention group was in the midmorning-snack. Intake of fruit and vegetables at home on schooldays increased significantly in the intervention group but no disparity was found in intake difference between intervention and control group in lunch at school and the mean amount eaten at lunch at follow-up was almost the same for both groups. The intervention effect was seemingly strongest where the parents are in charge of what is bought and available for the children. That is consistent with Wind's et al. findings that indicate that fruit and vegetable promotion should focus on improvement in general availability especially at home. This is improved with parents' involvement in the intervention[15]. When a variety of fruit and vegetables are available, the children tend to choose what and how much they eat dependent upon their liking and familiarity[8,15].

Most former European studies have found that girls consume more fruits and vegetables than boys[13]. In the present study no significant gender difference was found in total intake at baseline but a little difference was found in the consumption pattern. Girls consumed almost double the amount of fruit compared to the boys in the midmorning-snack and it gave the girls half of their schoolday intake while the boys had one third of their schoolday intake in the midmorning-snack. Boys had more than half of their intake at home on schooldays. Boys and girls showed similar intake pattern of vegetables. At baseline less than 20% of the total schoolday intake of vegetables came from lunch at school so over 80% was eaten at home or brought from home for the midmorning-snack.

The intervention had different effects on fruit intake in girls vs. boys. Girls in the intervention group did not change the mean amount of their fruit intake while the girls in the control group decreased their intake significantly. On the other hand, boys in the intervention group increased their intake, but only significantly in the midmorning-snack while the boys in the control group did not change the mean amount of fruit intake. This is in contradiction with other findings that indicate that fruit and vegetable interventions works better on girls than boys[37,38] but some indicate that this is just the case for intervention effects on vegetable intake[39,40]. When vegetable intake was analyzed in the same way, boys and girls showed similar change in consumption. The intervention group increased their total habitual intake, total schoolday intake and intake in the lunch at school while the control group did not have any change in vegetable intake. The reasons for this disparity of difference in fruit- vs. vegetable-intake is unknown. The reasons for the gender disparity of difference in fruit intake seen in this study are not clear. One might conclude that the known decrease in fruit and vegetable intake with age happens sooner for girls than boys. That might be because they mature earlier at this age and the boys will reduce their intake later. This is a topic for further study in the future.

The largest increase in intake in the intervention group was seen in the group with the lowest initial intake and the largest decrease in the control group was seen in the groupwith the highest initial intake. This is in line with former studies[26-29].

The intervention was successful in increasing fruit and vegetable intake. It is essential to prevent a fall in intake and encourage a rise in fruit and vegetable intake, especially for boys and the children with low initial consumption. In the intervention group the vegetable increase was higher than for fruits in g/day, but the baseline values were lower. Proportional increase was high at lunch both for intervention and control group but follow-up mean value was still rather low. There seems to be a lot of opportunities for increasing vegetable intake during school lunch. That does not only require good availability but also good peer influence, and role modeling of school staff since availability has been shown not to be enough to change intake pattern[27,28]. The intervention had most impact on the midmorning-snack and the home environment where the parents are in charge and the children can express their wants and taste preferences.

Conclusion

Nutrition education and intervention implementation can be very efficient and will reduce the downfall in fruit and vegetable intake seen in the control group in this study. It is important to increase the intake further. Intervention aimed at increasing vegetable intake is imperative, more so than for fruit since the initial intake of fruits are much higher than for vegetables at this age. A good place for that is the lunch at school, but this requires good collaboration with the school staff and the staff in the school canteen. Interventions including nutrition education and stimulation by increased availability in school similar to this intervention are necessary to improve fruit and vegetable intake in school-children.

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Table 1. Mean intake (g/d) of 7 year old children, all participants together (n=163), girls (n=87) and boys (n=76), shown at time and place of intake. P-values showing the difference between girls and boys (Mann-Whitney test), significant differences in bold.

	All		**Girls**		**Boys**		
Food group	Mean (g/d)	(SD)	Mean (g/d)	(SD)	Mean (g/d)	(SD)	P -value
Fruits total (fresh fruits)							
Habitual total[1]	133	(100)	142	(100)	124	(101)	0.158
Schoolday total[2]	167	(130)	180	(131)	152	(128)	0.073
Schoolday at home[3]	74	(94)	68	(81)	82	(107)	0.710
Schoolday at Morning-snack[4]	72	(77)	90	(89)	50	(52)	**0.005**
Schoolday at Lunch[5]	21	(29)	23	(28)	19	(30)	0.315
Vegetables							
Habitual total[1]	41	(40)	38	(40)	44	(41)	0.250
Schoolday total[2]	48	(50)	45	(47)	53	(53)	0.373
Schoolday at home[3]	22	(32)	23	(33)	21	(31)	0.724
Schoolday at Morning-snack[4]	18	(33)	14	(27)	21	(38)	0.281
Schoolday at Lunch[5]	9	(14)	7	(12)	11	(16)	0.089

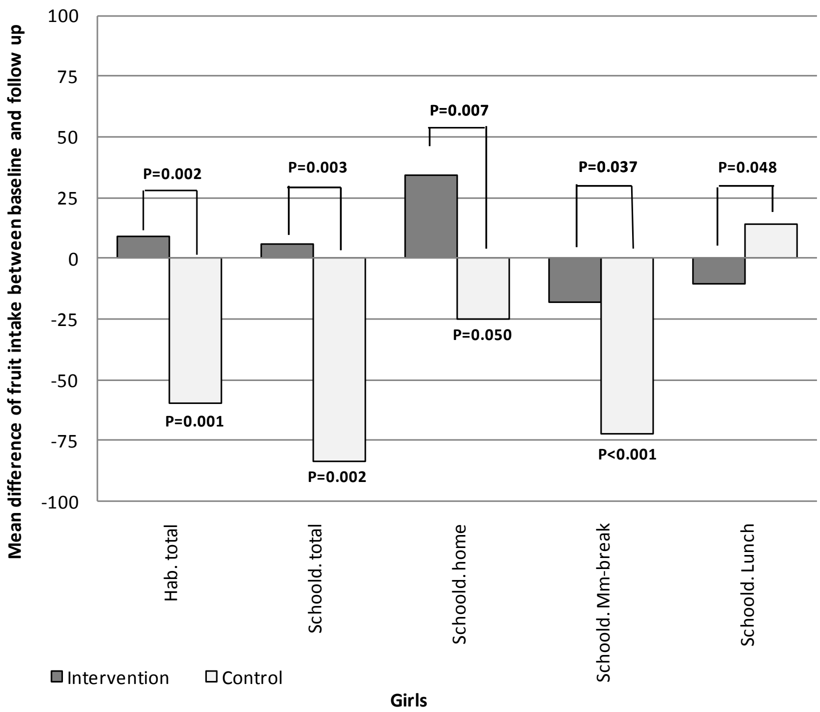
[1]Habitual total intake is calculated from individual mean intake of two weekdays and one weekend-day.
[2]Schoolday total intake is calculated from individual mean intake of two weekdays wherein the children attended school.
[3]Schoolday at home intake is calculated from individual mean intake of food eaten at home on two weekdays wherein the children attended school.
[4]Schoolday at Morning-snack intake is calculated from individual mean intake of food eaten in the Morning-snack at school on two weekdays wherein the children attended school.
[5]Schoolday at Lunch intake is calculated from individual mean intake of food eaten at lunch in school on two weekdays wherein the children attended school.

Table 2. Food intake, mean intake (25^{th}, 50^{th} and 75^{th} percentiles), shown separately for intervention (n=58) and control schools (n=47) at baseline and follow-up, shown for place and time of intake. P-values are shown for the difference of intake at baseline and follow-up (Wilcoxon Signed Rank Test), significant differences in bold. P- values shown for disparity of mean difference between intervention- and control-group (Mann Whitney U), significant differences in bold.

	Intervention							Control							Mean differnce
	Baseline		**Follow-up**		Mean difference			**Baseline**		**Follow-up**		Mean difference			Intervention/ Control
Food group	Mean (g/d)	Percentiles (g/d) (25^{th},50^{th},75^{th})	Mean (g/d)	Percentiles (g/d) (25^{th},50^{th},75^{th})	(g/d)	(SD)	P-value	Mean (g/d)	Percentiles (25^{th},50^{th},75^{th})	Mean (g/d)	Percentiles (25^{th},50^{th},75^{th})	(g/d)	(SD)	P-value	P-value
Fruits total (fresh fruits)															
Habitual total[1]	109	(36, 85,160)	134	(48, 94, 186)	25	(114)	0.142	161	(85, 153, 193)	124	(60, 113, 168)	-37	(95)	**0.008**	**0.002**
Schoolday total[2]	136	(44, 114, 186)	168	(54, 120, 230)	31	(145)	0.135	198	(100, 175, 273)	151	(69, 141, 195)	-47	(141)	**0.025**	**0.005**
Schoolday at home[3]	65	(0, 31, 106)	73	(0, 31, 101)	8	(118)	0.357	78	(9, 53, 126)	64	(0, 30, 136)	-14	(105)	0.154	0.079
Schoolday at Morning-snack[4]	43	(0, 16, 74)	71	(0, 38, 106)	28	(99)	**0.047**	106	(50, 88, 148)	61	(0, 49, 93)	-46	(99)	**0.002**	**0.001**
Schoolday at Lunch[5]	28	(0, 20, 50)	23	(0, 0, 41)	-5	(33)	0.232	14	(0, 0, 20)	27	(0, 15, 45)	13	(42)	0.055	**0.032**
Vegetables															
Habitual total[1]	46	(14, 38, 71)	82	(29, 62, 128)	37	(55)	**<0.001**	43	(11, 31, 60)	34	(13, 27, 48)	-9	(49)	0.230	**<0.001**
Schoolday total[2]	52	(4, 39, 90)	94	(30, 81, 144)	42	(67)	**<0.001**	53	(15, 42, 88)	43	(8, 28, 55)	-10	(58)	0.234	**<0.001**
Schoolday at home[3]	23	(0, 6, 30)	38	(0, 28, 56)	15	(51)	**0.033**	27	(0, 10, 49)	19	(0, 0, 23)	-8	(46)	0.213	**0.025**
Schoolday at Morning-snack[4]	22	(0, 0, 33)	36	(0, 19, 55)	15	(57)	0.066	16	(0, 0, 26)	6	(0, 0, 0)	-11	(31)	**0.030**	**0.001**
Schoolday at Lunch[5]	8	(0, 0, 15)	20	(0, 21, 30)	13	(22)	**<0.001**	10	(0, 0, 15)	18	(0, 20, 33)	8	(21)	**0.014**	0.207
Fruits and vegetables															
Habitual total[1]	155	(73, 130, 221)	216	(125, 200. 272)	61	(126)	**<0.001**	204	(115, 180, 250)	158	(78, 139, 204)	-46	(109)	**0.005**	**<0.001**
Schoolday total[2]	188	(73, 171, 260)	262	(163, 234, 350)	73	(157)	**<0.001**	251	(144, 220, 335)	194	(112, 189, 249)	-57	(160)	**0.018**	**<0.001**
Schoolday at home[3]	88	(2, 57, 132)	111	(38, 76, 159)	23	(131)	**0.037**	104	(25, 75, 154)	82	(3, 50, 140)	-22	(119)	0.095	**0.009**
Schoolday at Morning-snack[4]	65	(0, 48, 110)	108	(37, 96, 153)	43	(97)	**0.001**	123	(56, 104, 167)	67	(0, 66, 101)	-56	(102)	**<0.001**	**<0.001**
Schoolday at Lunch[5]	36	(0, 24, 63)	43	(8, 33, 71)	7	(43)	0.216	24	(0, 15, 35)	45	(10, 45, 70)	21	(50)	**0.007**	0.086

[1]Habitual total intake is calculated from individual mean intake of two weekdays and one weekend-day.
[2]Schoolday total intake is calculated from individual mean intake of two weekdays wherein the children attended school.
[3]Schoolday at home intake is calculated from individual mean intake of food eaten at home on two weekdays wherein the children attended school.
[4]Schoolday at Morning-snack intake is calculated from individual mean intake of food eaten in the Morning-snack at school on two weekdays wherein the children attended school.
[5]Schoolday at Lunch intake is calculated from individual mean intake of food eaten at lunch in school on two weekdays wherein the children attended school.

a)



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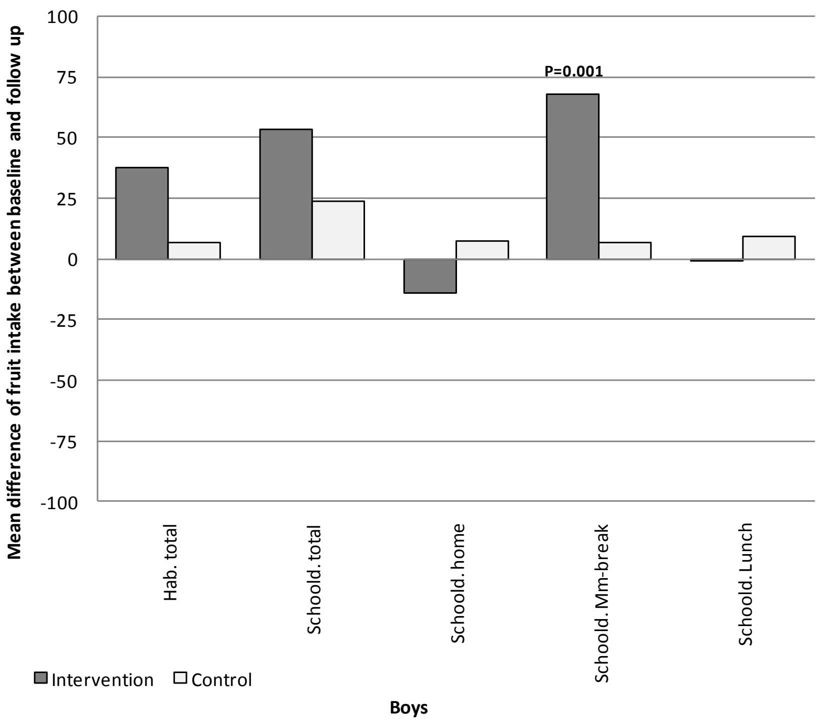
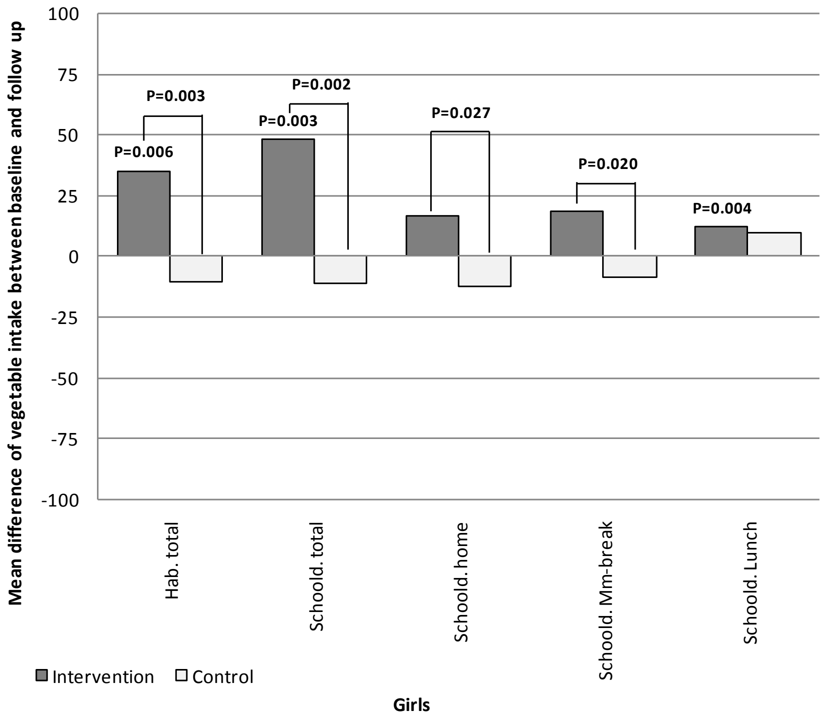


Figure 1 Mean difference between baseline and follow-up of fruit intake for: a) girls and b) boys, in the intervention-group and in the control-group. P-values are shown for the difference of intake at baseline and follow-up (Wilcoxon Signed Rank Test), significant differences in bold. P-values shown for disparity of mean difference between intervention- and control-group (Mann Whitney U), significant differences in bold.

a)



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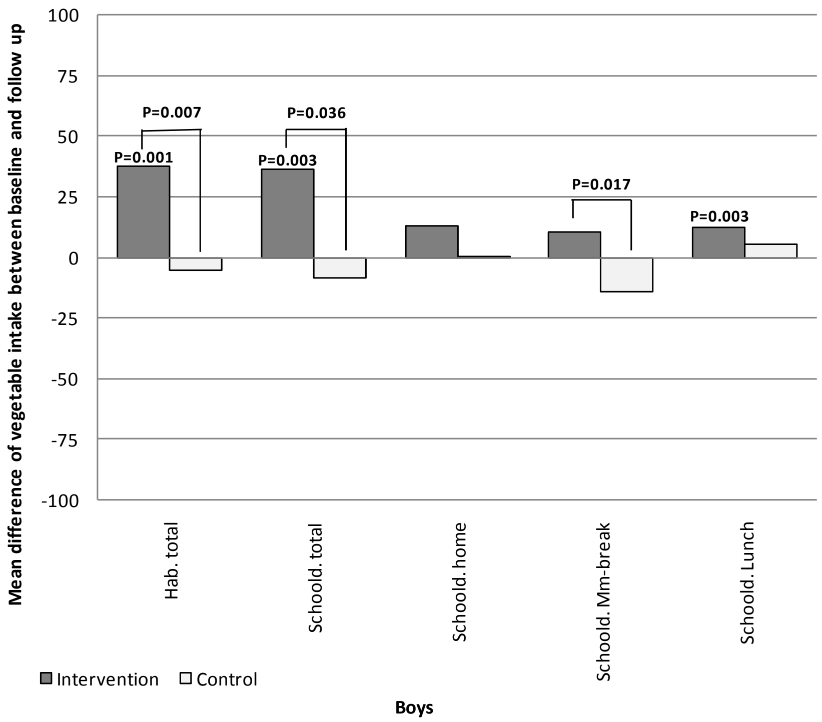
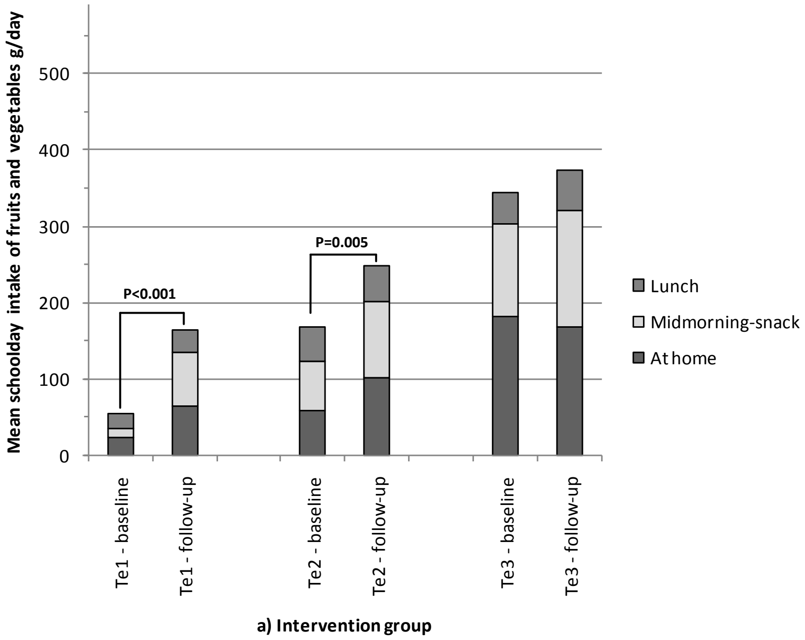


Figure 2 Mean difference between baseline and follow-up of vegetable intake for a) girls and b) boys, in the intervention-group and in the control-group. P-values are shown for the difference of intake at baseline and follow-up (Wilcoxon Signed Rank Test), significant differences in bold. P-values shown for disparity of mean difference between intervention- and control-group (Mann Whitney U), significant differences in bold.

a)



b)

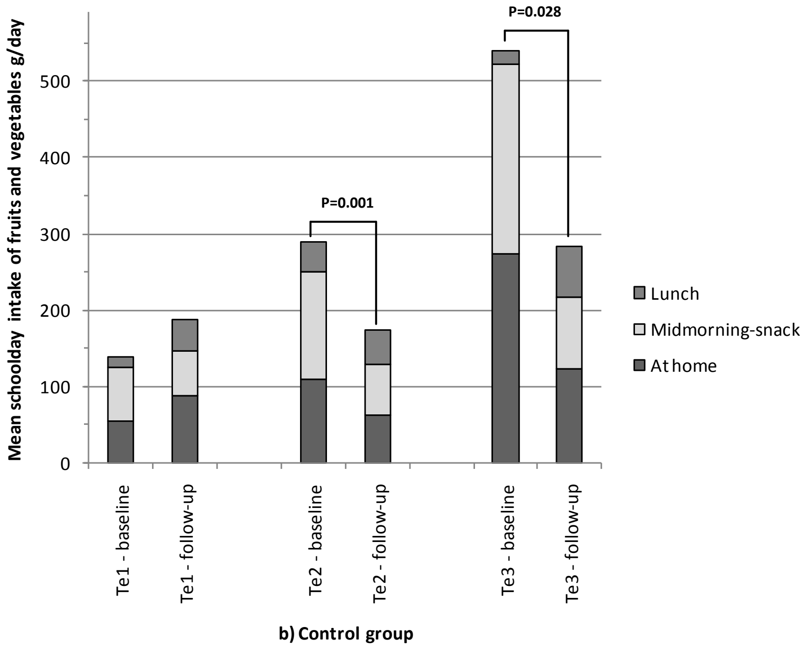


Figure 3 Mean schoolday intake of aggregated fruit and vegetable. The intervention-group (a) divided in tertiles(Te1-Te3) (N=19-20-19). Cut points 127.7 g/day and 219.0 g/day. The control-group (b) divided in tertiles(Te1-Te3) (N=16-15-16). Cut points 169.0 g/day and 304.0 g/day.

Significant P-values are shown for the difference of total schoolday intake at baseline and follow-up (Wilcoxon Signed Rank Test)